

BIOMIMICRY CASE STUDY OF THE

LIVING BUILDING CHALLENGESM



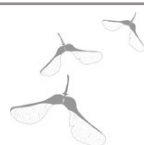
EXECUTIVE SUMMARY

The Living Building Challenge is known as the world's most rigorous building standards certification. It goes well beyond energy efficiency as a metric for quality building design. It embraces a holistic view, treating every building as living system within and inexorably tied to its natural and social ecosystems, tied to the global biosphere, responsive to the life that surrounds it, and responsible for the occupants in it. The standard consists of 7 Petals: Place, Water, Energy, Health + Happiness, Materials, Equity, and Beauty. Within each Petal are multiple (between 2 and 5) Imperatives. All 7 Petals, and all 20 imperatives must be met in order to achieve Living Building certification.¹ Further, certification is only given after 12 months of continuous occupancy once it has been proven that the building is Net Positive Energy, Net Positive Water, and Net Positive Waste. This means the buildings must produce more energy on site than they consume. They must harvest and treat more water on site than they use. They must divert materials used on site from waste streams and include, in the construction, salvaged materials that would have gone to waste. In recognition that these standards are difficult to achieve, and difficulty for some petals can vary greatly given context (the water petal is incredibly difficult in the desert, for example), and to encourage a broader range of builders, owners, and designers to try, the ILFI offers Petal Certification for buildings that manage to satisfy 3 petals. At least one of these Petals must be Energy,

Water, or Materials. New in the 4.0 version of the certification are ten CORE Imperatives, which together make up Core Green Building Certification. A building can achieve Zero Energy certification, if it produces as much energy as it consumes. And finally, if a building receives all of its energy from on or off-site clean and renewable sources, it achieves the Zero Carbon certification.¹

In 2017 the Living Building Challenge had 380 registered buildings across the globe. There were 15 full Living Building Certified buildings at that time, 25 Petal Certifications, and 33 Net Zero Energy Certifications². Today there are at least 23 full Living Building Certified buildings³.

A Living Building operates like a plant, a flower, gathering energy and spreading it to its local community. It contributes to its local ecosystem, gives back across every spectrum, and acts as a beacon of beauty and symbol for vibrance and prosperity. Put simply, it ***Creates Conditions Conducive to Life***. The Petals of the Living Building Challenge mirror Life's Principles in multiple ways. The Petals, the organization, and their global network weave together with their contextual systems, displaying the Essential Elements of Biomimicry of Emulate, Ethos, and (Re)Connect all while directly addressing Earth's operating conditions of sunlight, water, and gravity; cyclic process; limits and boundaries; and dynamic nonequilibrium.



THE COMPANY

The Living Building Challenge (LBC) exists within the International Living Futures Institute (ILFI). The LBC certification came before the ILFI, officially launching in November of 2006. The idea for the LBC arose from a project in the mid 90's in Bozeman, Montana called EpiCenter - an effort to create the most sustainable design project in existence.⁴

"Dubbed the EPICenter (Educational Performance and Innovation Center) the building was meant to be a structural laboratory for sustainable design and engineering. The goal was to create a building that operated like an organism; one that fit into and coexisted with its environment by being self-sustaining, non-toxic, and beautiful."⁵

The Living Building Challenge: The Roots and Rise of the World's Greenest Standard (pg. 47)

The EpiCenter was funded by the National Institute of Standards and Technology and was led by Bob Berkebile and Kath Williams. Jason McLennan was working with Berkebile at the Architecture firm BNIM at the time and was put in charge of research and technology for the EpiCenter project. While thinking about what would be required to create the world's most sustainable building, McLennan began formulating a list of requirements. These requirements were the roots of what would later go on to define a Living Building.⁴

In 2000, Jason McLennan brought a new idea to the partners at BNIM. He proposed a sustainability consulting arm of the Architecture firm. The consulting arm would be called Elements and it was seen as a way to benefit the whole building ecosystem beyond the walls of BNIM. While working on Element projects in Seattle, McLennan met Amanda Sturgeon, who was

Dixon Water Foundation, Full Living Building Certified, Decatur, TX, showcasing local, natural materials

