The Living Building Challenge

In Pursuit of True Sustainability in the Built Environment

INTERNATIONAL
LIVING BUILDING
INSTITUTE

Version 1.3
August 2008

NOTIFICATION

AUTHORSHIP

The *Living Building Challenge* was authored and conceived by Jason F. McLennan prior to joining Cascadia. McLennan serves as the Principal Investigator overseeing the development of the standard and associated tools, together with Cascadia staff Eden Brukman and Thor Peterson.

Table of Contents

The Living Building Challenge 3
Executive Summary
How the Living Building Challenge Works

Site 9
Major Environmental Issues/Petal Intent
Ideal Conditions and Current Limitations
Prerequisites

Energy 11
Major Environmental Issues/Petal Intent
Ideal Conditions and Current Limitations
Prerequisites

Materials 12
Major Environmental Issues/Petal Intent
Ideal Conditions and Current Limitations
Prerequisites

Water 16
Major Environmental Issues/Petal Intent
Ideal Conditions and Current Limitations
Prerequisites

Indoor Quality 17
Major Environmental Issues/Petal Intent
Ideal Conditions and Current Limitations

Beauty & Inspiration 19
Major Environmental Issues/Petal Intent
Ideal Conditions and Current Limitations
Prerequisites

Next Steps and Protocol 20
How to Get Involved

Appendix 21
A Brief History
About the Cascadia Region Green Building Council
Summary of Prerequisites
Acknowledgements
Bibliography

Imagine a building designed and constructed to function as elegantly and efficiently as a flower.

Imagine a building informed by its eco-region's characteristics, and that generates all of its own energy with renewable resources, captures and treats all of its water, and operates efficiently and for maximum beauty.

The International Living Building Institute (ILBI) issues a challenge to all building owners, architects, design professionals, engineers and contractors to build in a way that provides for a sustainable future.

Now is the right time for Living Buildings.

The Living Building Challenge

Executive Summary

No credits, just prerequisites.

The *Living Building Challenge* is attempting to raise the bar and define the most advanced measure of sustainability in the built environment, using a benchmark of what is currently possible and given the best knowledge available today. Projects that achieve this level of performance can claim to be among the 'greenest' anywhere, and will serve as role models to others that follow. Although it may be difficult to achieve the *Living Building Challenge*, understanding the standard and documenting compliance with the requirements is inherently easy: Just sixteen simple and profound requirements that must be met.

This standard is in no way meant to compete with the LEED® Green Building Rating System, the United States Green Building Council (USGBC) or the Canada Green Building Council (CaGBC). The ILBI was founded in 2009 by the Cascadia Region Green Building Council (Cascadia), a chapter of both of these national organizations, and views the *Living Building Challenge* as an additional outlet to promote the goals set by the USGBC and CaGBC – it establishes a vision for a project's environmental and social responsibilities from a new vantage point. It is our sincere hope that the ideas captured in the *Living Building Challenge* will influence program and project outcomes towards greater ecological benefit and that this standard provides additional unifying power for our organizations.

When LEED® emerged in the late 1990's, it filled a huge void in the building industry: designers all over the country were trying to understand how to effectively define 'green building' and measure it in a consistent way. With a focused goal on market transformation, LEED® has done more for the national green building movement than anything previously conceived. When the Platinum certification level was defined, it was widely accepted as the highest rank of environmental performance possible for buildings, and indeed it is significant. Yet, completing the requirements for LEED® Platinum certification does not fulfill the ultimate obligations of the building industry towards the pursuit for sustainability. Rather, it was defined by the changes that seemed possible at the inception of the LEED® program for the majority of projects. The main focus of LEED® is to make green building mainstream and to move the bulk of buildings being built towards higher standards. The *Living Building Challenge's* aim is to push projects even further to provide models for the industry to follow.

Concentric Rings to Sustainability[1]

1 Image courtesy of BNIM Architects

Several milestones have transpired in the last decade that put the *Living Building Challenge* in context:

1. LEED® has been broadly adopted at a considerable rate and has begun to reform the entire building industry. Many municipalities have adopted LEED® certification at the Silver level as a baseline standard.

2. Multiple LEED® certified buildings at the Platinum level have been constructed around the country, some with zero or small first-cost premiums, signaling that the market has evolved and is ready to take the next course of action.

3. The USGBC is in the process of a major restructuring of the LEED® system, modifying the weightings of credits based on potential life cycle impact and adding a focus on regionalization. Minimum performance requirements for energy have also been set.

4. Decentralized buildings that operate solely using onsite renewable energy or that have a closed loop wastewater reuse capacity are being developed across the country. Wind, solar and other sustainable technologies continue to become more economically sound options because we have passed the point of peak oil and cheap fossil-fuel energy is increasingly difficult to procure. Carbon neutral building construction will no doubt follow.

5. Most significantly, it is clear that major environmental trends, such as climate change, are directly linked to human expenditure of natural resources and to the building industry itself. The rate of change and potential disastrous scenarios for our communities and quality of life are increasing. It is also clear that there is a broad societal awakening to this reality, as evidenced by the shift in mass media attention to the issues, the Clinton Climate Initiative, the Mayor's Climate Initiative, the 2030 Challenge and governmental efforts led by the State of California and elsewhere.

