

Live | Build | Sustain

A new green building program aims to push the design and construction industry well beyond current best practices. **By Nancy B. Solomon, AIA**



Continuing Education

Use the following learning objectives to focus your study while reading this month's ARCHITECTURAL RECORD/AIA Continuing Education article. To earn one AIA learning unit, including one hour of health, safety, and welfare/sustainable design (HSW/SD) credit, turn to page 118 and follow the instructions:

Learning Objectives

- 1 Explain the goals of the Living Building Challenge.
- 2 Describe its organizational framework and requirements.
- 3 Discuss the hurdles to achieving Living Building designation.
- 4 Compare the Challenge and the LEED rating system.

THE LIVING BUILDING CHALLENGE is not for the faint of heart. Part polemic, part rating system, it looks squarely at the environmental crisis – from rising global temperatures to shrinking natural habitats – and asks: What are we going to do about it, not in a few decades or a few years, but today?

The program challenges like-minded people to avoid any further degradation when they build. In fact, it asks participants to try to heal their sites as they create structures that exist in harmony with their surrounding ecosystems, inhabitants, and cultures. And if myopic building codes or manufacturing processes are limiting sustainable options, it requires the project team to advocate change.

While applauding the progress that has been made by the green-building movement in the past 20 years, the authors of the Challenge say it has not been enough. In an April 2010 description of the program, they argue that "incremental change is no longer a viable option." Given the enormity of the task that still lies ahead, they maintain that we need "to completely reshape humanity's relationship with nature and realign our ecological footprint to be within the planet's carrying capacity."

The concept of a living building grew out of a mid-1990s project to design a highly sustainable building for Montana State University. The design team, which included BNIM Architects of Kansas City, Missouri, sought to shift from a mechanistic model of architecture, in which natural resources are viewed as fodder for construction, to a more organic one, in which a building is designed to be fully part of, and in balance with, its ecosystem.

Although the Montana project was never built, Bob Berkebile, a founding principal of BNIM, and Jason F. McLennan, then head of the firm's building-science team, continued to work on the concept. They coauthored an article titled "Living Building," which appeared in the October 1999 issue of *The World & I*, and used the same term to signify

ideal green-building practices in a study initiated the next year for the David and Lucile Packard Foundation. The latter analyzed the construction and operating costs of market-rate construction, comparing them to the costs associated with certification under the four tiers of the Leadership in Energy and Environmental Design (LEED) rating system, which had only recently been launched by the U.S. Green Building Council. The Packard study also examined the cost of achieving the then-largely-hypothetical living building, which was envisioned to be even more sustainable than one meeting LEED's highest level of certification, Platinum.

McLennan continued to refine the living building concept and, in August 2006, presented the first version of the program to Cascadia Green Building Council (Cascadia), a chapter of both the U.S. and Canada Green Building Councils covering Oregon, Washington State, British Columbia, and Alaska. McLennan joined the organization as its C.E.O. soon thereafter, and Cascadia formally announced the launch of the Living Building Challenge in November 2006. To administer the expanding program, Cascadia established a separate organization, the International Living Building Institute (ILBI), in May 2009, which released Version 2.0 of the system later that year.

The framework

To fully meet the Challenge in its current version, a man-made environment must address seven performance areas: site, water, energy, health, materials, equity, and beauty. These categories are called "petals" to emphasize the overarching goal: A building, like a flower, should be in ecologic balance with its environment, rooted to its place, and an ongoing source of inspiration.

Each performance area has one or more requirements, or "imperatives." There are 20 imperatives in all, with names like "limits to growth" and "inspiration + education." All

IMPERATIVES AND TYPOLOGY MATRIX To obtain Living Building status, projects must satisfy the following:

● Required ■ Solutions beyond project boundary permitted

PROJECT TYPOLOGIES	SITE		WATER		ENERGY		HEALTH		MATERIALS		EQUITY		BEAUTY							
	Limits to growth	Urban agriculture	Habitat exchange	Car-free living	Net-zero water	Ecological water flow	Net-zero energy	Civilized environment	Healthy air	Biophilia	Red list	Embodied carbon footprint	Responsible industry	Appropriate sourcing	Conservation + reuse	Human scale + humane places	Democracy + social justice	Rights to nature	Beauty + spirit	Inspiration + education
NEIGHBORHOOD	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BUILDING	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
LANDSCAPE + INFRASTRUCTURE	●		●		●	●	●				●	●	●	●	●					
RENOVATION	●		●		●	●	●				●	●	●	●	●					

SOURCE: INTERNATIONAL LIVING BUILDING INSTITUTE



PHOTOGRAPHY: © MATTHEW MILLMAN

imperatives within a performance area must be met to earn that particular petal of the Challenge.