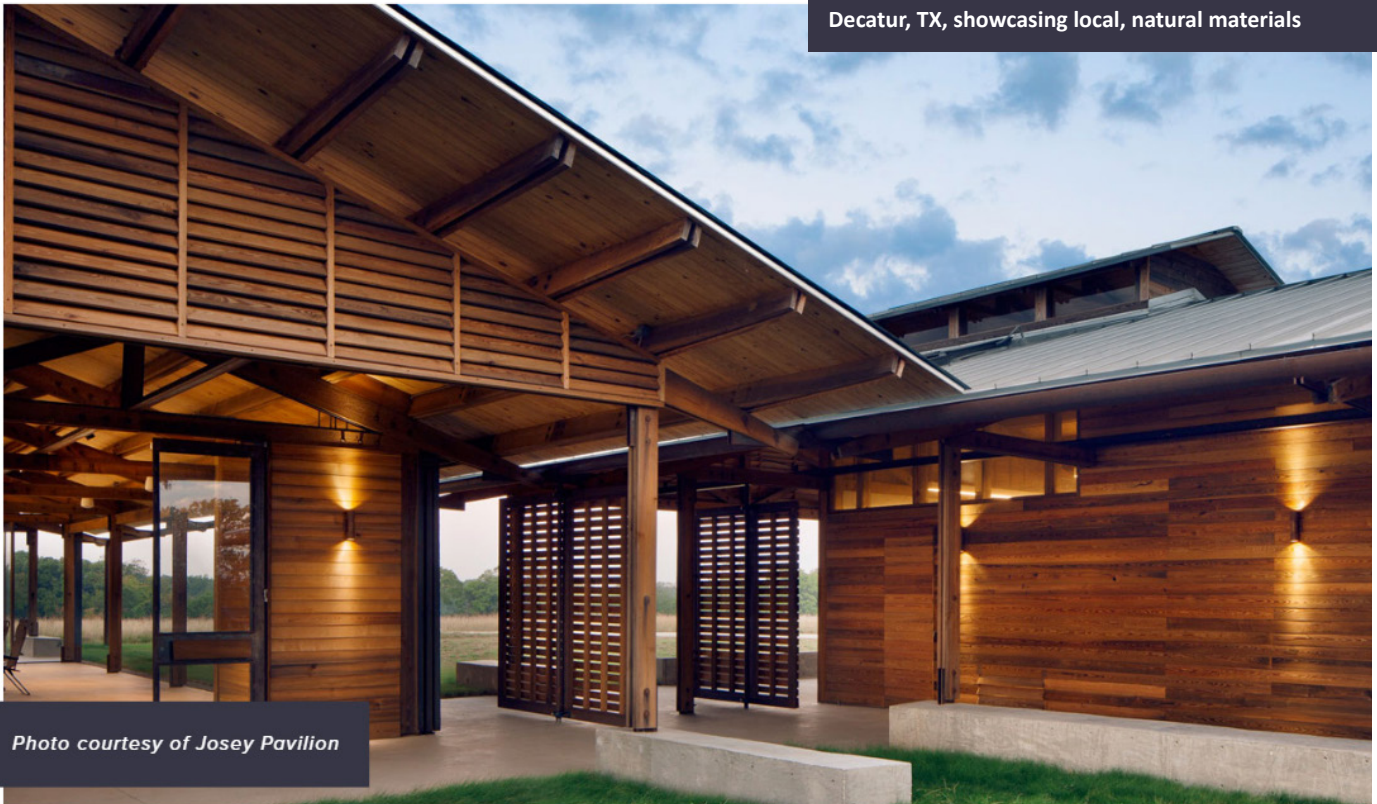


Photo courtesy of Josey Pavilion

Image from: <https://living-future.org/lbc/case-studies/dixon-water-foundation-betty-and-clint-josey-pavilion/>



at the time serving as Seattle's sustainable building specialist. Amanda was also a founding board member of Cascadia Green Building Council and would meet McLennan again when he interviewed for a position in 2006. It was at Cascadia where The Living Building Challenge would get its official launch.⁵

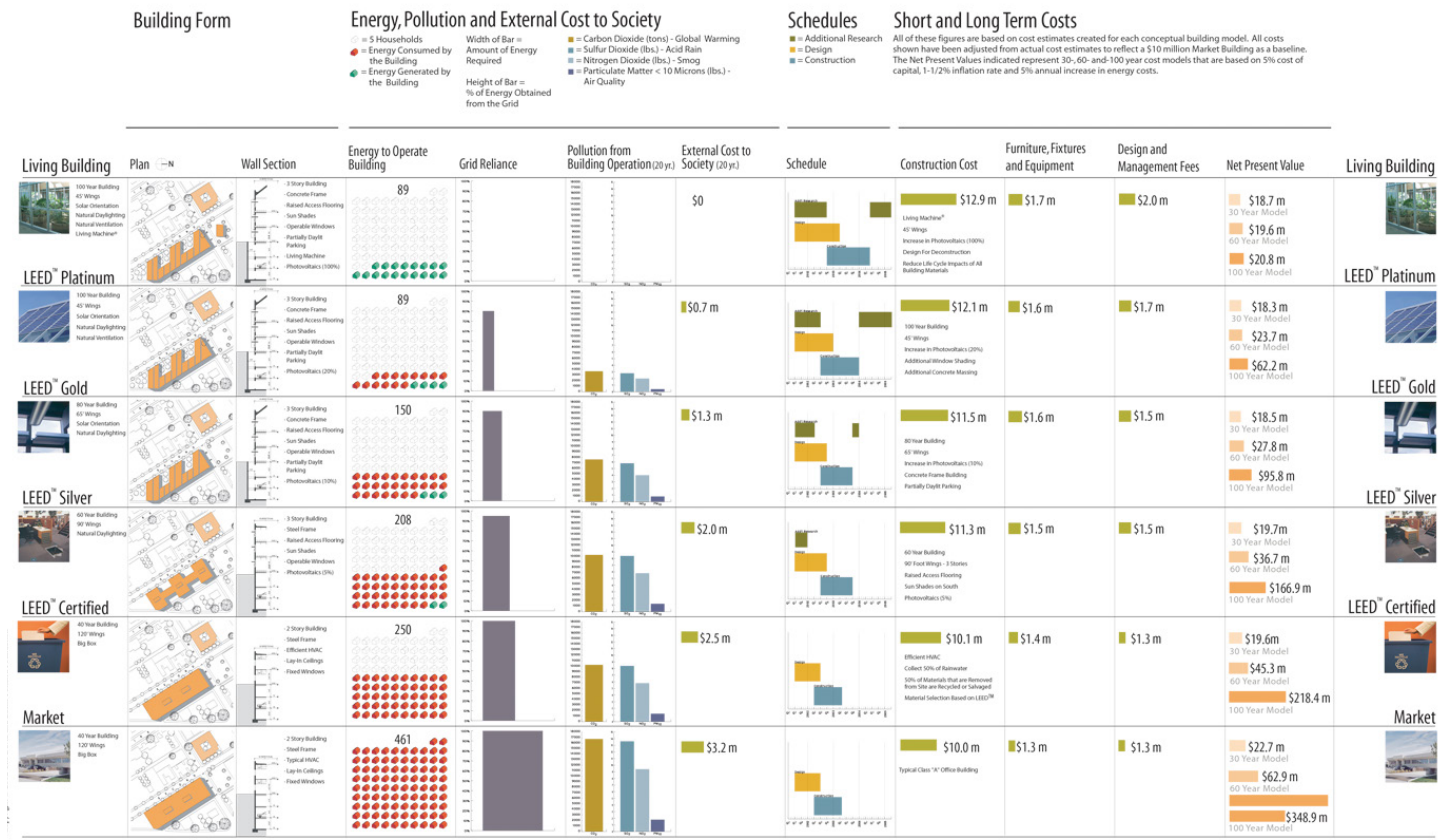
Below is a document called the Packard Matrix. It was commissioned by the David and Lucile Packard Foundation in 2000 to compare the overall costs and environmental impacts of a Living Building and a LEED certified building. The figures were conceptual, but the conclusions were promising. Although initial costs were higher for a Living Building, costs to operate and maintain were lower, there were no external costs to society, and the environmental impact was far better than even the best LEED certification level. Even from a strictly (long-term) economic standpoint, a Living Building was the best choice.⁴

Still concerned with codifying the standards he had been exploring in the EpiCenter and with Elements, in 2005, McLennan began a focused effort to create an applicable,

and adaptable, certification tool. After more than a year of concentrated work to solidify the standards imagined in the Living Building, in August of 2006, McLennan presented the Living Building Challenge version 1.0 to the Cascadia Green Building Council. The LBC went public in November and Jason McLennan would take the role of CEO. In 2009 the International Living Futures Institute was founded by Cascadia to support the growing popularity of the Living Building Challenge.⁵

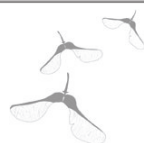
The ILFI continues to grow and develop. In 2016, Jason McLennan started his own Architecture firm and Amanda Sturgeon took over as CEO of the ILFI. Since then the network has grown 10-fold.⁶ Today the ILFI is home to several programs designed to create a sustainable world, including the Living Product Challenge, the Living Community Challenge, and the Reveal, Declare and Just labels.² The ILFI also has outlets that provide information and education on the changing landscape of sustainable building. These include Trim Tab Magazine and Ecotone Publishing.