At the heart of the *Living Building Challenge* is the belief that our society needs to quickly find a state of balance between the natural and built environments. The release of the Living Building Challenge is an act of optimism and faith in the marketplace to reach high-level goals and project teams are already responding: In the short time since it was unveiled at Greenbuild in 2006, dozens of building owners, designers, developers and contractors throughout North America and around the world have embarked on the *Challenge*.

The race is on.

Despite the rigor encapsulated in the *Living Building Challenge*, project teams are confident that the theoretical requirements are solvable. However, there are two primary perceived limitations to success: code restrictions and first costs. In response to this impression, Cascadia has initiated several studies to shed some light on these influencing factors. Findings will be posted as available to the Resources section of the *Living Building Challenge* website: www.ilbi.org.

Code Studies

In early 2008, Cascadia teamed with David Eisenberg, Director of the Development Center for Appropriate Technology (DCAT) and King County, Washington, to evaluate codes and standards across North America using the *Living Building Challenge* requirements as a guide. To augment this effort, more than a dozen case studies were selected and contributing team members shared their experiences designing buildings to meet the *Challenge* or tackling aspects of the program in projects completed prior to the release of the standard. In this context, the resulting White Paper discusses at a conceptual level the various barriers to creating Living Buildings. It also identifies creative solutions by municipalities and opportunities for modification of and incentives for the adoption of new 'greener' standards. This initial effort to analyze codes and standards is complete and available to download from the Cascadia website.

The City of Vancouver and Clark County, Washington, have also embarked on a study with Cascadia to simulate the code review process using six prototypical affordable housing projects with Living Building characteristics. The goal of this mock-review is to identify specific City, County and State constraints as a way to expand the implementation of sustainable design strategies. Due to the partnership with these agencies, this research project is not merely an academic exercise, but a template for broad institutional change. The completion of this study is anticipated for Spring 2009.

Financial Study

A subsequent endeavor to the widely distributed 'Packard Sustainability Matrix', published by the David and Lucile Packard Foundation in 1999, the purpose of Cascadia's Financial Study is to investigate the economic obstacles to creating Living Buildings, and determine how these vary based on building type and location. Using an RFP process, Cascadia contracted with a multi-disciplinary team, including SERA Architects, Gerding/Edlen Development, Skanska Construction, Interface Engineering, and New Buildings Institute. Nine building types, ranging from residential to commercial and institutional, will be evaluated in five different climate zones: cold; mixed; temperate; hot humid; and hot arid. Ultimately, the research will be compiled into a matrix that includes a cost estimate and payback calculation, savings, and net present value of the buildings through time accounting for energy and water costs, maintenance and repairs. The completion of this study is anticipated for late 2008.

LIVING BUILDING CHALLENGE

How the Living Building Challenge Works

not what you are going to do.... but what you've done
not baby steps... but giant leaps

The purpose of the *Living Building Challenge* is straightforward – to define the highest measure of sustainability possible in the built environment based on the best current thinking – recognizing that 'true sustainability' is not yet possible. The *Living Building Challenge* is by definition difficult to achieve. Although facets of this standard have been accomplished in numerous projects around the world, to date, no single project has integrated the *Challenge* in its entirety. With this standard, the ILBI aims to encourage dialogue on the necessary evolution of the building industry and engender support for the first pilot projects, until more and more Living Buildings emerge.

Two rules govern the standard:

1. All elements of the *Living Building Challenge* are mandatory. Many of the requirements have temporary exceptions to acknowledge current market limitations. These are listed in the footnotes of each section. Exceptions will be modified or removed as the market changes.

2. Living Building designation is based on actual, rather than modeled or anticipated, performance. Therefore, buildings must be operational for at least twelve consecutive months prior to evaluation.

Some useful guiding information:

- This standard is an evolving tool. Periodically, new releases that update or provide clarification for the prerequisites will be made available.
- The implementation of this standard requires leading-edge technical knowledge, an integrated design approach, and design and construction teams well versed in advanced practices related to green building.
- The Living Building is performance-based instead of prescriptive in nature and for the most part does not concentrate on *how* prerequisites are met. This should be the domain of the design team and owner.
- The *Living Building Challenge* is suitable for any building type since it is performance-based. As a result, the strategies to create Living Buildings will vary widely by occupancy, construction type and location, which is appropriate.
- The standard can be applied to existing buildings as well as to new buildings. Specific modifications of the standard to heighten relevance for existing buildings will be specified in this document or in the User's Guide.
- The *Living Building Challenge* does not dwell on basic best practice issues so it can instead focus on fewer, high level needs. It is assumed that to achieve this progressive standard, typical best practices are being met.[2]

2 It is highly encouraged that projects that cannot achieve the *Living Building Challenge* pursue LEED certification at a Platinum or Gold level, since LEED remains the market's premier rating system.

- The internal logic of the *Living Building Challenge* is based on pragmatic experience with what has been built in the marketplace. The standard is difficult – but not impossible – to fulfill.

There will not be a uniform ease of achieving the *Living Building Challenge* due to a number of variables, including climate factors and building characteristics. For example, becoming water-independent in the desert demands "evolving" building design to be more like a cactus and less like a tree. Making a 30-story building energy independent requires great investments in efficiency and in a building skin that fundamentally harnesses energy. Architecture will be richer because of this response to place.