Projects are categorized as belonging to one of four typologies, or construction types: landscape and infrastructure, renovation, building, and neighborhood. The projects are also grouped into one of six living transects according to the density of their context – a concept based on Duany Plater-Zyberk & Company’s New Urban Transect. The transects range from natural habitat preserve (L1) to urban core zone (L6).

The conceptual nature of the imperatives allows them to be overlaid with these various typologies and transects to create a holistic matrix that can be effectively applied to any kind of man-made environment, from park gazebo to office tower.

The matrix adds flexibility to an otherwise extremely demanding program. Some typologies, for example, do not have to meet all 20 imperatives because the requirement does not apply to that form or scale of construction. A renovation, for

instance, does not have to address the biophilia imperative.

And certain criteria within some imperatives are adjusted according to the project’s transect. For example, according to the urban agriculture imperative, a project with a floor area ratio (FAR) of less than .05 located in a rural agricultural zone (L2) must use 80 percent of its project area for food production, while one located in the urban center zone (L5) with an FAR of 2.5 need only allot 5 percent for such use.

Furthermore, the matrix allows the Challenge to employ a mechanism called “scale jumping,” in which a project may be exempted from meeting certain imperatives (such as net-zero water or net-zero energy) within its boundaries. However, the team must demonstrate that the overall goal of the imperative can be achieved by implementing solutions at the campus, neighborhood, or community scale.

Recognizing that the program is still evolving, the developers have also included temporary exceptions to

The Energy Laboratory at the Hawaii Preparatory Academy in Waimea, Hawaii, was designed by Flansburgh Architects of Boston and completed in January 2010. To source materials for projects in such remote regions, the Challenge increases allowable transportation distances.

TRANSPORTATION RESTRICTIONS

Source locations for materials and services must adhere to the following limits:

ZONE	MAXIMUM DISTANCE	MATERIALS OR SERVICES
1	500 km	Heavy or high-density materials
2	1,000 km	Medium-weight and medium-density materials
3	2,000 km	Light or low-density materials
4	2,500 km	Consultant travel
5	5,000 km	Assemblies that actively contribute to building performance and adaptable reuse
6	15,000 km	Renewable technologies
7	20,004 km	Ideas

RED LIST

Projects may not contain any of the following materials or chemicals:

- Asbestos
- Cadmium
- Chlorinated polyethylene and chlorosulfonated polyethylene
- Chlorofluorocarbons (CFCs)
- Chloroprene (neoprene)
- Formaldehyde (added)
- Halogenated flame retardants
- Hydrochlorofluorocarbons (HCFCs)
- Lead (added)
- Mercury
- Petrochemical fertilizers and pesticides
- Phthalates
- Polyvinyl chloride (PVC)
- Wood treatments containing creosote, arsenic, or pentachlorophenol



1. The Omega Center for Sustainable Living in Rhinebeck, New York, was completed in May 2009. The building, designed by BNIM Architects, houses a classroom and an Eco-Machine, which treats wastewater with algae, fungi, bacteria, plants, snails, and fish.

2. EcoCenter at Heron's Head Park opened in April 2010 on a landfill site in San Francisco. Designed by Toby Long, the center includes an intensive green roof and a rainwater-harvesting system.

3. Ann and Gord Baird designed and built Eco-Sense, a house in Highlands, British Columbia, for their own family. Completed in late 2008, its walls are made of cob – a mixture of sand, straw, and clay.

4. On the condition that water quality be tested monthly, authorities in Eureka, Missouri, allowed Hellmuth+Bicknese Architects to specify a potable rainwater system for the Tyson Living Learning Center. It opened in May 2009.

many of the imperatives. Once the market successfully responds to an imperative's demands, these exceptions will be removed. Typically, a project team can take advantage of an exception by demonstrating that it has made every effort to meet the requirement and has advocated some kind of industrywide change. Examples of such advocacy include writing manufacturers to request modifications in material sourcing, product formulation, or assembly, or by filing an appeal with the appropriate agencies to amend a code.