Building For Sustainability: Sustainability Matrix



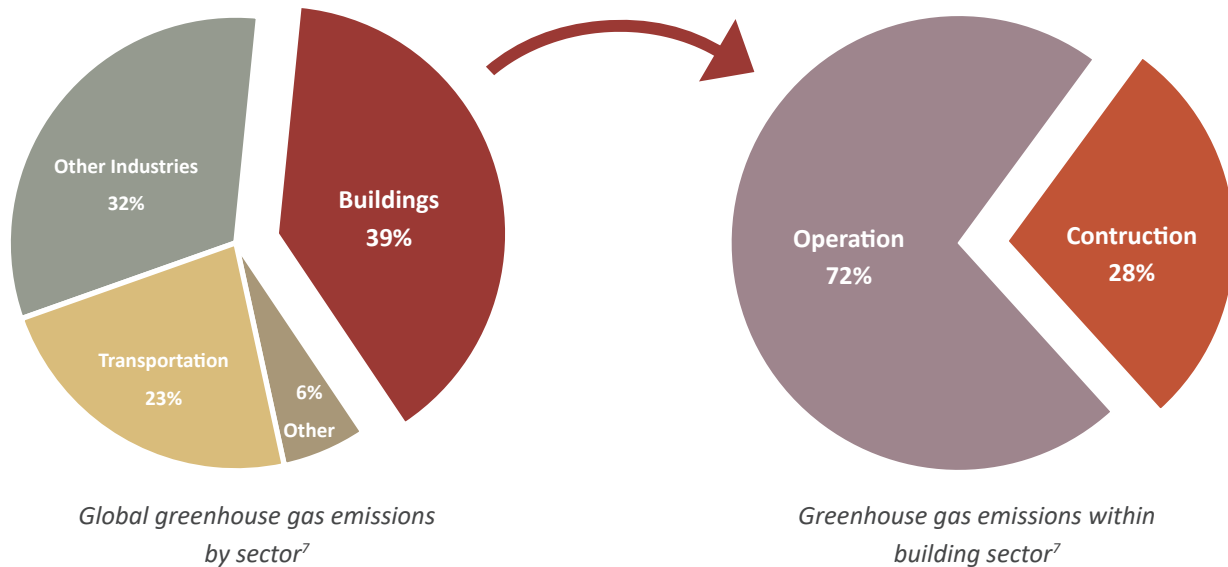
UNDERSTANDING THE BUSINESS CASE FOR BIOMIMICRY

MASTER OF SCIENCE IN BIOMIMICRY AT THE BIOMIMICRY CENTER, ASU



INNOVATION CONTEXT

PROBLEMS AND CHALLENGES



A good place to start when defining the problem is to recognize that the built environment contributes nearly 40% of the total global greenhouse gas emissions⁷ (see above graph on the left). The building industry represents an inherently ecologically intrusive and destructive, energy intensive, and wasteful system. Movement to address systematic change is evident near the end of the 1980's and into the 1990's, with the *Passivhaus* standard introduced in Germany in 1988, AIA Committee on the Environment (AIA/COTE) in 1989, and the launch of the BREEAM building energy efficiency rating system in Europe in 1990.¹⁶

Today we have many green building rating systems, including BREEAM, LEED, WELL, Green Globes, Active House, Miljöbyggnad, Nordic Ecolabel, DGNB, Green Star, HQE, and of course, the Living Building Challenge. BREEAM currently has the most certified projects globally with about 425,000 while LEED is the most widely adopted certification system in the United States and second most globally with about 67,200 certifications.⁸ Early on, with all of these certification systems, the primary focus was on energy consumption during building operation. Even today, LEED's most recent version, v4, places the largest weight, 30%, on their Environment and Atmosphere

category – the category concerned with operation energy. The category concerned with embodied energy, Material and Resource, receives just 12% of the weight.⁹ Operation energy consumption is an enormously important focus. If we hope to close the gap between energy demand and available clean and renewable energy, we need energy efficient buildings. Nevertheless, there are several problems with green building certification systems that focus narrowly on energy consumption during building operation. The most obvious of these would be the fact that any energy consumption of energy derived from fossil fuels, especially at the scale of a building, is unacceptable given the current concentrations of carbon in our atmosphere and their continued upward trend. Secondly, this narrow focus places too little weight on embodied energy. Emissions from the construction process (seen in the graph above on the right), including extraction, processing, transportation, and assembly of materials contribute 28% to the total, and because energy sources are becoming cleaner, this percentage is getting larger as the operation contribution decreases – we should be more and more concerned with embodied energy when we are evaluating a building's potential contributions to climate change. A study in the *Journal of Industrial Ecology*⁹ found that in areas where clean



energy makes up a significant proportion of the energy supply, contributions from embodied energy can be as much as 8 times higher than operation energy consumption.

Historically, building certifications have been prescriptive. This means, typically, they have set out a list of preferred “best-practice”, a list of devices and measures, which are considered energy efficient or part of good building design, and required projects to check a certain number of these. These point-based, or checklist systems ignore the fact that there are an infinite number of ways to create a truly sustainable building and the specific strategies to get there may vary greatly depending on the specific conditions of any particular site: climate, day-night temperature swings, sun direction and path, precipitation patterns, available materials, wind patterns, etc.

SOLUTION

The solution is a performance-based system using an organism as the metric for success. This isn’t emulation of a single organism or of a single strategy or mechanism. This is emulation of the deep patterns found in well-adapted organisms – producers that give to the communities they inhabit. The ILFI and the LBC give guidance and assistance to the building community. The buildings that come from this program give to their ecosystems and to their local communities.

The solution is a holistic system that addresses all impacts a building has on its environment, its community, and society. In order to address the complexity involved in environmental effects of a building the LBC lays out performance goals. Instead of requiring a building include specific efficiency measures, designers are free to use whatever innovative strategies they can conceive with special consideration of the specific context. The building simply must cleanly produce more energy than it consumes. In order to address the massive negative contributions of embodied energy, a building must

Also, a prescriptive approach ignores the fact that even when we are just looking at a building’s effect on the environment, there are overlapping and interacting factors, and the problems are complex. Here are two simple examples to illustrate the sometimes-counterintuitive nature of building energy performance: 1) Consider a home that changes from incandescent light bulbs to all LED. If they are in a cold climate, depending on their fuel for heating, negative impact might actually increase since LED lights produce very little heat and energy consumption for heating might go way up. 2) Consider an office building that transitions to a tighter envelope to save energy, adding more insulation, higher R-values, and/or installing better performing doors and windows. This could increase energy consumption for cooling since the computers inside produce a lot of heat.

offset its carbon footprint. Rather than require a building to include specific water efficient plumbing fixtures, or a grey water system, the building must simply collect all water used on site, and it is free to do so in whichever way meets the site’s contextual constraints.