Living Buildings have their own 'utility,' generating their own energy and processing their own waste. They more appropriately match scale to technology and end use, and result in greater self-sufficiency and security. Yet, the ideal scale for solutions is not always at the level of a single building. Depending on the technology, the optimal scale can vary when considering environmental impact, first cost and operating costs. To address these realities, the *Living Building Challenge* has inserted the concept of Scale-Jumping to allow multiple buildings or projects to operate in a symbiotic state – sharing green infrastructure as appropriate and allowing for Living Building status to be achieved as elegantly and efficiently as possible. For more information on Scale Jumping, refer to the User's Guide.

There are a variety of tools available that provide insight to and assistance with the successful implementation of the *Living Building Challenge*. Cascadia strongly recommends that project teams make use of these to have a well-rounded understanding of the standard.

The User's Guide

The companion guide to this document, The User's Guide provides technical information and support for the *Living Building Challenge*. Throughout these pages you will find references to the User's Guide to flesh out specific parameters of the standard. In-depth commentaries, compliance paths and documentation requirements are also located in the User's Guide. It, too, is a burgeoning component of the *Living Building Challenge*, and is available through the Community, described below.

The Community

The online presence for the *Living Building Challenge*, the Community is the site for all key resources for the program. In addition to housing the published standard and the User's Guide, other documents such as Cascadia-initiated studies, articles about projects pursuing the *Challenge*, project team generated support information, and other tools are also available. Some areas of the website are accessible solely to Community members, and subscriptions are available for an annual fee and include one 'living' t-shirt:

$125 Cascadia Members, $150 Non-Cascadia members

(Please note that Cascadia individual membership is separate from USGBC and CaGBC corporate membership, although some discounts apply. Refer to our website for more information: www.cascadiagbc.org/membership.)

Primarily, the Community is intended to be a key starting point for increased cooperation and communication across disciplines to generate Inter-organizational Collaboration. The building industry and all its sectors must transcend beyond the typical constraints imposed by traditional competition and 'trade secrets', and find ways to educate each other, train each other, and push each other. Indeed, more important than any single project is the spirit of helping a network of projects achieve Living Building status.

The Community Dialogue

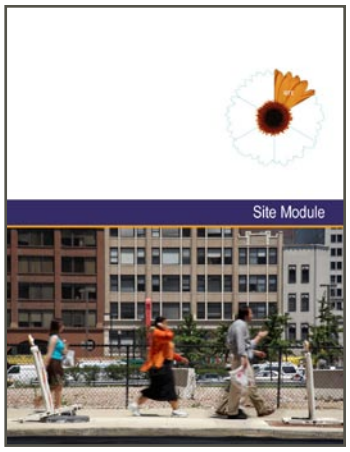
Ultimately, the success of the *Living Building Challenge* will rely on the active engagement of project teams and creative input from knowledgeable individuals. The Dialogue website was created to support general discussion and channel feedback and constructive criticism about the standard. Using the six Petals of the *Living Building Challenge* to organize and encourage conversations, this forum will not only yield modifications to future releases of the standard itself, but it will also serve as a platform for distributing strategies for success.

The Living Building Leader Program

The goal of the Living Building Leader program is to cultivate thought and action leaders to help shepherd in a new era where humanity works in concert with the natural environment. A series of online courses taught by experts in the diverse fields that underpin the multidisciplinary effort that is green building, the program provides educational support to the industry as a means to develop the intensive skill set required to create Living Buildings and effect transformative change. Individuals who successfully complete all courses may use Living Building Leader designation behind their name. More information about this program can be found online at www.livingbuildingleader.org.

The internal logic of the Living Building Challenge is based on pragmatic experience with what has been built in the marketplace. The standard is difficult, but not impossible, to fulfill.

Site



Humanity has co-opted enough land; it is time to draw boundaries and declare it enough.

Major Environmental Issues/Petal Intent

The continued outward spread of development and sprawl threatens the few wild places that remain. The decentralized nature of our communities increases transportation impacts and pollution. As flat, prime land for construction diminishes, more and more development tends to occur in sensitive areas that are easily harmed or destroyed. Invasive species threaten ecosystems, which are already weakened by the constant pressure of existing development. The intent of this Petal is to clearly articulate where it is acceptable to build and how to protect and restore a place once it has been developed and degraded.

Ideal Conditions and Current Limitations

The *Living Building Challenge* envisions a moratorium on the seemingly never-ending growth outward and a focus on compact, connected communities, which is an inherent conservation tool for the natural resource systems that support human health. As previously disturbed areas are restored, the trend is reversed and nature's functions are invited back into a healthy interface with the built environment.

Prerequisites

Prerequisite One – Responsible Site Selection

You may not build on the following locations:

- On or adjacent to sensitive ecological habitats[3] such as:
  - Wetlands[4]: maintain at least 50-feet, and up to 225-feet[5] of separation
  - primary dunes[6]: maintain at least 120-feet of separation
  - old growth forest[7]: maintain at least 200-feet of separation
  - virgin prairie[8]: maintain at least 100-feet of separation
- Prime farmland[9]
- Within the 100 year flood plain[10]

Prerequisite Two – Limits to Growth

Projects may only be built on greyfield or brownfield[11] sites that have been previously developed[12] prior to December 31, 2007. Project teams must document conditions prior to start of work..

