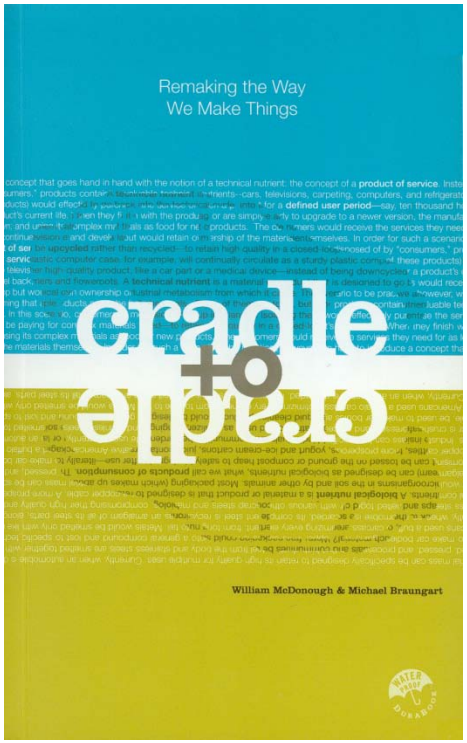
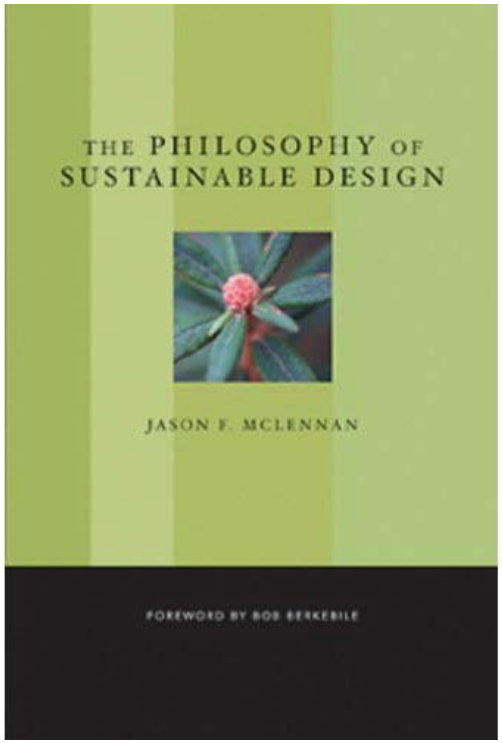
Philosophies of Sustainable Design