The process

To formally participate in the Challenge, at least one member of the project team must join ILBI's Living Building Community Membership, which is available to any interested individual or organization according to a tiered fee schedule (currently \$125 for an individual), offers access to various online resources, from the actual user's guide to discussion forums. According to Eden Brukman, ILBI vice president and research director for Cascadia, there are currently more than 475 members.

To officially participate in the Challenge – and obtain any needed clarifications from ILBI – a member must register the proposed project for an additional fee, ranging from \$100 to \$500, based on type. Brukman estimates that 70 projects in North America and a handful in Europe and Australia are registered under some version of the Challenge, although she has heard anecdotally about many more unregistered projects informally trying to meet the program's criteria.

The actual certification requires a third fee. A payment starting at \$1,000 for projects less than 500 square meters and aiming for full certification is due prior to an audit, which takes place after the project has been in operation one full year. According to Brukman, ILBI will select people with a knowledge of green building and train them to undertake these audits. They will function as consultants to ILBI rather than employees and will visit the site and review the various metrics and documentation submitted by the team.

The imperatives for all petals must be met for full certification, or "Living Building" status. If at least three petals are met, including at least one being the energy, water, or materials petal, the project will earn partial certification, or "petal recognition." The team can later apply for full certification, if and when it fulfills the remaining petals.

At press time, only five of the registered projects had completed construction: Eco-Sense in Highlands, British Columbia; Tyson Living Learning Center in Eureka, Missouri; Omega Center for Sustainable Living in Rhinebeck, New York; Hawaii Preparatory Academy Energy Laboratory in Waimea, Hawaii; and EcoCenter at Heron's Head Park in San Francisco. Eco-Sense, Tyson, and Omega have finished their 12-month operational phase and are currently under audit. ILBI could make an announcement about their status later this month.

Verification

The method of verification will depend on the particular imperative. Some have very clear-cut, albeit demanding, criteria. Net-zero energy, for example, requires that "one hundred percent of the project's energy needs must be supplied by on-site renewable energy on a net annual basis." Verifying these kinds of imperatives is relatively straightforward: a site visit plus either 12 months of utility bills demonstrating net-zero

energy over the year or a letter from the local utility company confirming that the project is not connected to the grid.

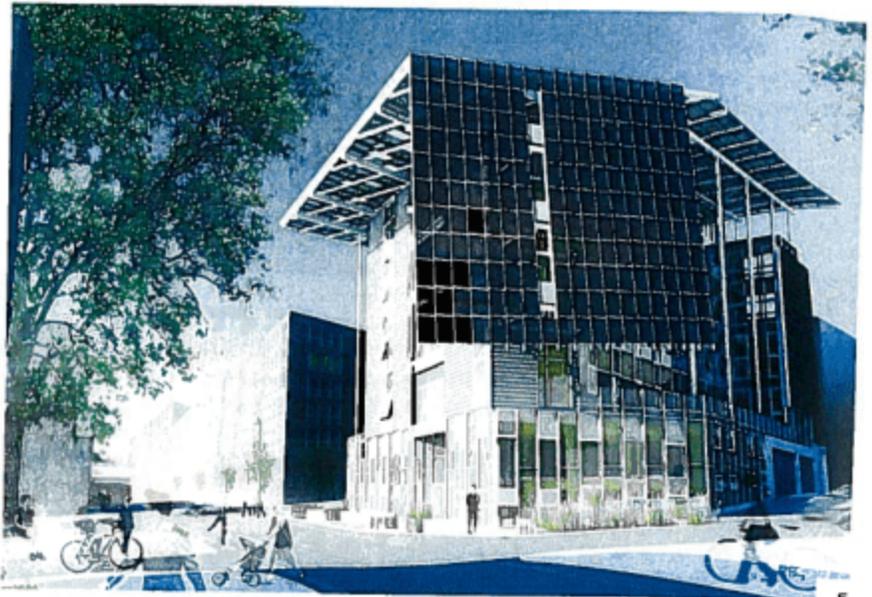
Other imperatives are much less objective. "Beauty + spirit," for example, states that "the project must contain design features intended solely for human delight and the celebration of culture, spirit, and place appropriate to its function." To demonstrate that this objective has been met, the architect and owner must write essays describing the value of the place in physical and cultural terms, the purpose of the project, the aesthetic intent of the design, how the aesthetic intent relates to the particular region, and how this intent was carried out in practice. During their site visits, auditors will judge if the team successfully translated their written goals into physical form. In addition, occupants and visitors will be surveyed to gauge their reaction to the finished product.