Prerequisite Three - Habitat Exchange

For each acre of development, an equal amount of land must be set-aside for at least 100 years as part of a habitat exchange[13].

3 Increased setbacks my be appropriate on specific sites. The following are minimum distances to property line boundaries. For the definition of Sensitive Ecological Habitats and other terms used herein, refer to the Glossary in the User's Guide.

4 Unless the building's purpose is related to wetland protection or interpretation.

5 Minimum buffer widths vary, depending on the wetland classification. See the User's Guide for more information. Also see the wetland Considerations factsheet for King County, Washington: www.metrokc.gov/ddes/cao/#factsheets.

6 Unless the building's purpose is related to primary dune protection or interpretation and demonstrates that the site's ecological systems are not disturbed.

7 Unless the building's purpose is related to forest protection or interpretation and demonstrates that the site's ecological systems are not disturbed.

8 Unless the building's purpose is related to prairie protection or interpretation and demonstrates that the site's ecological systems are not disturbed.

9 Unless the building is related to farming or is a working farm/farmhouse.

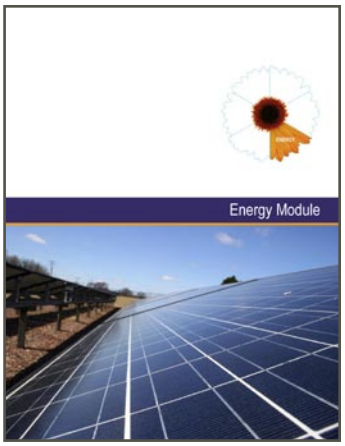
10 Unless part of an existing historic community core developed prior to 1945, or a location classified by Walk Score (www.walkscore.com) with a minimum rating of 70. For more information, refer to the User's Guide.

11 Previously developed sites will be defined in the User's Guide.

12 Unless the building purpose is related to the protection or interpretation of the virgin land.

13 One acre is the minimum offset amount. Compliance path and acceptable habitat exchange programs will be provided in the User's Guide.

Energy



A living building relies solely on current solar income.

Major Environmental Issues/Petal Intent

The majority of energy generated today is from unsustainable sources including coal, gas, oil and nuclear energy. Large-scale hydro, while inherently cleaner, brings widespread damaging ecosystem impact. The effects of these energy sources on regional and planetary health is becoming more and more evident, with climate change being the most worrisome of major global trends due to human activity. The intent of this prerequisite is to signal a new age of design, whereby all buildings rely solely on renewable forms of energy and operate year in and year out in a pollution-free manner. Since renewable energy sources are inherently more expensive than energy efficiency measures, efficiency as a first step is assumed.

Ideal Conditions and Current Limitations

The *Living Building Challenge* envisions a safe, reliable decentralized power grid relying completely on renewable energy powering incredibly efficient buildings. The major limitation currently is cost.

Prerequisites

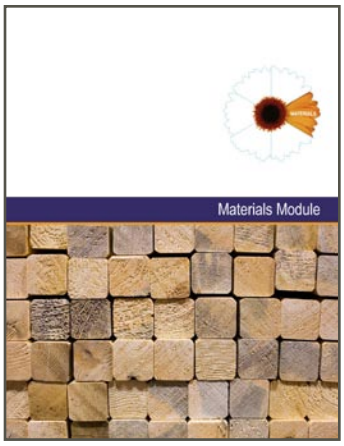
Prerequisite Four – Net Zero Energy[14]

One hundred percent of the building's energy[15] needs supplied by on-site renewable energy[16] on a net annual basis.

14 This prerequisite may be attempted using the Scale Jumping design overlay, which endorses the implementation of solutions beyond the building scale that maximize ecological benefit while maintaining self-sufficiency at the city block, neighborhood, or community scale. For more information on Scale Jumping, refer to the User's Guide.

15 Must include all electricity, heating and cooling requirements. Back-up generators are excluded. System may be grid-tied or off the grid.

16 Renewable energy is defined as photovoltaics, wind turbines, water-powered microturbines, methane from composting only, direct geothermal or fuel cells powered by hydrogen generated from renewably powered electrolysis.



Materials

Safe, healthy and responsible for all species.

Major Environmental Issues/Petal Intent

The environmental issues surrounding materials are numerous and include health and toxicity, embodied energy, pollution and resource depletion. The intent of these prerequisites are to remove, from a health and pollution standpoint, the worst known offending materials, and to reduce and offset the environmental impacts associated with the construction process. At the present time it is impossible to gauge the true environmental impact and toxicity of the buildings we create.

Ideal Conditions and Current Limitations

The *Living Building Challenge* envisions a future where all materials in the built environment are safe and replenishable and have no negative impact on human and ecosystem health. The precautionary principle guides all materials decisions.

There are significant limitations to achieving the level of the Living Building in the materials realm. The biggest limitation is due to the market itself. While there are a huge number of "green" products on the market, there is a shortage of good data that sufficiently backs up manufacturer claims and provides consumers with the ability to make conscious, informed choices. Cascadia recognizes the Pharos Project[17] protocol developed by the Healthy Building Network, University of Tennessee Center for Clean Products and Cascadia as the best framework for evaluating materials and the most progressive tool for consumer benefit. Project teams are encouraged to eliminate all known persistent bio-accumulative toxins (PBTs), carcinogens and reproductive toxicants from their specifications.[18]

At the present time it is impossible to gauge the true environmental impact and toxicity of the buildings we create.