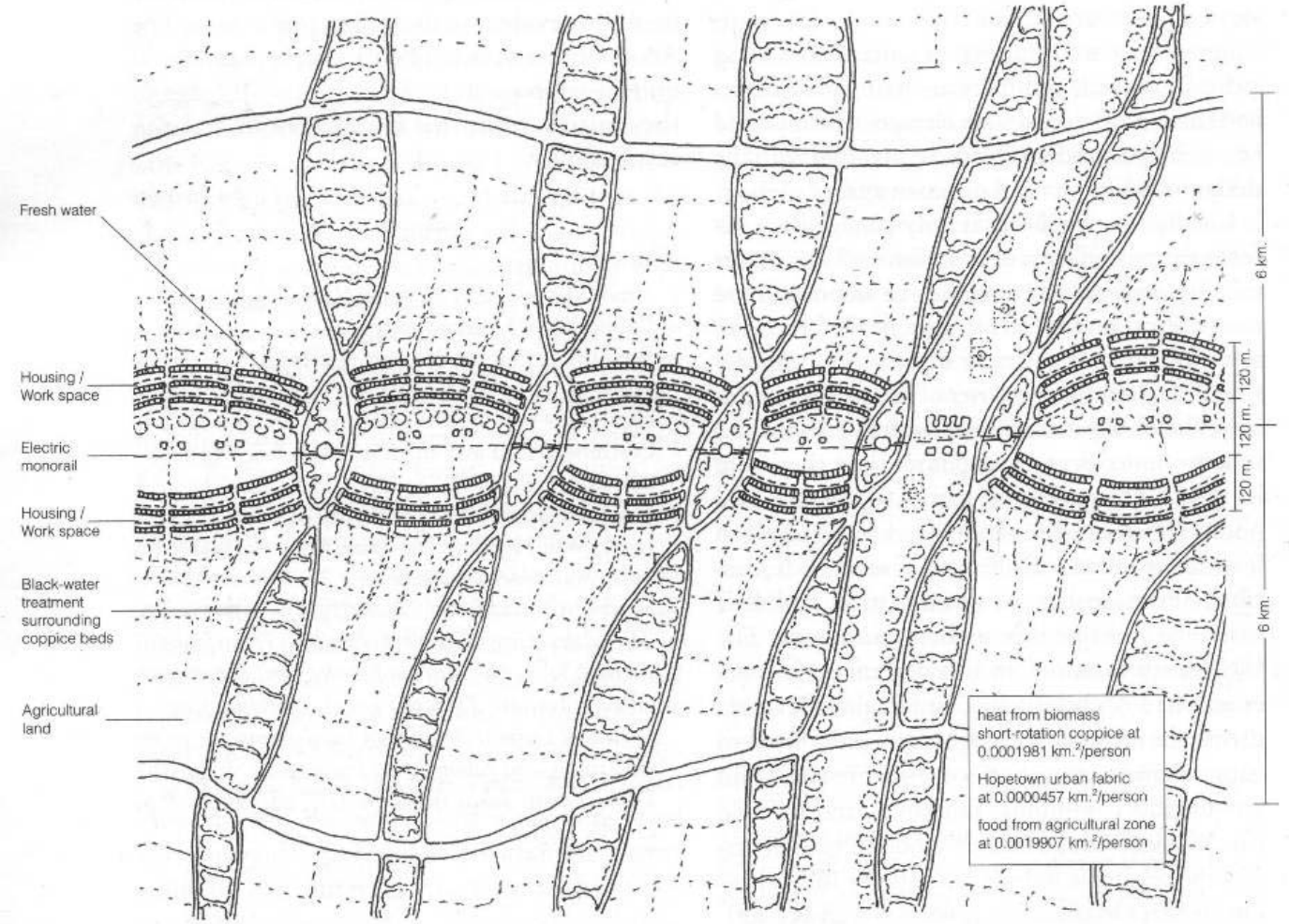
“The world will not evolve past its current state of crisis by using the same thinking that created the situation.”