Although the metric for beauty is far less clear cut than the ones for energy or water, ILBI believes a genuine effort on the part of the entire team to discuss the meaning of beauty within a particular context and how they hope to achieve this is a significant accomplishment in itself. "We are trying to bring the question of beauty back into the forefront," says Brukman. And she adds that it is the more indeterminate concepts of beauty and equity that tend to draw people to the Challenge: "That is what they really appreciate about the program – even if they are hard to measure."

Craig Curtis, FAIA, a partner at Seattle-based Miller Hull Partnership, concurs, noting that a living building "has to be beautiful" if proponents are going to convince others to build this way. Miller Hull is currently working toward Living Building status for the Cascadia Center for Sustainable Design + Construction, a commercial structure that is being built in Seattle by the Bullitt Foundation to house like-minded organizations, including the Cascadia Green Building Council.

Early adopters

Although it certainly wishes otherwise, ILBI does not expect everyone to sign on at once. Says Brukman, "The Living Building Challenge targets the top end – the early adopters who have been pushing the envelope." Generally speaking, this means a client with an established, institutional concern for the environment. To be willing to tackle the seemingly impossible demands of the Challenge, "the owner has to be the driver," points out Chris Minnerly, AIA, principal of The Design Alliance



5

Architects, who is working on the Center for Sustainable Landscapes at the Phipps Conservatory and Botanical Gardens in Pittsburgh, another registered project.

A quick run-through of the clients of the first five constructed projects bears this out: Eco-Sense is the 2,150-square-foot home for a multigenerational family committed to living off the grid; the Tyson Center is a 2,900-square-foot environmental research and education facility for the International Center for Advanced Renewable Energy and Sustainability at Washington University in St. Louis; the Omega Center is a 6,200-square-foot education center and natural wastewater treatment facility for the Omega Institute for Holistic Studies, which lists biologist John Todd, leader in the field of ecological water purification, as one of its teachers; the Energy Lab is a 6,100-square-foot educational facility for Hawaii Preparatory Academy, a private school that has instituted a "go green" initiative; and EcoCenter is a 1,500-square-foot environmental education facility run by the organization Literacy for Environmental Justice.

5. The Cascadia Center for Design + Construction by Miller Hull Partnership is part of Seattle's Living Building Pilot Program. The team has received approval to extend a photovoltaic canopy into a right-of-way so that the building can generate sufficient energy on-site.

6. Designed by Iredale Group Architecture, the Robert Bateman Art and Environmental Education Centre makes use of old growth Douglas fir salvaged from a nearby abandoned aircraft hangar in its roof structure.

RENDERINGS: COURTESY MILLER HULL PARTNERSHIP (5); IREDALE GROUP ARCHITECTURE (6)



6

The Centre for Interactive Research on Sustainability (CIRS), under construction in downtown Vancouver, will serve as a "living laboratory" for the study of building products, technologies, and systems in context. The idea for CIRS, designed by Busby Perkins+Will, was conceived about eight years ago by John Robinson, former director of the University of British Columbia's Sustainable Development Research Initiative. He was frustrated that sustainable processes were not being implemented quickly enough and envisioned a building that could operate within its own footprint.

Like these first five, most of the other registered projects are also fairly small. However, a few intrepid teams are attempting to apply the challenge's strictures to larger buildings. But jumping up in scale is not easy, reports Laura Lesniewski, AIA, the BNIM partner in charge of the Omega project: "It gets pretty tricky with water, energy, and materials when you enter that world."

In addition to the 50,000-square-foot Cascadia Center and the 24,000-square-foot Center for Sustainable Landscapes, larger registered projects currently in design or construction include two in British Columbia: the 27,000-square-foot Robert Bateman Art and Environmental Education Centre on the campus of Royal Roads University in Victoria and the 61,000-square-foot Centre for Interactive Research on Sustainability (CIRS) at the University of British Columbia in Vancouver. As all their names imply, the clients for these projects, like the first five, have strong environmental missions.

The thorniest petal

The difficulties of the Challenge vary markedly by project, depending in large part on local natural resources and codes and building program and size. But if one petal of the Challenge stands out as the most difficult, it would have to be the one pertaining to materials.