17 www.PharosProject.net

18 For more information see: http://www.healthybuilding.net/healthcare/HCWH-CHD-POP_PBT_list.pdf and http://www.oehha.ca.gov/prop65.html

Prerequisites

Prerequisite Five – Materials Red List[19]

The project cannot contain any of the following Red List materials or chemicals.[20]

- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethlene[21]
- Chlorofluorocarbons (CFCs)
- Chloroprene (Neoprene)
- Formaldehyde (added)[22]
- Halogenated Flame Retardants[23]
- Hydrochlorofluorocarbons (HCFCs)
- Lead[24]
- Mercury[25]
- Petrochemical Fertilizers and Pesticides[26]
- Phthalates
- Polyvinyl Chloride (PVC)[27]
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol

Prerequisite Six – Construction Carbon Footprint[28]

The project must account for the embodied carbon footprint of its construction through a one-time[29] carbon offset tied to the building's square footage and general construction type.[30]

19 Cascadia has adopted a Red List of materials that we believe should be phased out of production due to health/toxicity concerns. This list will be updated as new science emerges. Due to manifold manufacturing processes, there is a Small Component exception for complex products made from more than ten constituent parts. Small components must be less than ten percent of a product by both weight *and* volume. Refer to the User's Guide for more information.

20 It is acceptable to jump one Zone, as defined in Prerequisite 8, if compliant materials or products are not procurable within apportioned Zones. Once a compliant product is available within the Zone as originally designated in this standard, the exception will be removed. Refer to the User's Guide for more information.

21 HDPE and LDPE are excluded.

22 A temporary exception is made for glulam beams made using phenol formaldehyde. Refer to the User's Guide for documentation requirements.

23 Halogenated flame retardants include: PBDE, TBBPA, HBCD, Deca-BDE, TCPP, TCEP, Dechlorane Plus and other retardants with bromine or chlorine.

24 An exception is made for solder and grid-tied solar battery systems only.

25 A temporary exception is made for low-mercury fluorescent lighting.

26 To attain Living Building status, petrochemical fertilizers and pesticides may not be used for the duration of the certification period or be needed for subsequent operations and maintenance.

27 A temporary exception is made for PVC in wiring applications where it is mandated by code or where the Small Component exception applies.

28 This number can be reduced by 50 percent for retrofits of existing buildings, which will be described in the User's Guide.

29 It should be recognized that buildings continue to accrue embodied energy as systems are replaced and repaired over time. It is recommended that additional offsets be purchased at 7-10 year intervals; however, this is not currently a *Living Building Challenge* requirement.

30 This offset formula will be presented in the User's Guide.

Prerequisite Seven – Responsible Industry[31]

All wood must be certified by the Forest Stewardship Council (FSC),[32] from salvaged sources, or the intentional harvest of timber onsite for the purpose of clearing the area for construction [33].

Prerequisite Eight – Appropriate Materials/Services Radius

Source locations for Materials and Services must adhere to the following restrictions[34]:

Weight/Distance List

ZONE	MATERIAL OR SERVICE	MAXIMUM DISTANCE
7	Ideas	12,429.91 miles
6	Renewable Energy Technologies[35]	9000 miles
5	Assemblies that actively contribute to building performance once installed[36]	3000 miles
4	Consultant Travel[37]	1500 miles
3	Light, low density materials[38]	1000 miles
2	Medium Weight and density materials	500 miles
1	Heavy, high density materials[39]	250 miles

Materials radius determined by shipping weight. Image of sample radius for Seattle, Washington, courtesy of Bassetti Architects, overlaid on a Google map.

31 Subsequent iterations of this standard will include regulations for other industries as they become available. All regulations referenced must be from independent third party organizations and not funded by the industries themselves.

32 An exception is made for wood in situ in existing buildings undergoing retrofit.

33 It is acceptable to jump one Zone, as defined in Prerequisite 8, if compliant materials or products are not procurable within apportioned Zones. Once a compliant product is available within the Zone as originally designated in this standard, the exception will be removed. Refer to the User's Guide for more information.

34 There is a variance for remote locations, such as Alaska, Hawaii and Yukon that modifies the Zone distances as follows: Zone 1 - 1,000 miles, Zones 2 and 3 - 3,000 miles. For all other project locations, it is also acceptable to jump one Zone to comply with either Prerequisite 5 or 7 if compliant materials or products are not procurable within apportioned Zones. Once a compliant product is available within the Zone as originally designated in this standard, the exception will be removed. Refer to the User's Guide for more information.

35 Defined as wind, solar thermal, photovoltaics or fuel cells – also see footnote 16.

36 Assemblies include products that contribute to the successful attainment of the Energy and Water Petals over time, such as high performance windows, mechanical equipment and decentralized water systems. Refer to the User's Guide for a complete listing and rationale of this Zone distinction.

37 Applies only to major project team members including the architect of record, mechanical, electrical, plumbing and structural engineers of record. A temporary exception is made for specialty consultants, who may travel up to 3000 miles.

38 The scale for weight designations will be in the User's Guide. The Small Component exception for complex products may apply - see Footnote 19.