The LBC requires collaboration across fields. This collaboration drives connectivity to each other and to nature, it drives creativity and innovation, and it drives positive change at the ecosystem level. It aims to create a new built environment ecosystem that benefits all the systems it interacts with.

In order to go beyond the narrow focus of most sustainable building certifications, the LBC addresses the physical and psychological health of the occupants, the health of the broader community, human-nature connections, the health of the local economy, and important social issues. This helps ensure any new building, or new renovation, will contribute to the creation of a thriving social and natural ecosystem.

“A very deep lesson on collaboration”

Jonathan Wright, Owner, Wright Builders

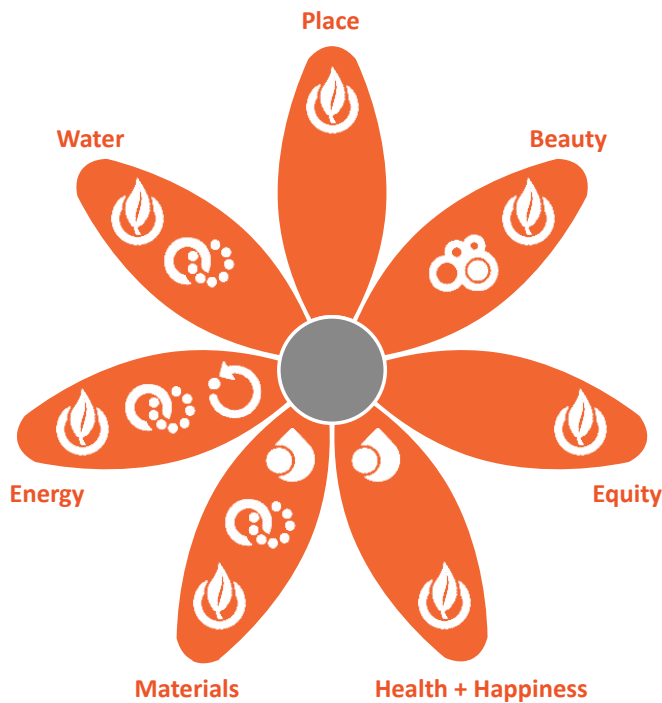


THE BIOMIMICRY STORY

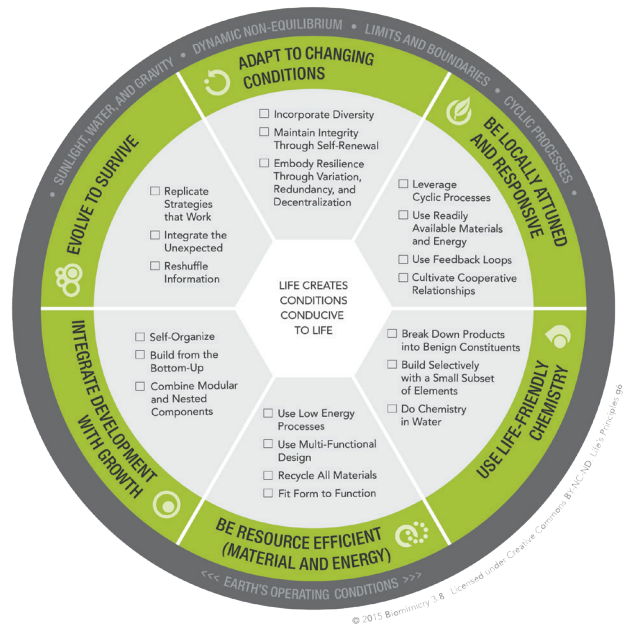
The solution to such a complex problem, as mentioned above, was a holistic approach to a building that treated it not as an isolated entity, but an integral piece to many different systems, having impact and influence well beyond its walls. The most appropriate model for this is as a living organism, a living system. The Petals of the Living Building Challenge address the different specific systems a building influences and is influenced by. They reimagine what a building should be doing within these contexts by imagining what a well-adapted living organism would do, thereby **creating conditions conducive to life**.

The Petals of the Living Building Challenge align well with Life's Principles identified by Biomimicry 3.8. First, the Petals are briefly described. Then, the presence of Life's Principles in the Living Building Challenge, and the International Living Futures Institute, is highlighted by going through each Life's Principle and calling out each Petal that specifically speaks to directly to it, along with other features of the program and organization that address that specific Life's Principle.

LBC PETALS
ILFI



LIFE'S PRINCIPLES
BIOMIMICRY 3.8



THE PETALS¹

The Petal descriptions below provide a general idea of the purpose and requirements of each Petal and their respective Imperatives. While all Petals and Imperatives are listed, the descriptions are far from comprehensive. Complete accounts of the requirement for each Petal are available through the ILFI website.

Place

The Place Petal is meant to literally and psychologically connect the building and the people to the natural environment hosting them.

1. Ecology of Place

This imperative aims to protect and regenerate ecology on and near the site by documenting preconstruction conditions and showing they have made positive contributions to the ecology, avoiding construction on pristine sites, and including landscape that emulates the functionality of the surrounding ecology.

2. Urban Agriculture

This imperative requires space for growing food to promote access to healthful food.

3. Habitat Exchange

Land equal to the project area must be preserved to protect habitats abroad.

4. Human-Scaled Living

To promote occupant health and to reduce fossil fuel use, this imperative requires walkability and human powered transportation considerations be part of the design.

Water

The Water Petal is in place to recognize and respect the limited resource of fresh water.

5. Responsible Water Use

Buildings must not use water for irrigation and use less than baseline consumption for other uses.

6. Net Positive Water

100% of the water used on site must come from captured precipitation and closed-loop water systems.

Energy

The Energy Petal promotes a decentralized, 100% clean and renewable energy grid, and efficient use of energy.

7. Energy + Carbon Reduction

New buildings must achieve a 70% energy use reduction under an equivalent baseline. Existing

buildings must achieve 50% reduction and interior projects must achieve a 35% reduction.