– Albert Einstein

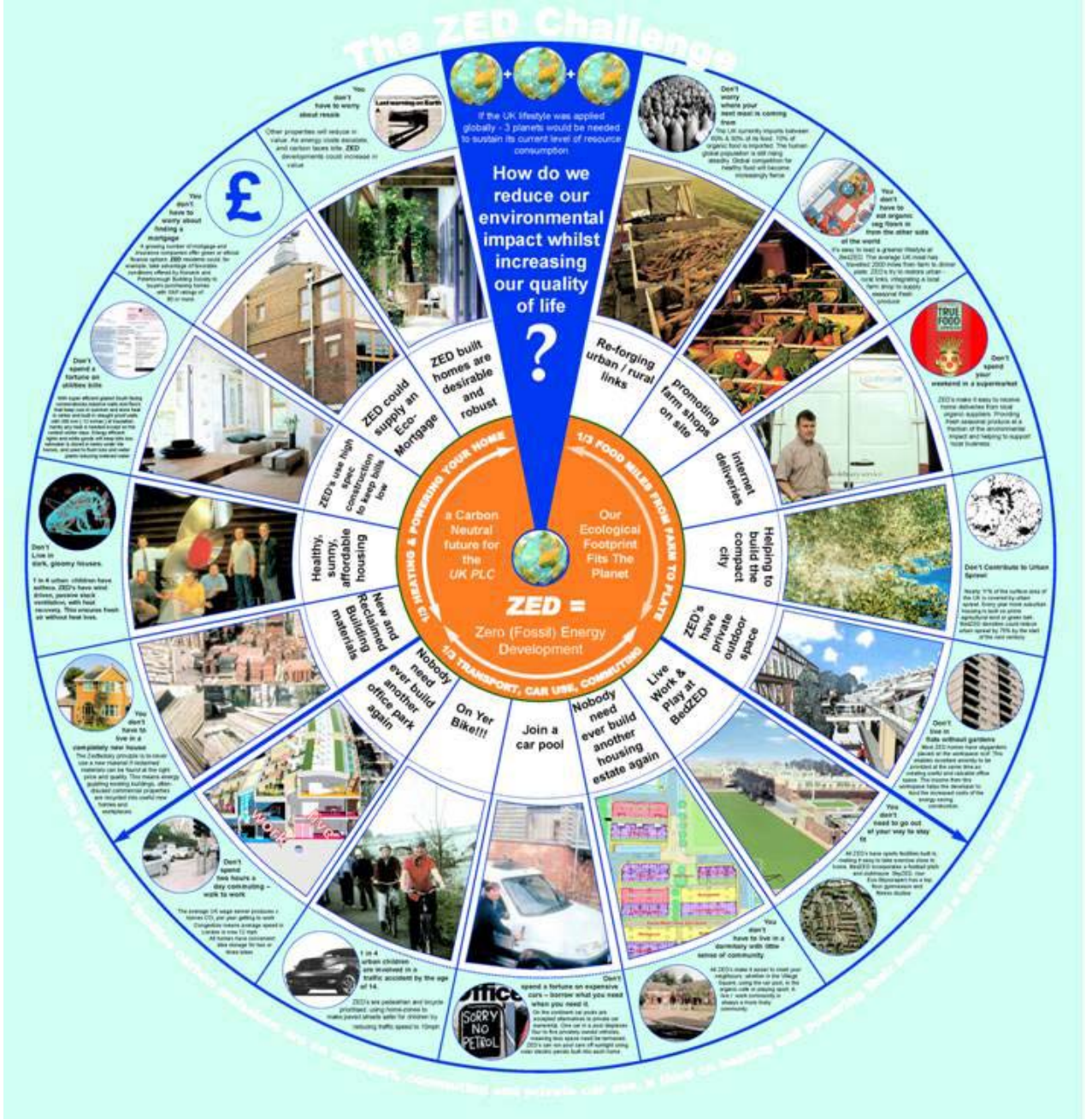
why being less BAD is not GOOD enough

The Hopecity urban model - 1997

urban planning based on ecological footprint providing all its food and fuel needs



Autonomous urban model incorporating housing, work space, agricultural land and biomass plantations.


The ZED Challenge
If the UK lifestyle was applied globally - 3 planets would be needed to sustain its current level of resource consumption.
How do we reduce our environmental impact whilst increasing our quality of life
?
ZED built homes are desirable and robust
Re-forging urban / rural links
promoting farm shops on site
internet deliveries
Helping to build the compact city
ZED's have private outdoor space
Live Work & Play at BedZED
Nobody need ever build another housing estate again
Join a car pool
On Yer Bike!!!
Nobody need ever build another office park again
New and Reclaimed Building materials
Healthy, sunny, affordable housing
ZED's use high spec construction to keep bills low
ZED could supply an Eco-Mortgage
1/3 FOOD MILES FROM FARM TO PLATE
1/3 TRANSPORT, CAR USE, COMMUTING
HEATING & POWERING YOUR HOME
a Carbon Neutral future for the UK PLC
Our Ecological Footprint Fits The Planet
ZED =
Zero (Fossil) Energy Development

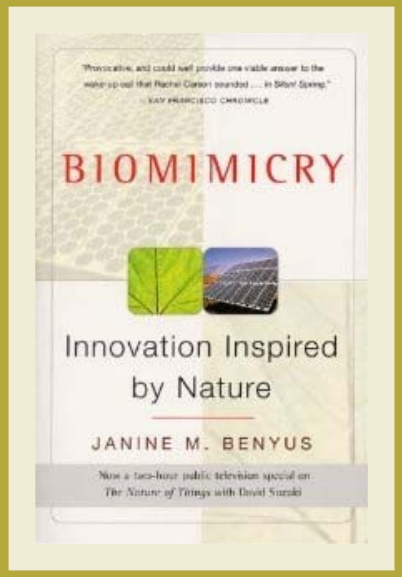
What is Biomimicry?

A design discipline that seeks sustainable solutions by emulating nature's time-tested patterns and strategies.

Core Idea: Nature has already solved many of the problems we are grappling with: energy, food production, climate control, non-toxic chemistry, transportation, packaging, and more.

Brings disciplines together who historically don't interact (e.g., biologists, engineers, designers, economists)

"The biomimics are discovering what works in the natural world and more important, what lasts. After 3.8 billion years of research and development, failures are fossils, and what surrounds us is the secret to survival."