39 There is an exception for metal products (such as steel, aluminum and its alloys, copper, and nickel) that typically are composed from globally-sourced recycled content. Fabrication of these products must be domestic and within Zone radius per density class. Refer to the User's Guide for more information.

Prerequisite Nine Leadership in Construction Waste

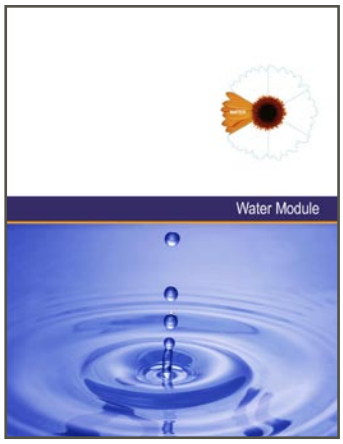
Construction Waste must be diverted from landfills[40] to the following levels:

MATERIAL	MINIMUM Diverted/Weight
Metals	95%
Paper and Cardboard	95%
Soil, and biomass	100%
Rigid Foam, carpet & insulation	90%
All others - combined weighted average[41] Asphalt Concrete and concrete masonry units (CMUs) Brick, tile and masonry materials Untreated lumber Plywood, oriented strand board (OSB) and particle board Gypsum wallboard scrap Glass Plumbing fixtures Windows Doors Cabinets Architectural fixtures Millwork, paneling and similar Electric fixtures, motors, switch gear and similar HVAC equipment, duct work, control systems, switches	80%

Hazardous materials in demolition waste, such as lead-based paint, asbestos, and polychlorinated biphenyls (PCBs), are exempt from percentage calculations.

40 Diverted waste includes those that are: recycled, reused, salvaged or composted. Incineration is not permitted.

41 Weighted average is lower to account for lack of diversion markets in certain jurisdictions.



Water

A Living Building is water independent.

Major Environmental Issues/Petal Intent

Scarcity of clean potable water is quickly becoming a serious issue in many countries around the world. Most regions of the United States and Canada have avoided the majority of these limitations and problems to-date due to the presence of abundant fresh water, but highly unsustainable water use patterns and the continued draw-down of major aquifers portent significant problems ahead. These prerequisites realign how people use water in the built environment, so that water is respected as a precious resource.

Ideal Conditions and Current Limitations

The *Living Building Challenge* envisions a future whereby all buildings are designed to harvest sufficient water to meet the needs of occupants, while respecting the natural hydrology of the site, the water needs of neighbors and the ecosystem it inhabits. Indeed, water can be used and purified and then used again. Currently, such practices are often illegal due to health code regulations in North America, which arose precisely because people were not properly safeguarding the quality of their water. Therefore, reaching the ideal for water use presently is dependent on what is allowable by code.

Prerequisites

Prerequisite Ten – Net Zero Water[42]

100 percent of occupants' water use[43] must come from captured precipitation or closed loop water systems that account for downstream ecosystem impacts and that are appropriately purified without the use of chemicals[44].

Prerequisite Eleven – Sustainable Water Discharge

One hundred percent of storm water and building water discharge must be managed[45] on-site and integrated into a comprehensive system to feed the project's demands.

42 This prerequisite may be attempted using the Scale Jumping design overlay, which endorses the implementation of solutions beyond the building scale that maximize ecological benefit while maintaining self-sufficiency at the city block, neighborhood, or community scale. For more information on Scale Jumping, refer to the User's Guide.

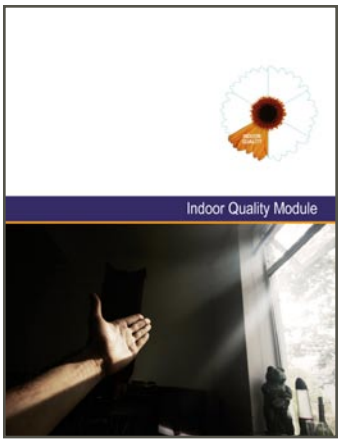
43 There is an exception for water that must be from potable sources due to local health regulations, including sinks, faucets and showers but excluding irrigation, toilet flushing, janitorial uses and equipment uses. However, due diligence to comply with this prerequisite must be demonstrated through filing an appeal(s) with the appropriate agency (or agencies).

44 An exception is made for an initial water purchase to get cisterns topped off. A Living Building only buys water once.

45 Acceptable onsite stormwater management practice will be defined in the User's Guide.

Indoor Quality

Maximize health, minimize impact.



Major Environmental Issues/Petal Intent

Most buildings provide far less than ideal conditions for maximum health and productivity. As comfort decreases, environmental impact often increases, as people find inefficient and wasteful solutions to improve their physical environment. The intent of these prerequisites is not to address all of the potential ways that an interior environment could be compromised, but to focus on best practices to create a healthy interior environment.

Ideal Conditions and Current Limitations

The *Living Building Challenge* envisions an indoor environment that enhances physical and emotional well being. However, it is difficult to ensure that these places will remain vibrant for people - especially over time - as sensory aspects such as air quality, thermal control and visual comfort can easily be compromised in numerous ways. Further, it is difficult to insure optimal conditions due to the unpredictable nature of how people operate and maintain a building.