Two imperatives in particular – the "red list" and appropriate sourcing – can be difficult to satisfy. The red list specifies potentially toxic substances that must be avoided in

products and finishes, even though many are still common in construction materials. The appropriate sourcing imperative limits the distance products and consultants can travel to reach the project site.

Design teams must research every product they are considering to determine if any contain forbidden substances. Typically this means calling the product supplier, who in turn must often call the manufacturer to obtain the information. But some manufacturers won't release the data, points out Minnerly, because they consider it proprietary. And many others haven't conducted chemical testing and "don't even know what's in their products," says Richard H. Iredale, a partner at Iredale Group Architecture. The firm has offices in Vancouver and Victoria, British Columbia, and is designing the Bateman Centre.

Specifiers also must keep tabs on shipping distances. The mileage restrictions can severely limit product options. And, needless to say, the effort required to research and track this information adds significantly to a team's workload.

Several project teams also found it hard to meet another of the materials imperatives – responsible industry, which requires that all timber be "certified by the Forest Stewardship Council (FSC), from salvaged sources, or from the intentional harvest of timber on-site for the purpose of clearing the area for construction." At least one client felt that FSC-certified wood was cost-prohibitive, and one architect reported that it was difficult to obtain FSC-certified structural lumber within

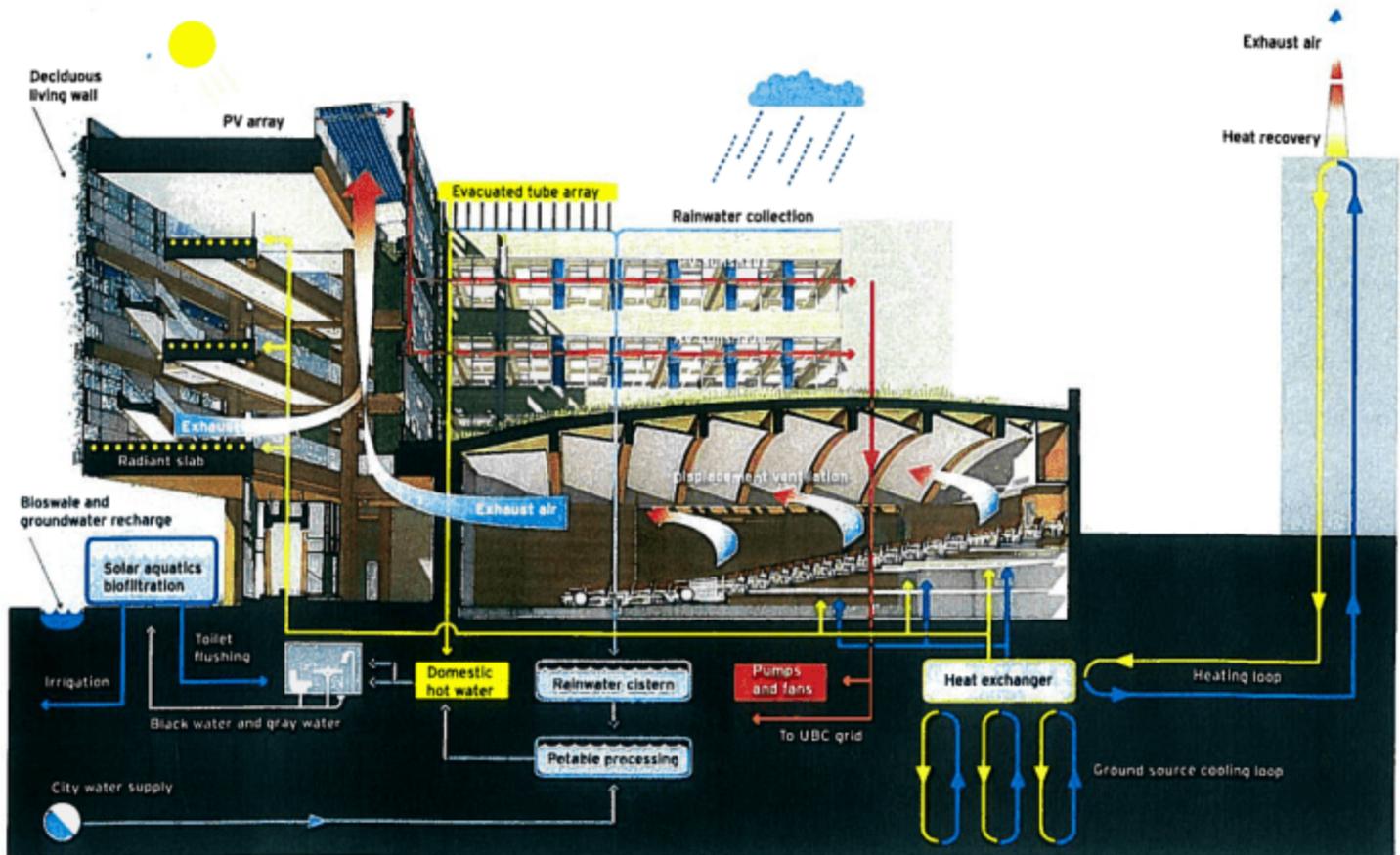
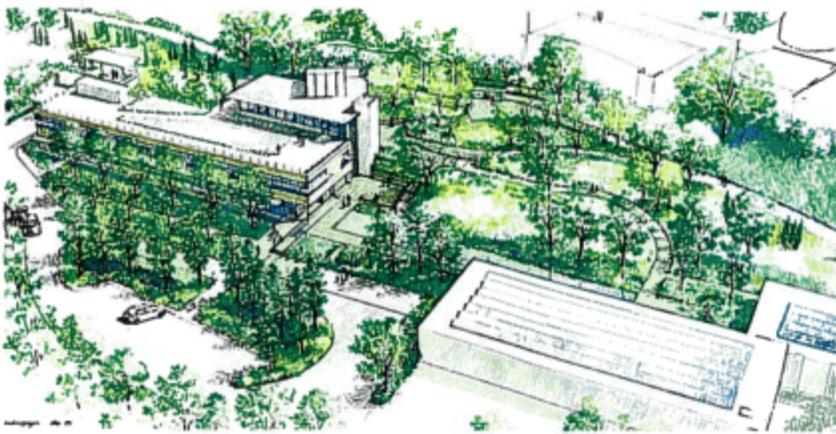