8. Net Positive Carbon

Projects must collect, on-site, 105% of the energy the project consumes on an annual basis. Also, projects must offset all embodied carbon from construction with carbon-sequestering materials and/or a purchase from an ILFI-approved carbon offset provider.

Health + Happiness

The Health + Happiness Petal promotes health for all life. It promotes physical and psychological health for occupants through natural light, clean indoor environments, and connections to nature.

9. Healthy Interior Environment

Projects must comply with ASHRAE 62 (or international equivalent); prohibit smoking indoors; have indoor air quality plan; and provide direct exhaust for janitorial, kitchens, and bathrooms.

10. Healthy Interior Performance

Addresses indoor air quality tests, materials with VOC emission potential, safe cleaning products, operable windows, control of airflow, and access to outdoor views and daylight.

11. Access to Nature

Requires direct connections with nature along with occupant evaluations regarding health outcomes of daylight, air quality, and connections with nature.

Materials

The Materials Petal promotes health and transparency in the building materials economy by forbidding the use of harmful ingredients, requiring disclosure of material ingredients, and requiring responsible sourcing of materials.

12. Responsible Materials

This imperative aims to positively influence the materials economy requiring Declare labels,



Living Product Challenge materials (except in residential), FSC certified or salvaged wood, and the diversion of waste from landfills.

13. Red List

Projects must avoid materials containing chemical classes on their Red List in 90% of new material.

14. Responsible Sourcing

This imperative focuses on sourcing material from transparent and responsible suppliers. One item per 200 square meters must have a Declare Label and one per 1,000 square meters must be Living Product certified. All dimension stone products must be Natural Stone Council (NSC) 373 Standard certified and 80% of wood (if not salvaged) must be Forest Stewardship Council (FSC) certified.

15. Living Economy Sourcing

This Imperative focuses on the origin of the materials in construction. To support the local economy and minimize transportation energy, at least 20% must come from within 500 km, at least 30% from within 1,000 km, and another 25% must come from within 5000 km.

16. Net Positive Waste

Projects must minimize waste at all stages of the process, create a Materials Conservation Management Plan, and include one salvaged material per 500 square meters of gross building area. A table of material types is provided specifying percentage of materials to be diverted from landfill by weight.

Equity

The purpose of the Equity Petal is to promote a “just and inclusive community” and to ensure all in that community can access and benefit from the project.

17. Universal Access

The building and all non-building infrastructure must be accessible for all members of the public. This Imperative also addresses the project’s refrain from air contamination, restriction of access to natural waterways, and blocking of sunlight for neighboring spaces and buildings.

18. Inclusion

This Imperative discusses requirements for the involvement of JUST organization and/or organizations that are registered Minority, Woman, or Disadvantaged Business Enterprises (MWDBE).

Beauty

The Beauty Petal is meant to facilitate the public’s interest and embrace of the project via beauty and connections to nature.

19. Beauty + Biophilia

A one-day exploration of biophilic design is required and a framework and strategy must be created that discusses how the project will incorporate nature, incorporate natural processes and patterns, and how it is connected to that unique ecology, climate, and culture.

20. Inspiration + Education

All projects must provide educational material on the project and how it functions. This includes a case study, all of which can be viewed at the ILFI website.



LIFE'S PRINCIPLES

BE RESOURCE EFFICIENT (MATERIALS AND ENERGY)

Water

The Water Petal recognizes the value of the limited natural resource of fresh water. It is an example of the broad Life's Principle: **Be Resource Efficient**; and a clear reminder of one Earth's Operating Conditions: Limits and Boundaries.

Responsible Water Use

This Imperative directly addresses efficiency by requiring buildings to use less water than the baseline for that building type in that location. It addresses waste by prohibiting the use of water for irrigation.

Net Positive Water

This Imperative requires buildings to be self-sufficient with this resource, water – 100% captured on site.

Energy

The Energy petal directly addresses Energy Efficiency.

Energy + Carbon Reduction

In order to achieve the Energy + Carbon reduction, buildings must **Use Low Energy Processes** and **Fit the Form** of the building to the **Functions** of passive heating and cooling, passive ventilation, and daylighting.

Net Positive Carbon

Projects collect more energy than they use.

Materials

The Materials Petal directly addresses material efficiency.

Responsible Materials

By requiring material certification like FSC, this Imperative helps keep projects within Earth's material Limits and Boundaries.

Responsible Sourcing

By requiring materials be sourced near the site of the project, this Imperative ensures **Low Energy Processes** for material transportation.

Net Positive Waste

By requiring a certain percentage of the materials used are salvaged, this Imperative directly addresses Life's sub-Principle: **Recycle All Materials**.

ADAPT TO CHANGING CONDITIONS

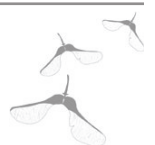
The Living Building Challenge is continually going through the process of Self-Renewal. Version 1.0 was released in 2007. The ILFI recently released version 4.0.

There are local collaboratives that represent the Living Building Challenge all over the world. I spoke with Matt Salenger, the facilitator of the Sonoran Collaborative in Phoenix. He explained that the collaboratives exist, in part, to grow awareness at the local level. Awareness has skyrocketed in the past several years and the Sonoran Collaborative has moved to focus more on implementation at the local level and addressing local environmental and civic issues that make implementation more difficult or complicated. Because there is so much variation across the globe in climate, ecosystems, cultures, and economies, specific strategies to achieve these performance-based goals differ dramatically. This kind of local focus, on a global scale, gives the ILFI tremendous resilience and adaptability. Matt also explained that many collaboratives do, and the Sonoran Collaborative is looking to, maintain stronger connections across collaboratives to facilitate idea exchange and ensure adaptability and progress in this rapidly changing world.¹⁰

Energy

Net Positive Carbon

This Imperative promotes a decentralized energy grid that is resilient to major disturbances, like natural disasters, that often cause the loss of power for large portions of a region by affecting a single, centralized power hub.



BE LOCALLY ATTUNED AND RESPONSIVE

Place

The Place Petal directly addresses **Being Locally Attuned and Responsive** to the local ecosystem and to the local community.

Ecology of Place

This Imperative addresses integrating and harmonizing with the local ecosystem.

Urban Agriculture

By requiring space for growing fresh produce, this Imperative benefits the health of the occupants and the local community, and potentially facilitates Cooperative Relationships with local food vendors.

Human-Scaled Living

By promoting walking and human powered transportation, this Imperative connects people to the local environments they walk or bike through and helps to lower vehicle pollution locally.

Water

This Petal requires the use of only locally available water.

Net Positive Water

This Imperative addresses using **Readily Available Water** and measures water collection and consumption based on annual **Cyclic Processes**.