Janine Benyus

Biomimicry: Innovation Inspired by Nature

Several excellent videos of her talks on TED and YouTube web sites

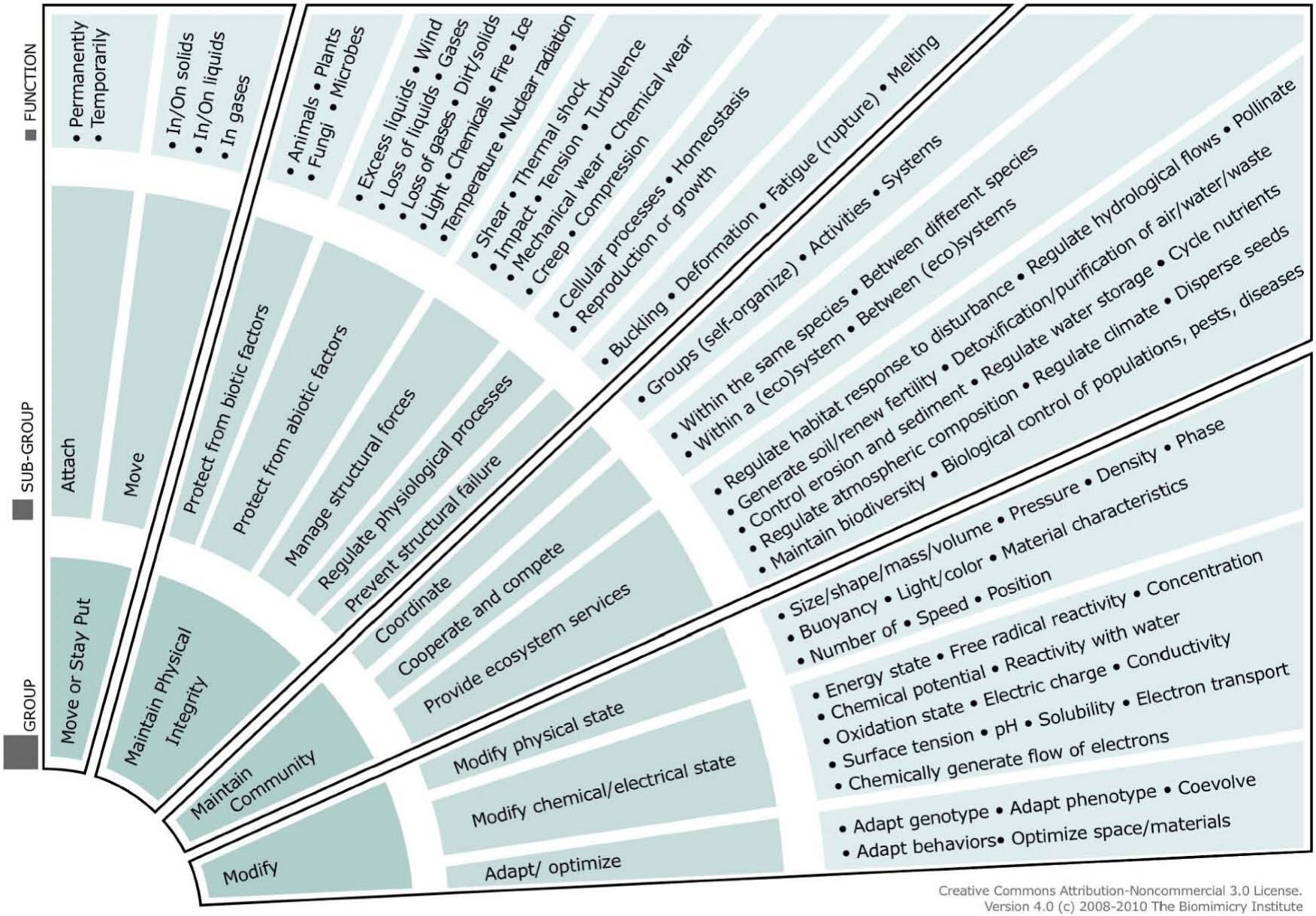
AskNature.org – Database of biomimetic strategies & examples