IMAGE: COURTESY BUSBY PERKINS+WILL



The Center for Sustainable Landscapes will house the administrative staff of the Phipps Conservatory and Botanical Gardens, in Pittsburgh. The project team, which includes Design Alliance Architects, is aiming to achieve Living Building status with existing and affordable technologies.

the allowable distances. Many teams instead spent considerable time and energy looking for salvaged wood within the acceptable mileage range.

LEED vs. the Challenge

One cannot discuss a new green building rating system without asking how it compares to LEED, which has become the most accepted system in the country, if not the world. "We fully recognize that the industry wouldn't be ready for the Challenge if it hadn't been for LEED," says Brukman. "We are tackling the same issue from different angles," she says. "While LEED is targeting

incremental change, working to increasingly improve building performance above code to achieve broad market transformation, the Living Building Challenge is coming from the other side, inspiring people by identifying the ideal and seeing how close they can come to it."

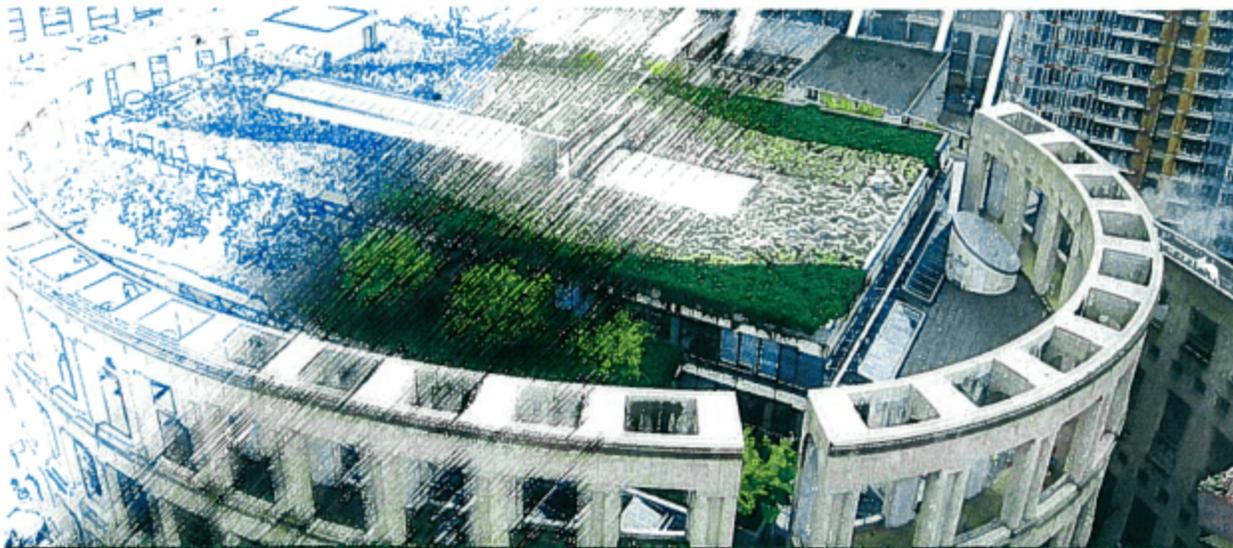
In practice, the most noticeable difference between LEED and the Living Building Challenge is that the former is primarily prescriptive while the latter is primarily performance-based. LEED spells out how a practitioner can accomplish its goals, while the Living Building Challenge encourages team discussion and brainstorming to develop the best strategies, no matter how unique, for the site. "The Challenge's endgame is rigid – all or nothing – but they don't care how you get there," says Minnerly.

And while practitioners generally seem to agree that LEED has established itself firmly in the market, many believe that it will gradually adopt the best ideas of the Living Building Challenge as the goals of this newer, cutting-edge rating system become more attainable. After all, notes Martin Nielsen of Vancouver-based Busby Perkins+Will, the design principal for CIRS, "the avant-garde is continually consumed by the mainstream." ■

Nancy B. Solomon, AIA, writes regularly about architecture, planning, and sustainable design.

CEU questionnaire continued on page 118.

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CIRCLE 05

AIA/Architectural Record Continuing Education

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- 1 The seven Living Building Challenge performance areas, or "petals," include all except which?
 - A water
 - B energy
 - C innovation
 - D beauty