Energy

The Energy Petal requires all energy is gathered and shared locally.

Energy + Carbon Reduction

Many passive heating and cooling strategies (window orientation, shading devices, thermal mass, and night purging), and some passive ventilation strategies (solar chimneys), **Leverage Cyclic Processes**.

Net Positive Carbon

By requiring 105% of energy consumed be collected on site with clean and renewable methods, this Imperative ensures the Use of **Readily Available Energy**.

Health + Happiness

The Health + Happiness Petal directly addresses the health of the occupants and the local ecosystem.

Healthy Interior Environment

This Imperative promotes the health of local community members that visit the building or local residents.

Healthy Interior Performance

This Imperative promotes the health of local community members that visit the building or local residents.

Access to Nature

This Imperative connects the community to the local ecosystem.

Materials

The Materials Petal looks locally for **Readily Available Materials**.

Living Economy Sourcing

This Imperative **Cultivates Cooperative Relationships** and supports the local economy by requiring materials be sourced nearby.

Net Positive Waste

This Imperative promotes local closed loops and Cooperative Relationships while promoting the use of Readily Available Materials.

Equity

The Equity Petal promotes a just and inclusive local community.

Universal Access

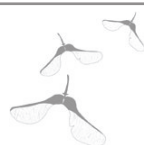
This Imperative is attuned to the local community by ensuring everyone has access and benefits from the project.

Beauty

The Beauty Petal gives the local community the gift of a beautiful and engaging building.

Beauty + Biophilia

The project must connect to its local ecosystem, climate, and culture.



BE LOCALLY ATTUNED AND RESPONSIVE

Feedback Loops of the ILFI

The organization is keenly aware of **Leveraging Feedback Loops**. Through my interview with Amanda Sturgeon, I learned that they currently have, and are actively upgrading, online forums where the LBC community (stakeholders, architects, builders, consultants, etc.) can give and receive feedback and learn from each other. The ILFI is continually receiving feedback from a diverse range of stakeholders involved in the projects. In 2018, alone, they received 16,000 customer service questions.⁶ They use these questions and comments gathered during monthly meetings with local collaborative facilitators, and meetings with experts in various fields,¹⁰ to hone and guide the evolution of the LBC and the organization as a whole. For example, the Red List Imperative was changed in the most recent LBC version (4.0) from specific chemicals to chemical classes after discussions with materials experts revealed this would make implementation easier.⁶

Living Transects¹

As another example of Being Locally Attuned, the requirements of each project vary slightly depending on the specific type of location the building will exist within. Although the principle performance-based standards remain the same regardless where the project is, the Living Transects portion of the LBC encourages different kinds of developments and different mixes of strategies to achieve certification depending on the density of the existing development in question. Transects include: L1 Natural Habitat Preserve (no development allowed), L2 Rural Zone, L3 Village or Campus Zone, L4 General Urban Zone, L5 Urban Center Zone, and L6 Urban Core Zone.

USE LIFE-FRIENDLY CHEMISTRY

Health + Happiness

The Health + Happiness Petal focuses on the physical health of occupants and the surrounding ecosystem which requires Life-Friendly Chemistry.

Healthy Interior Performance

This Imperative places restrictions on materials that may emit Volatile Organic Compounds (VOCs) and cleaning supplies that may contain harmful chemicals.

Materials

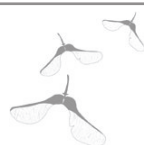
The Materials Petal ensures materials used in the building's construction don't contain harmful ingredients.

Responsible Materials

By requiring Declare labels and materials from the Living Product Challenge this Imperative aims to influence the material economy by promoting transparency and thereby decreasing the presence of harmful chemicals in construction materials.

Red List

By creating a Red List of harmful chemical classes, this Imperative ensures the presence of harmful chemicals in a building are at a minimum.



INTEGRATE DEVELOPMENT WITH GROWTH

The Living Building Challenge started as an idea for a single project, a single building to exemplify sustainable building. From there standards were created. Only after their success was the International Living Futures Institute created to support this growing phenomenon. This is a clear example of Building from the Bottom Up.

The ILFI has several certifications, including the Living Product Challenge, the Living Community Challenge, and the Reveal, Declare and Just labels.² During my interview with Amanda Sturgeon, she explained that the organization is focusing on deep development of these programs rather than horizontal and shallow growth of more programs. Part of this deep development includes “ladders” to assist more groups into what would otherwise be a daunting path for many owners, designers, and builders.⁶ An example of this is the recent inclusion of the CORE Green Building Certification, the Zero Energy Certification, and the Zero Carbon Certification. These are more narrowly focused certifications that are easier to achieve. They put projects on the path to full certification while increasing engagement with the LBC and adoption of sustainable building practices.

EVOLVE TO SURVIVE

The Living Building Challenge is continually evolving. They have recently released the Living Building Challenge 4.0 standard. The Institute is always collecting feedback, monitoring frustrations in the implementation of their most recent release, and surveying new technologies that could provide new opportunities or change the landscape of the built environment.

The global network of the ILFI allows the exchange of ideas across the world, locally optimized, and incorporated elsewhere. Publications and case studies further amplify this exchange of information incorporated at every level, from the designer of a single project, to representatives at local collaboratives, to the designers of the next Living Building Challenge standards.

Beauty

20. Inspiration + Education

The Inspiration + Education imperative promotes the evolution of sustainable building practices by spreading knowledge about best-practices and sharing knowledge of new innovations.

Te Kura Whare, Full Living Building Certification – Tūhoe, Tāneatua, New Zealand, belonging to the people of Tūhoe and symbolizing their story,¹¹ exemplifies beauty and a connection to culture

