



Taking the Living Building Challenge in High End Residential Projects

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Fundamentals of Sustainable Design
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Introduction

The goal of this paper is twofold:

- to prime designers, builders and clients on The Living Building Challenge
- to help project teams decide if The Living Building Challenge is right for them

At its core, the Living Building Challenge is a project evaluation and certification process that promotes regenerative design. Regenerative design can be defined as follows:

...a systems theory based design process that restores, renews or revitalizes its own sources of energy and materials, creating sustainable systems that integrate the needs of society with the integrity of nature.



<http://interactioninstitute.org/>

The project registration process is comprised of a project team, a third-party auditor, and the International Living Future Institute (ILFI). The ILFI has a goal to reduce the resources required for registration and audit. In addition, there is a required project performance evaluation period of one year.

Confidentiality

ILFI will keep project information (drawings, project manuals, and construction documents) for up to one year, after which this information is destroyed. However, IFLI may deem to use general project information, including submitted images, for educational purposes and to further the mission of the Institute.

History

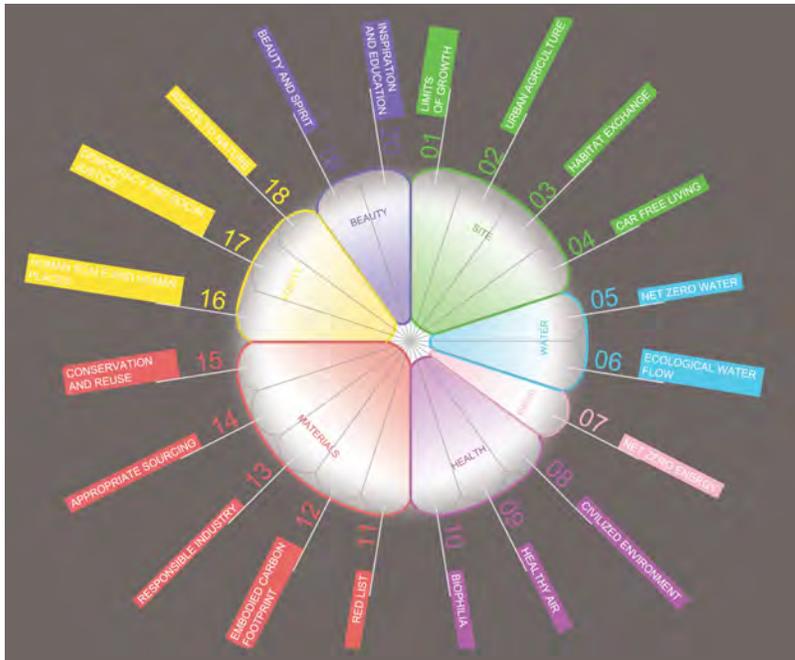
“Living Building Challenge is the Institute’s flagship program for deep systemic change.”

The origins of the Living Building Challenge can be traced to the 1990’s where it began as an effort *“to produce the most advanced sustainable design project in the world.”* This project, the EpiCenter in Bozeman, Montana, was led by Bob Berkebile and Kath Williams, with research and technology development directed by Jason F. McLennan and funding from the National Institute of Standards and Technology. The EpiCenter project gave the Living Building framework its legs, and in 2000, BNIM was enlisted by the David and Lucile Packard Foundation to compare performance and evaluation of a “Living Building” to multiple types of LEED building certification requirements. The Packard Matrix was produced, and this document *“...demonstrated that a Living Building was the smartest long-term choice economically...”*

In August of 2006, McLennan presented Living Building Challenge version 1.0 to the Cascadia Green Building Council and three months later the Challenge was made public. Living Building Challenge 2.0 development began in 2007, and was expanded to include renovations, landscaping, neighborhoods, and infrastructure in addition to buildings. The International Living Building Institute was founded in 2009 to cultivate, promote and organize the Living Building Challenge and additional programs and began certifying projects in 2010. Its mission: *“to lead the transformation to a world that is socially just, culturally rich and ecologically restorative.”* The Institute, later renamed the International Living Future Institute, offers membership and volunteer opportunities, and has a superb online presence including a community and blog.

Core Components

Petals & Imperatives



<http://greenbuildingadvisor.com/>

The Petals are broken down into 20 imperatives. Each imperative has the option of one or more exemptions if other criteria can be met demonstrating the goal of the imperative.