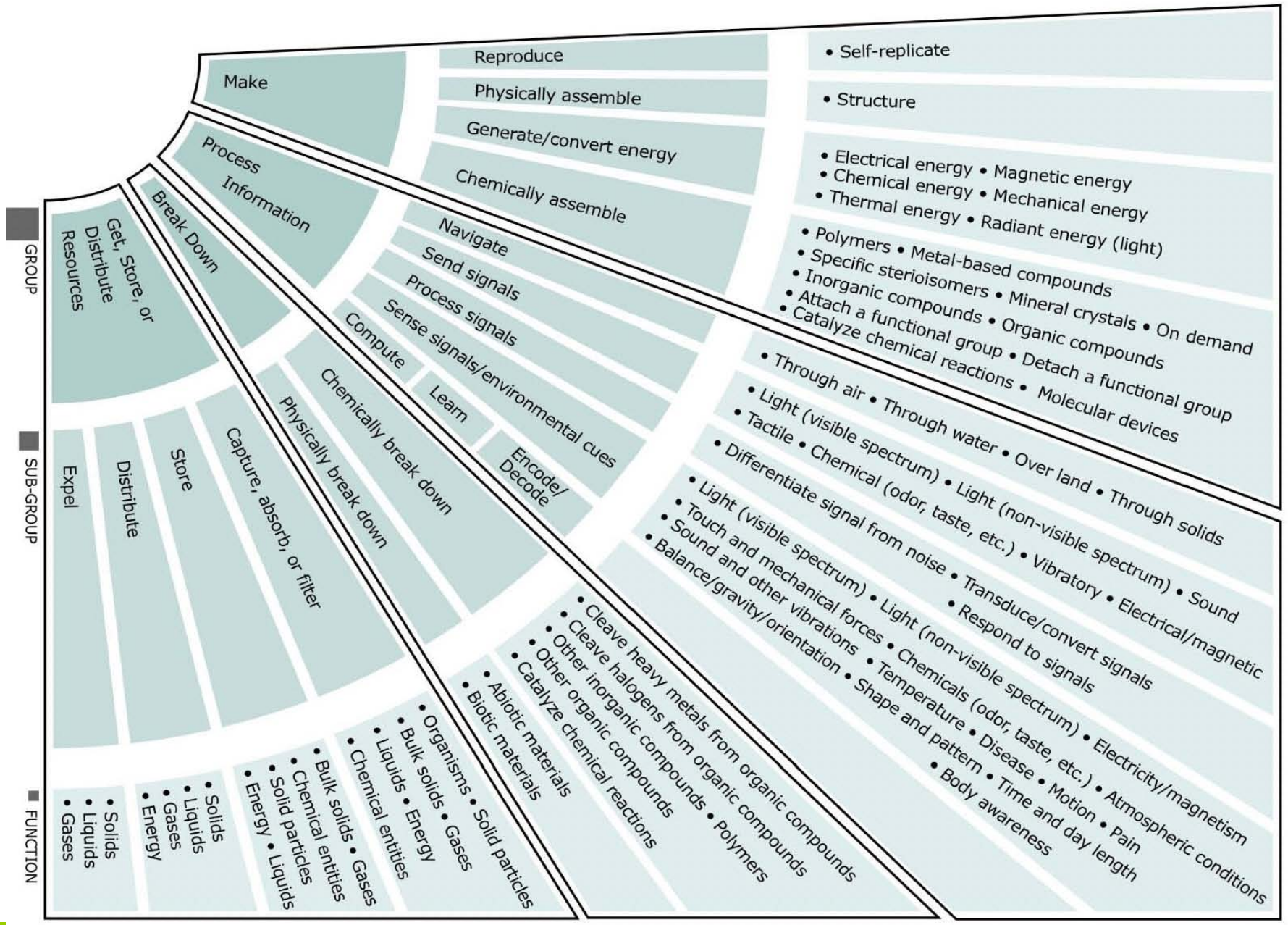
Biomimicry Taxonomy

What is the biomimicry taxonomy?