- 2 Which of the following regarding the appropriate sourcing imperative are true?
 - A it limits distances materials and services can be transported, based on density or weight
 - B it identifies potentially toxic substances that must be avoided in products and finishes
 - C both A and B
 - D none of the above
- 3 Which of the following can be used to demonstrate compliance with the net-zero energy imperative?
 - A a whole-building energy simulation
 - B a year's worth of utility bills
 - C a letter from the utility company stating that the building is not connected to the grid
 - D B or C
- 4 The Challenge allows the use of which type of timber?
 - A timber certified by the Forest Stewardship Council
 - B timber from salvaged sources
 - C timber harvested on-site for the purposes of clearing the area for construction
 - D all of the above
- 5 According to the urban agriculture imperative, a renovation must devote how much of its project area to food production?
 - A 80 percent
 - B 5 percent
 - C 2.5 percent
 - D renovation projects have no urban agriculture requirement
- 6 Which of the following substances is not included on the red list?
 - A halogenated flame retardants
 - B thermoplastic polyolefins (TPO)
 - C polyvinyl chloride (PVC)
 - D chlorinated polyethylene
- 7 How can "scale jumping" make it easier to meet the Challenge?
 - A It allows products to come from farther away if these materials are bought in large enough quantities
 - B it allows certain imperatives to be addressed beyond the project's boundaries
 - C it relaxes the criteria for large-scale projects
 - D all of the above
- 8 To achieve Living Building certification, what percent of a project's energy needs must be supplied by on-site renewable energy on a net-annual basis?
 - A 75
 - B 85
 - C 95
 - D 100
- 9 What are some common difficulties faced by project teams trying to determine if a product contains a substance on the red list?
 - A the product supplier cannot answer the question
 - B the manufacturer will not answer because it considers the information proprietary
 - C the necessary chemical tests on the product have never been undertaken
 - D all of the above
- 10 In comparing the Challenge to LEED, which of the following are true?
 - A both require that a project be completed and operating for at least 12 months prior to certification
 - B LEED more clearly indicates how an architect can achieve the rating system's goals
 - C the Challenge is primarily performance-based
 - D B and C

Program title
 "Live | Build | Sustain,"
 ARCHITECTURAL RECORD,
 10/2010, page 110.

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