Prerequisites

Prerequisite Twelve – A Civilized Environment

Every occupiable space must have operable windows[46] that provide access to fresh air and daylight[47].

46 There are exceptions for spaces where the absence of daylight is critical to the performance of the space (such as a theatre) or where operable windows could pose a health risk (such as laboratory spaces with fume hoods where air flow could be compromised). A list of exempt spaces is in the User's Guide.

47 Minimum requirements for window sizes and placement relative to interior spaces and program are defined in the User's Guide.

Prerequisite Thirteen – Healthy Air: Source Control

All buildings must meet the following criteria:

- Entryways must have an external dirt track-in system and an internal one contained within a separate entry space.[48]
- All kitchens, bathrooms, copy rooms, janitorial closets and chemical storage spaces must be separately ventilated.
- All interior finishes, paints and adhesives must comply with SCAQMD 2007/2008 standards[49]. All other interior materials such as flooring and case works must comply with California Standard 01350 for IAQ emissions[50].
- The building must be a non-smoking facility.

Prerequisite Fourteen – Healthy Air: Ventilation

The building must be designed to deliver air change rates in compliance with California Title 24 requirements.

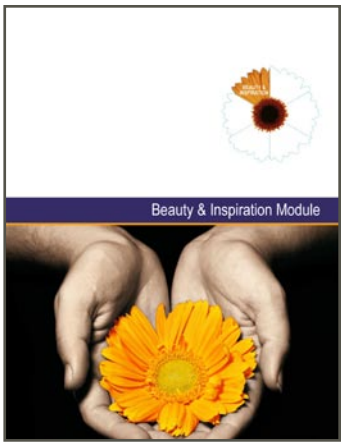
As comfort decreases, environmental impact often increases, as people find inefficient and wasteful solutions to improve their physical environment.

48 Acceptable Dirt track in systems are defined in the User's Guide.

49 South Coast Air Quality Management District http://www.aqmd.gov/

50 Based on Title 24 requirements at the time of construction.

Beauty & Inspiration



A Living Building tells a story.

Major Environmental Issues/Petal Intent

As a society we are often surrounded by ugly and inhumane physical environments. If we do not care for our homes, streets and offices then why should we extend care outward to our farms, forests and fields? When we accept billboards, parking lots and strip malls as being aesthetically acceptable, in the same breath we accept clear-cuts, factory farms and strip mines. The *Living Building Challenge* recognizes the need for beauty as a precursor to caring enough to preserve, conserve and serve the greater good.

Ideal Conditions and Current Limitations

The *Living Building Challenge* envisions designs that elevate our spirits. Mandating beauty is, by definition, an impossible task. And yet, the level of discussion and, ultimately, the results are elevated through attempting difficult but critical tasks. In this Petal, the prerequisites are based merely on genuine efforts. We do not begin to assume we can judge beauty and project our own aesthetic values on others. But we do want to understand people's objectives and know that an effort was made to enrich people's lives with each square foot of construction on each project. This intentionality must carry forth into a program for educating the public about the environmental qualities of their Living Building.

Prerequisites

Prerequisite Fifteen – Beauty and Spirit

The project must contain design features intended solely for human delight and the celebration of culture, spirit and place appropriate to the function of the building.

Prerequisite Sixteen – Inspiration and Education

Educational materials about the performance and operation of the project must be provided to the public[51] to share successful solutions and to motivate others to make change. Non-sensitive areas of the building must be open to the public at least one day per year, to facilitate direct contact with a Living Building.

51 Sample educational materials tailored to building occupancy will be provided in the User's Guide.

Next Steps and Protocol

The *Living Building Challenge* is intended to be a living document. This version is merely a starting point in the continual development of the standard. As new ideas emerge, the ILBI will update and improve upon the tools and its supporting documentation. Major modifications to the standard will be made periodically as new science emerges or as conditions in the marketplace change, thereby affecting what is possible. Specific developments that Cascadia is initiating include the following:

- Continue the development of the Living Building User's Guide.
- Increase online learning sessions and course topics available through the Living Building Leader program
- Update the Community Dialogue to ease discussion and feedback.
- Create a Living Communities standard based on this document.

How to Get Involved

Continued advancement of the *Living Building Challenge* will require many minds and great ideas. the ILBI will be looking for help in various ways, including:

- Providing informal feedback on version 1.3
- Joining the Living Building Community and contributing to the Dialogue.
- Sharing information, documents and tools that help facilitate the design and construction process
- Researching various support documentation.
- Making charitable donations to help sponsor the progress of the standard and its subsidiary programs.
- Participating in the creation of project review committees.

The Living Building Challenge is intended to be a living document. This version is merely a starting point in the continual development of the standard.

Appendix

A Brief History

The idea for the Living Building first emerged in the mid-nineties during the creation of the NIST[52]-funded EpiCenter project in Bozeman, Montana. The goal of this project, led by Bob Berkebile and Kath Williams, was to produce the most advanced sustainable design project in the world. Jason F. McLennan guided the research and technology efforts on the project, and originally conceptualized and began developing the requirements for what is now known as the Living Building. Following EpiCenter, Berkebile and McLennan continued to develop these ideas and publish several articles on the concept.[53]

In 2000, BNIM Architects[54] was selected to design the new headquarters of the David and Lucile Packard Foundation and, as part of this work, researched the economic and environmental implications of the Living Building concept along with levels of LEED® certification. In 2001, findings were presented in a document called the Packard Matrix. KEEN Engineering also significantly contributed to this effort. The Packard Matrix demonstrated that the level of the Living Building was the smartest long-term choice economically, although it carried a hefty first-cost premium. An updated study a year later showed this premium to be a bit smaller. It is projected that the first-cost premiums will continue to diminish and Living Buildings will soon emerge in response to the issuance of this standard.