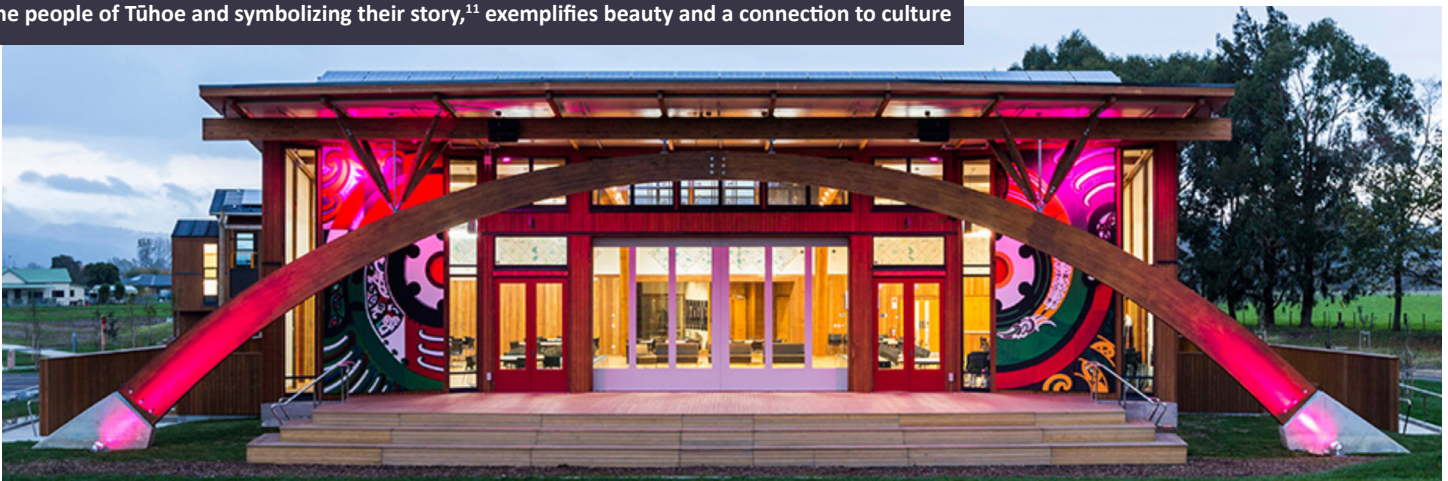


Image from LBC Case Study



ESSENTIAL ELEMENTS OF BIOMIMICRY

ETHOS

Ethos permeates every level of the Living Building Challenge. Core to the LBC is the determination that we have a moral obligation to the natural world, to ourselves, to future generations, to life, to create environments that operate in harmony with natural systems and within their limits, that have a positive impacts on all they touch, and that sustain this benefit through time.

(RE)CONNECT

Amanda Sturgeon has been a champion of biophilic design and biophilia is a prominent part of the LBC. She told me that she encourages her employees to connect with nature, and encourages designers “to look to their own connection to that place in nature” and look to the building’s connection to that place in nature.⁶

“The LBC is set up to systematize that way of thinking.”

EMULATE

The Living Building Challenge is based on the emulation of a living organism within an ecosystem. Each building that meets its standards must behave as a well-adapted organism would within that specific ecosystem – collecting its own energy and water, creating cooperative relationships within the community and the economy, using nearby resources as materials, and allowing its waste stream to become a nutrient stream. The broader organization (ILFI) emulates an ecosystem in its decentralized network approach to connecting globally and sharing human and knowledge resources.



OUTCOMES FOR:

COMPANY

The organization seems to be thriving. The ILFI is a non-profit organization in an in-flux environment, and at this point their trajectory is certainly positive. Jason McLennan laid the foundation for the most rigorous building certification in the world and brought that to the global stage. Since Amanda Sturgeon took over in 2016, the network of global collaboratives and volunteers has grown tenfold. The ILFI has future projects in the pipeline. They are encouraged by the attention and acclaim they've received and are focused now on scaling what they've created.⁶

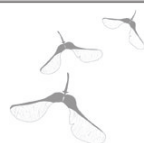
CONSUMER

A significant portion of the requirements in the Living Building Challenge focuses on benefits to the occupants. The Health + Happiness Petal is an obvious example of this, concentrating on the physical and psychological well-being of occupants and requiring these benefits be measured via survey after a twelve-month occupancy period. The Equity Petal ensures benefits extend to the community and society more broadly. And, of course, the Beauty Petal gives occupants exposure to the Educational + Innovation elements embedded in a project and requires Beauty + Biophilia be part of the design intent. There is a growing body of evidence that biophilic design can have beneficial psychological and physiological effects^{12, 13} – examples include improvements in mood and focus, stress relief and lowered blood pressure – and that it can improve productivity in the workplace. During our interview, Jonathan Wright, owner of Wright Builders and General Contractor on two Living Buildings, pointed out that for most businesses, 80-90% of total costs are for personnel. Just 3 months after the opening of the R. W. Kern Center on the Hampshire College campus, the director of admissions told Wright she could document a 30% increase in productivity.¹⁴

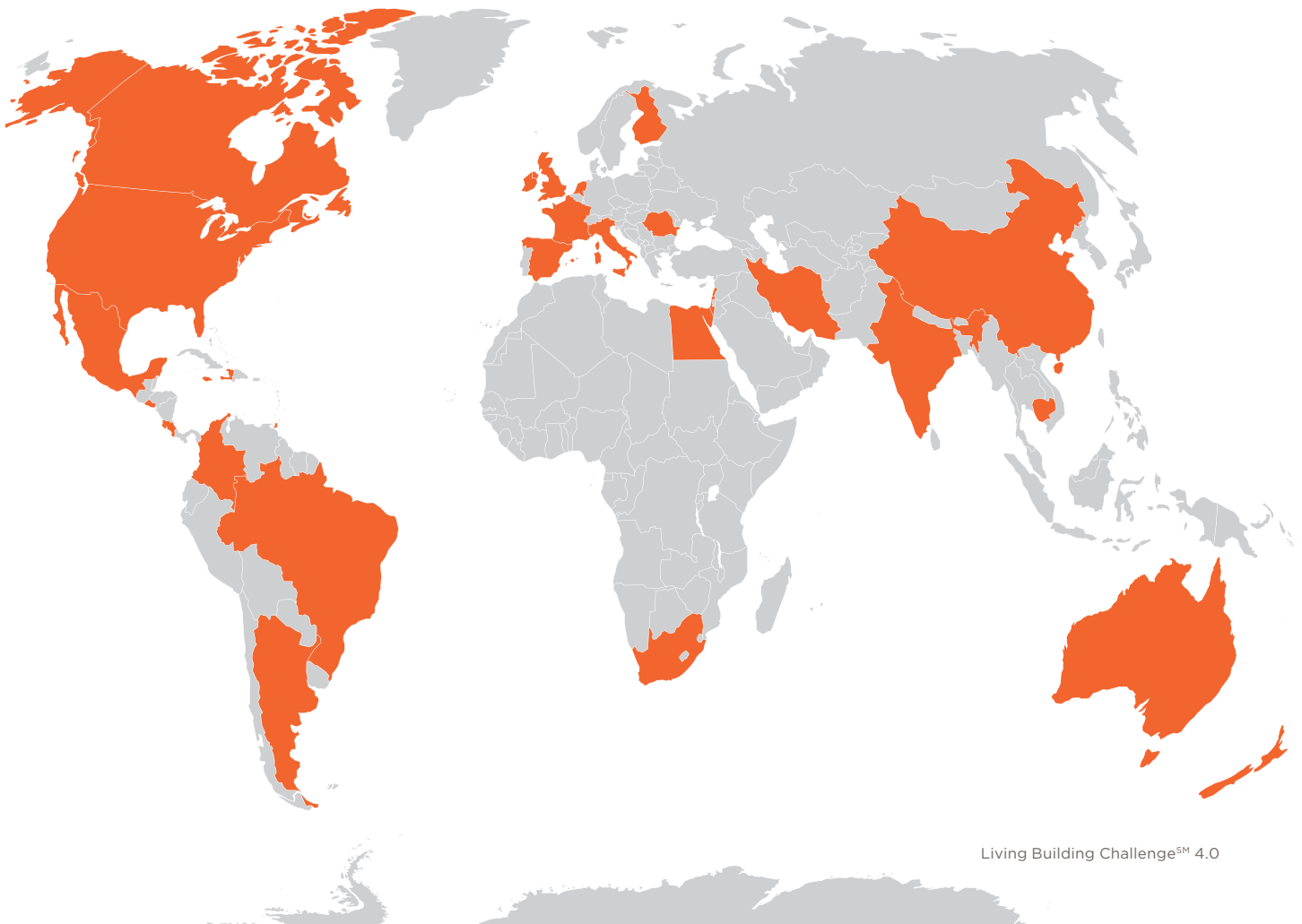
Wright describes a new metric in evaluating success. Living Buildings bring meaning and excitement to the workers involved. When you move from something incredibly harmful to something beneficial it changes the game, it changes everyone's perception of the work being done. A central theme of Living Buildings is eliminating all unnecessary materials and finishes. This exposes and celebrates the mechanics of the building. It celebrates how the building operates and how it was constructed. "Every trade has some work that shows." This is a way of showing appreciation for, and valuing, the work. "What you get out of the workforce is astonishing." Workers are valued and their health and safety is valued.¹⁴