Seven petals represent seven performance areas:

- 1.Place
- 2.Water
- 3.Energy
- 4.Health & Happiness
- 5.Materials
- 6.Equity
- 7.Beauty

IMPERATIVE

IMPERATIVE	
01	Limits to Growth
02	Urban Agriculture
03	Habitat Exchange
04	Human Powered Living
05	Net Positive Water
06	Net Positive Energy
07	Civilized Environment
08	Healthy Interior Environment
09	Biophilic Environment
10	Red List
11	Embodied Carbon Footprint
12	Responsible Industry
13	Living Economy Sourcing
14	Net Positive Waste
15	Human Scale + Humane Places
16	Universal Access to Nature and Place
17	Equitable Investment
18	JUST Organizations
19	Beauty + Spirit
20	Inspiration + Education

THE 20 IMPERATIVES OF THE LIVING BUILDING CHALLENGE™

Living Building Challenge is a philosophy, advocacy tool, and certification program that addresses development at all scales.

SITE

Restoring a healthy coexistence with nature.

01 Limits to Growth

Eligible sites include greyfields or brownfields that are not on or adjacent to sensitive ecological habitats, prime farmland, or within the 100-year flood plain. Landscape may only be native and/or naturalized species planted to support succession.

02 Urban Agriculture

All projects must integrate opportunities for agriculture appropriate to the scale and density of the project using its Floor Area Ratio as a multiplier for calculation.

03 Habitat Exchange

For each hectare of development, an equal amount of land must be restored for thriving ecosystems.

04 Car Free Living

Each new project should contribute towards the creation of walkable, pedestrian-oriented communities.

WATER

Creating water independent sites, buildings and communities

05 Net Zero Water

One hundred percent of occupants' water use must come from captured precipitation or closed loop water systems that are appropriately purified without the use of chemicals.

06 Ecological Water Flow

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

ENERGY

Relying only on current solar income

07 Net Zero Energy

One hundred percent of the project's energy demand must be supplied by on-site renewable energy on a net annual basis.

HEALTH

Maximizing physical and psychological health and well being

08 Civilized Environment

Every occupiable space must have operable windows that provide access to fresh air, views, and daylight.

09 Healthy Air

The project must take precautionary measures to maintain a sound indoor environment.

10 Biophilia

The project must be designed to include elements that nurture the innate human attraction to natural systems and processes.

MATERIALS

Endorsing products and processes that are safe for all species through time

11 Red List

The project cannot contain or use any listed worst-in-class materials or chemicals that are prohibited in the building industry.

12 Embodied Carbon Footprint

The project must account for the total footprint of embodied carbon from all economic and physical materials parts through some low-carbon pathway.

13 Responsible Industry

The project must advocate for the creation and evolution of third-party certified standards for sustainable resource extraction and fair labor practices.

14 Appropriate Sourcing

The project must incorporate place-based solutions and materials to the maximum of a regional economy rooted in sustainable practices, product longevity, and quality.

15 Conservation + Reuse

All projects must maximize to reduce or minimize the production of waste during design, construction, operation, and end-of-life either to conserve nature resources.

EQUITY

Supporting a just, equitable world

16 Human Scale + Humane Places

The project must be designed to create human-scaled rather than automobile-scaled places so that the experience brings out the best in humanity and promotes culture and interaction.

17 Democracy + Social Justice

Reasonable steps must be taken to ensure that all people, regardless of background, age and socioeconomic class, can benefit from the externally focused infrastructure created by the project.

18 Rights to Nature

The project may not block access to, nor diminish the quality of, fresh air, sunlight and natural waterways for any member of society or adjacent developments.

BEAUTY

Celebrating design that creates transformative change

19 Beauty and Spirit

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

20 Inspiration and Education

Educational materials about the performance and operation of the project must be made public to share successful solutions and to motivate others to make change.



<http://living-future.org>

Certification is based on actual performance over the course of twelve consecutive months. This gives true meaning to the term, “Living,” as the building must have been *alive* or operating for one year in order to be evaluated. The evaluation framework views financial performance in terms of social and ecological imperatives, demonstrating that reduction and efficiency measures provide real-time cost savings. Unlike other frameworks that utilize Life Cycle Analysis data, this framework assumes the basic understanding of underlying principles behind reuse, reduce and recycle. This framework focuses on the entire system, not just the life cycle of the building, by requiring projects to reduce and reuse all materials and energy.