In 2005, McLennan began to turn the conceptual idea of a 'living' building into a codified standard that became the *Living Building Challenge* version 1.0. He presented this standard to Cascadia in August 2006, and three months later the *Challenge* was launched.

In 2009, Cascadia founded the International Living Building Institute to encourage the creation of Living Buildings, Sites and Communities in countries around the world while inspiring, educating and motivating a global audience about the need for fundamental and transformative change.

The ideal of the Living Building continues to be mentioned within the green building movement, although a true Living Building has yet to emerge. That said, every single aspect of the *Living Building Challenge* has been implemented successfully in multiple projects. Indeed, it has been proven that the concept is possible today; it was only the specific standard that unites the requirements that was missing until now.

About the Cascadia Region Green Building Council

The Cascadia Region Green Building Council is named for the Cascadia bioregion, which covers land that drains to the Pacific Ocean through the greatest temperate rain forests on the planet. The Chapter promotes the design, construction and operation of buildings that are environmentally responsible, profitable and healthy places to live, work and learn throughout Alaska, British Columbia, Washington and Oregon. Incorporated as a 501(c)(3) charitable organization in December 1999, and incorporated in British Columbia under the Society Act in 2008, Cascadia is one of three original chapters of the United States Green Building Council. It is also the largest chapter of the Canada Green Building Council.

52 The National Institute of Standards and Technology

53 See Bibliography for an abbreviated list of articles

54 www.bnim.com

Summary of Prerequisites

Number	Petal	Prerequisite
One	Site	Responsible Site Selection
Two	Site	Limits to Growth
Three	Site	Habitat Exchange
Four	Energy	Net Zero Energy
Five	Materials	Materials Red List
Six	Materials	Construction Carbon Footprint
Seven	Materials	Responsible Industry
Eight	Materials	Appropriate Materials/Services Radius
Nine	Materials	Leadership in Construction Waste
Ten	Water	Net Zero Water
Eleven	Water	Sustainable Water Discharge
Twelve	Indoor Quality	A Civilized Environment
Thirteen	Indoor Quality	Healthy Air: Source Control
Fourteen	Indoor Quality	Healthy Air: Ventilation
Fifteen	Beauty & Inspiration	Beauty and Spirit
Sixteen	Beauty & Inspiration	Inspiration and Education

Acknowledgements

The following individuals have contributed to the development of the tool to-date:

Jason F. McLennan, Cascadia - Principal Investigator
Eden Brukman, Cascadia
Thor Peterson, Cascadia
Paul Anseeuw, Stantec
Bob Berkebile, BNIM Architects
Clark Brockman, SERA Architects
Maria Cahill, Green Girl Land Development Solutions
Peter Dobrovolny, City of Seattle
Mark Frankel, New Buildings Institute
Gina Franzosa, Cascadia
Deb Guenther ASLA, Mithun
Marni Evans Kahn, Cascadia
Tom Lent, Healthy Building Network
Joe Llona, cdi engineers
Dale Mikkelson, UniverCity - Simon Fraser
Gail Vittori, Center for Maximum Potential Building Systems
Kath Williams, Kath Williams + Associates
Jessica Woolliams, Cascadia

It is our intention to fully develop the technical team for the *Living Building Challenge* moving forward.

Bibliography

Berkebile, Robert and Jason McLennan. *The Living Building.* http://www.WorldandI.com, October 1999

Berkebile, Robert and Jason McLennan. *The Living Workplace Habitat.* http://www.WorldandI.com, April 2002.

LEED®-NC Version 2.2 Reference Guide. US Green Building Council and Paladino and Company, 2005.

McLennan, Jason. *Living Buildings.* Energy Program Evaluation Conference, ACEEE, Asilomar, California, August 1998.

McLennan, Jason. *The Philosophy of Sustainable Design*. Ecotone Publishing: Kansas City, 2004.

Packard Foundation, 2002. *The Sustainability Report and Matrix.* The David and Lucile Packard Foundation: Los Altos Project, www.bnim.com/fmi/xsl/research/packard/index.xsl.

Whitter, K.M., and T.B. Cohn. Second International Green Buildings Conference and Exposition, National Institute of Science and Technology: Gaithersburg, Maryland, 1995.

Williams, Kath, Robert Berkebile, Jason McLennan, Kathy Achelpohl, and Phaedra Svec. *The NIST Report for the MSU EPICenter*. National Institute of Standards and Technology: Washington, DC, September 2000.

ILBI's mission is to encourage the creation of Living Buildings, Sites and Communities in countries around the world while inspiring, educating and motivating a global audience about the need for fundamental and transformative change.

INTERNATIONAL
LIVING BUILDING
INSTITUTE

410 Occidental Avenue South | Seattle, WA 98104 | ph 206.223.2028 | fx 206.260.2450
www.ilbi.org