- Break down (87)
- Get, store, or distribute resources (412)
- Maintain community (306)
- Maintain physical integrity (923)
  - Manage structural forces (232)
    - Chemical wear (2)
    - Compression (55)
      - Bones self-heal: vertebrates
      - Hole structure strengthens bone: horse
      - Lightweighting: Scots pine
      - Fibers keep tall spikes upright: titan arum
      - Leaves given structural support: giant water-lily
      - Nest cells support heavy weights: bees and wasps
      - Structural composition provides strength in changing conditions: plants
      - Rod-like reinforcements provide strength: plants
      - Reinforced fibers provide strength: plants
      - Lignified parenchyma cells provide strength: plants
      - Sclereid cells prevent soft tissue collapse: plants
      - Collenchyma cells provide strength, flexibility: plants
      - Thickness stabilizes tall trees: baobob
      - Fluid protects eggs: birds
      - Intricate silica architecture survives forces: diatoms

Biomimicry Taxonomy





Biomimicry Taxonomy

1. Find the verb:

   Move away from any predetermined ideas of what you want to design, and *think more about what you want your design to do*. Try to pull out single functional words in the form of verbs. The questions you might pose through the Search or Browse options might be:

   How would Nature…

   Capture rainwater?
   Store water?

2. Try a different angle.

Some organisms live in areas that don't experience any rain, yet they still get all of the water they need. So other questions to pose might be:

How would Nature…

Capture water?
Capture fog?
Absorb water?
Manage humidity?
Move water?

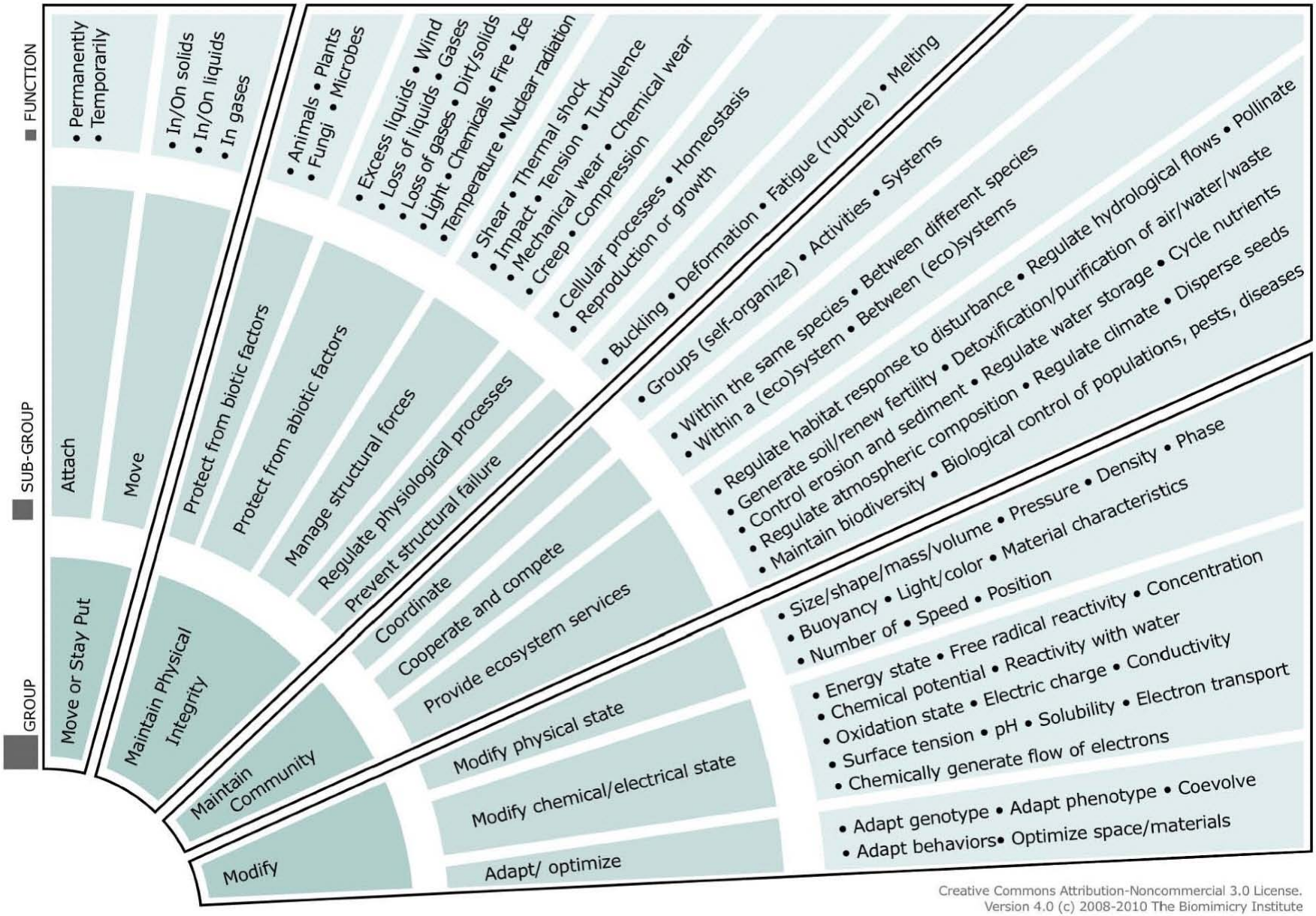
3. Turn the question around.