Like its counterpart, LEED, the Living Building Challenge measures performance related to site selection, water use, energy use, air quality and material use. However, unlike its counterpart, the Living Building Challenge has dedicated imperatives to measure equity, beauty, and spirit.

Case Study

David & Lucile Packard Foundation Headquarters Los Altos, California



<http://packard.org/>

Overview

Status: Certified Net Zero Energy Building

Date Certified: September 16, 2013

Version of Program: 2.1

Typology: Building

Occupant Type: Offices

Building Area: 50,956 sf

Building Footprint: 26,335 sf

Start of construction: November 2009

Start of Occupancy Period: July 2012

Number of occupants: 120

Architectural & Interior Design: EHDD

MEP: Integral Group

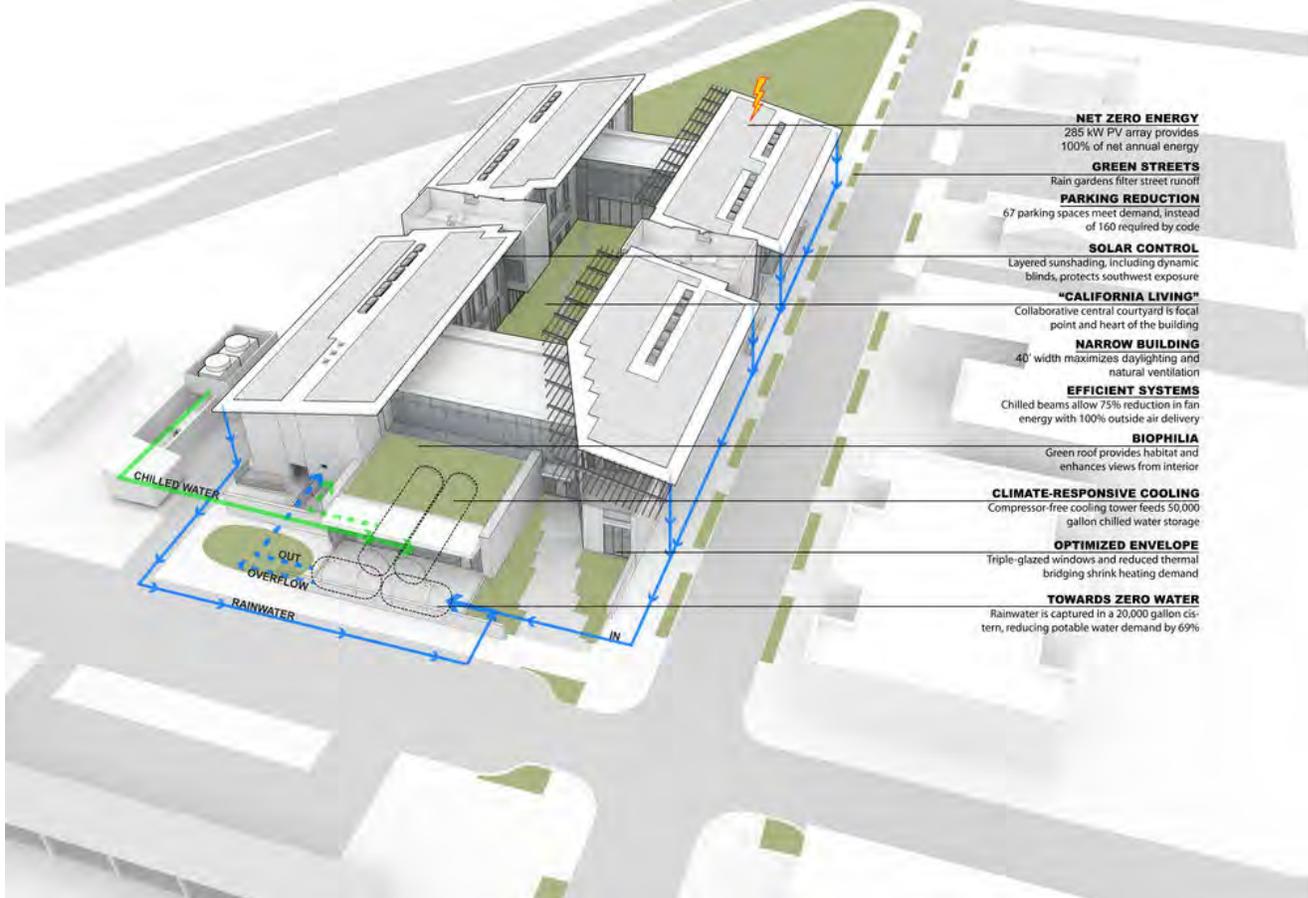
Contractor: DPR Construction

Summary

A LEED Platinum building utilizing passive, bioclimatic design strategies, this Net-Zero building produces *at least* as much energy as it consumes. Chilled beams are used for passive heating and cooling, alongside roof-top solar for providing energy and passive daylighting for lighting. To conserve water, green roofs, drip irrigation, and reduction measures are used including using collected rainwater for on-site irrigation and toilet flushing. 95% of building materials have been reused from other local projects, and all interior doors are made from salvaged local eucalyptus. Low-VOC finishing materials were used to provide a safe and healthy workplace. 90% of plants are native, eliminating pesticide use and providing a home for indigenous birds, insects and pollinators. Permeable paving and rain gardens are used to reduce runoff and pollution.



<http://packard.org/>



- NET ZERO ENERGY**
285 kW PV array provides 100% of net annual energy
- GREEN STREETS**
Rain gardens filter street runoff
- PARKING REDUCTION**
67 parking spaces meet demand, instead of 160 required by code
- SOLAR CONTROL**
Layered sunshading, including dynamic blinds, protects southwest exposure
- "CALIFORNIA LIVING"**
Collaborative central courtyard is focal point and heart of the building
- NARROW BUILDING**
40' width maximizes daylighting and natural ventilation
- EFFICIENT SYSTEMS**
Chilled beams allow 75% reduction in fan energy with 100% outside air delivery
- BIOPHILIA**
Green roof provides habitat and enhances views from interior
- CLIMATE-RESPONSIVE COOLING**
Compressor-free cooling tower feeds 50,000 gallon chilled water storage
- OPTIMIZED ENVELOPE**
Triple-glazed windows and reduced thermal bridging shrink heating demand
- TOWARDS ZERO WATER**
Rainwater is captured in a 20,000 gallon cistern, reducing potable water demand by 69%



SECTION A

- 1 PV panels supply 100% of energy
- 5 Layered shading strategies
- 2 Solar hot water panels
- 6 Triple-glazed, highly insulating windows
- 3 100% of rainwater captured for reuse