“A Living Building becomes a working person’s advocacy tool”

Jonathan Wright, Owner, Wright Builders



ENVIRONMENT



The Living Building Challenges urges buildings to emulate nature at all three levels: form, process, and ecosystem. It requires they emulate nature at the most difficult, the ecosystem level. This implies broad range environmental benefits: protecting and restoring biodiversity, protecting habitats, eliminating greenhouse gas emissions, clean air and water, conservation of natural resources. It was mentioned earlier that the building industry is responsible for nearly 40% of all greenhouse gas emissions.⁷ If the Living Building Challenge were used for all new buildings and renovations, the positive impact would be enormous. Their global presence is impressive, and they continue to grow. The map above shows all of the countries with projects registered with the Living Building Challenge. But, full certification is quite difficult given system level challenges and adoption is far from ubiquitous. LEED is the most widely adopted sustainable building certification in the United States, and in the United States LEED buildings comprise just 0.01% of the total building stock.⁸ Living Buildings are far rarer. There is still a lot of work to do. Awareness is growing around the Living Building Challenge and as more people participate and contribute, collaborative innovation and creativity can accelerate change in the building industry. The presence of something as comprehensive and thoughtful as the Living Building Challenge is promising for the environment.



LESSONS LEARNED AND FUTURE POTENTIAL

- Financial impediments are still a huge barrier to sustainability in the building industry at every level, including certifications which aim to align built systems with natural systems. Buildings need massive investments and investors are usually looking for quick completion at minimum upfront costs. Creating a building that operates like a well-adapted organism requires more thought, collaboration, integration, and cost at the beginning of the project.
- In a system where investors are looking for relatively quick returns, where investors would often prefer to sell a property long before longer term financial benefits from zero operation energy, low maintenance, and workforce productivity pay off, long-term sustainability is not appropriately valued.
- At the level of certifications, Amanda Sturgeon acknowledges that balancing revenue streams with innovations is difficult. There are several areas where they would like to go deeper but the funding just isn't there. They need to be entrepreneurial in their finances and a key focus now for the organization is how to further incorporate diversity in revenue streams.⁶
- An Ecosystem Level emulation will run into difficult, system level problems. For this lesson learned, I will go through two specific examples:
 - Matt Salenger helped me understand more about the complicated obstacles to achieving the Water Petal in Arizona. In Arizona, if the service (water, plumbing, electricity) is available, you must use it. Of course, water in the desert is scarce. Matt and I both live in Maricopa County. The county requires all buildings hook up to sewage and the water mains. The plan for Maricopa is to collect all waste water, treat it, and pump it down into the ground aquifers. "They believe they are better stewards of that water than people or sites at the individual level will be", Matt explained, "and to a certain degree I agree with that." Most people don't want to pay to have collected or reclaimed water filtered and used or reused. Much of it may go to excessive landscaping, and in the best case, it would simply flow back into the ground as the county had planned anyway. They haven't considered, if people do start creating their own semi-closed loops, filtering and reusing water on-site, their infrastructure costs will be much lower. So, the Sonoran Collaborative is actively looking at ways to educate and convince officials on this issue.¹⁰
 - Jonathan Wright explained the system level challenge of finding clean materials and getting manufactures to disclose the ingredients in their materials. It has taken effort and various pressures, but Wright said he is seeing change manifest: "It's happening, right now." Programs like Declare seem to be having their intended effect. Manufactures see a market shift. More and more transparency and materials free of harmful chemicals are being demanded. Further, Wright explained, when manufactures began to understand the health risks associated for contractors and construction workers, they made the connection and realized these issues are amplified for them. Their factory conditions are much worse, more concentrated with these materials, than building job sites.¹⁴

An example Wright offered of the changing ecosystem of building materials:

Red2Green by Integrated Eco Strategy

An online database and consulting service, specifically tuned to the LBC, that can instantly find the closest clean and transparent materials for a project. They locate materials, analyze specification, and coordinate certification documents. They currently have 10,000 products from 3,000 different manufactures.¹⁵



CONCLUSION

The Living Building Challenge is a comprehensive, scale spanning, systems solution to sustainable building certifications. By emulating nature, a well-adapted producer organism, the LBC addresses the current challenges of the building industry (enormous contributions to greenhouse gasses; habitat degradation; biodiversity loss; harmful materials; low-quality, mass-produced, and unattractive construction; excessive waste; and poorly functioning buildings) and it addresses problems in current sustainable building certifications (it is performance based rather than prescriptive, it focusses on healthy systems rather than promoting consumption of specific products). There is a long road ahead. The system in place today is enormous, globally connected and firmly attached to its current harmful operations. Wider adoption is a massive challenge. The Living Building Challenge is the first of its kind. It is adapting, developing, growing, and evolving to address these systematic challenges.

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