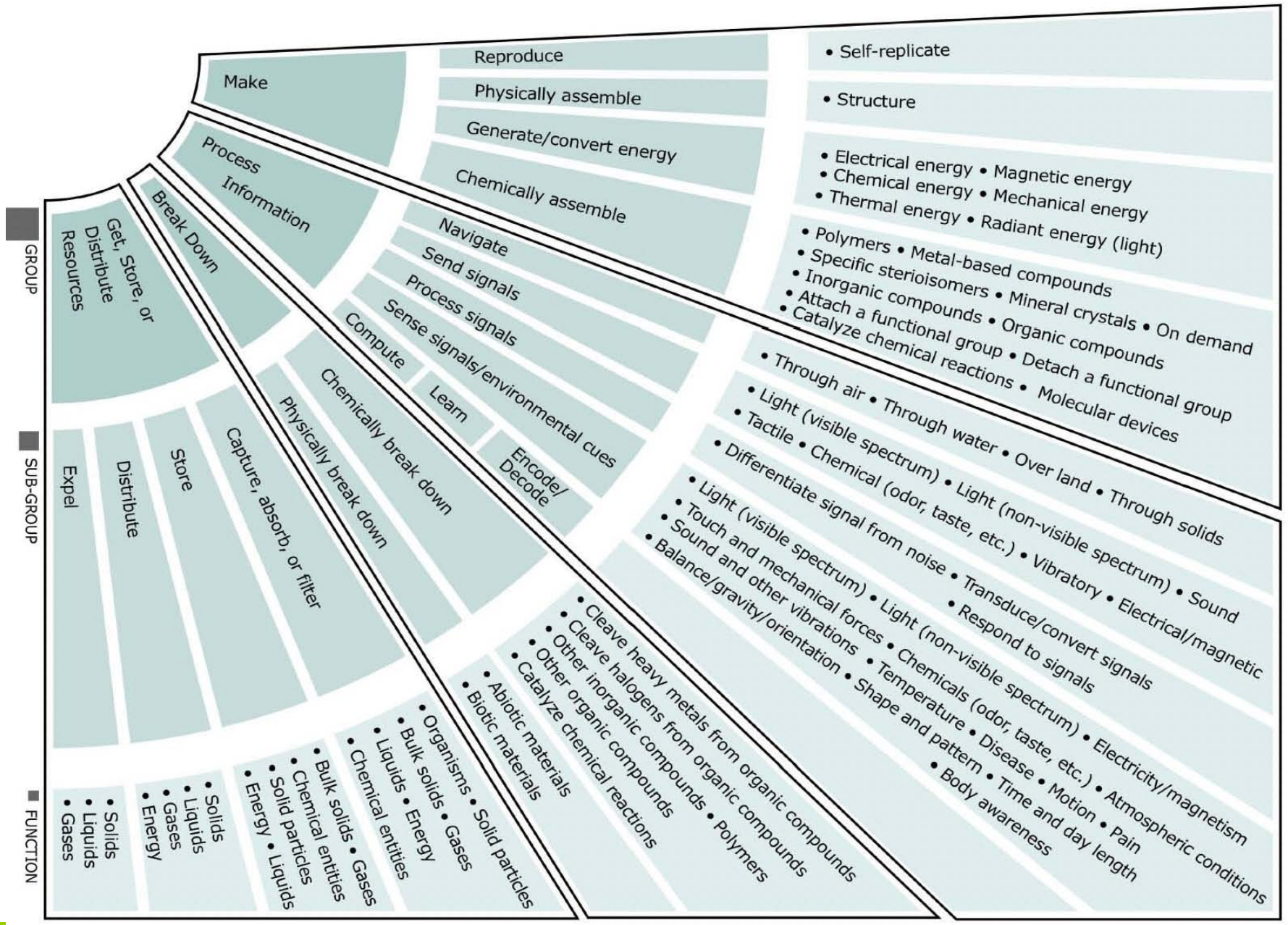
Instead of asking how Nature stores water, you might think about how Nature protects against excess water or keeps water out:

How would Nature…

Remove water?
Stay dry?