- 7 Exposed FSC certified wood structure
- 4 40' width maximizes daylighting and natural ventilation
- 8 Chilled beams with 100% fresh air
- 9 Dynamic exterior blinds lower with direct sun
- 10 "Green Street" strategies to capture and filter stormwater





Benefits and Limitations

The Living Building Challenge requires early commitment from project teams. It requires client buy-in early on, and requires a dedicated team of consultants to achieve optimal performance and maintain design intent. Some limitations include material qualities, as many beautiful and popular materials are not sustainable. This can change the aesthetic of the space, however the Living Building Challenge has dedicated imperatives for measuring beauty, spirit, and inspiration.

Though the Living Building Challenge originally required more cost up-front than its counterpart, LEED, its startup costs have diminished greatly since its inception, and the Living Building Challenge has been proven to save more money for a project long-term than LEED.

The Living Building Challenge can be consulted at any point the project design phases. It can be used as it was originally intended, to create the most sustainable projects, when it is consulted prior to project design. Alternatively, it can be used as a guide or checklist. Its imperatives can be programmed into or added onto an existing design. The imperatives can also be used a final resort to improve a more traditional project's sustainability. In my opinion, the framework is best utilized when consulted early on.

Recommendations

When a client directive is not in favor of the Living building Challenge, I highly recommend the imperatives be referenced by designers as tools for driving building efficiency, reducing material use/waste, and reducing energy use/waste. I can see the implementation of several of the imperatives in a building as being extremely useful for saving money in initial costs and operating costs. Therefore I would recommend the imperatives be reviewed prior to design to see which imperatives may be incorporated into the project. I also recommend that the imperatives be reviewed in schematic design phase for energy and water reduction, and that they be reviewed again during interior finish selection for further ways to reduce a building's ecological footprint and integrate regenerative strategies. The imperatives also include simple, proven methods for improving building performance and occupant wellness.

Conclusion

The Living Building Challenge is an excellent framework for evaluating sustainability of a project. It is suited for buildings, landscapes, and urban planning. It combines many tried and true strategies for reducing material and energy use and providing safe, functional spaces. It also provides project teams with a toolkit of sustainable approaches for use in design, integration and maximizing performance.