Biomimicry Taxonomy





Leaves given structural support: giant water-lily

The leaves of the Amazon water lily gain structural support via girder-like support ribs.

Biomimicry Taxonomy

- Maintain physical integrity >
- Manage structural forces >
- Compression

Biomimetic Application Ideas

Light-weight structurally strong panels for buildings or vehicles.

> Visit strategy page

SUMMARY [Collapse all sections]

"In still or slowly-moving waters there is one easy way to collect [light]: a plant can float its leaves upon the surface. No plant does this on a more spectacular scale or more aggressively than the giant

Biomimicry in Architecture

Singapore Arts Center

Facade photo sensor louvers that adjust to the sun's angle, inspired by polar bears hairs

BIOMIMICRY GUILD

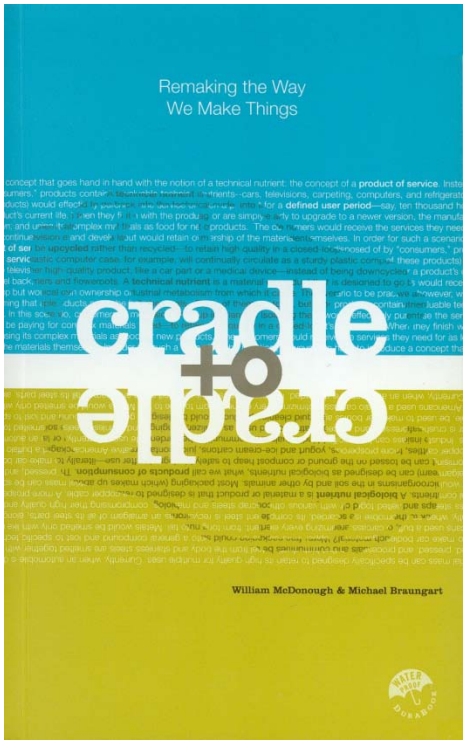
THE INNOVATION CONSULTANCY FOR BIO-INSPIRED DESIGN

The Biomimicry Guild is the only innovation company in the world to use a deep knowledge of biological adaptations to help designers, engineers, architects, and business leaders solve design and engineering challenges sustainably.

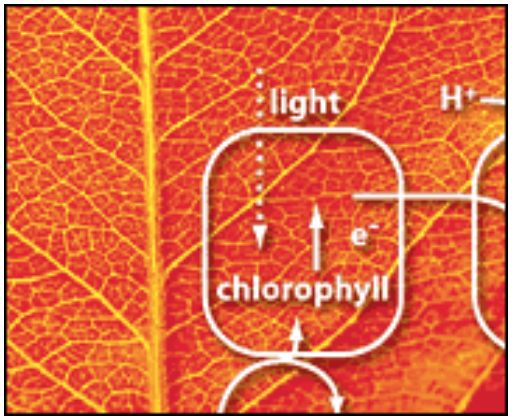
ENTER THE SITE

remaking the way we make things

cradle 2 cradle



MBDC *(McDonough Braungart Design Chemistry)* is articulating and putting into practice a new design paradigm; what *Time* calls "a unified philosophy that—in demonstrable and practical ways—is changing the design of the world."



"Eco-effectiveness seeks to design industrial systems that emulate the healthy abundance of nature."

“A walking college lecture--he is also dean of the University of Virginia school of architecture--McDonough is a compendium of similar maxims, phrases and rules: "Honor commerce as the engine of change"; "respect diversity"; "build for abundance"; "eco-efficiency should be replaced by eco-effectiveness"; "design is the first signal of human intention"; "all sustainability, like politics, is local"; "I want to do architecture that is timeless and mindful.“

All this and much more come from a 48-year-old *innocent anarchist*; his language has the touch of the poet and of the bomb thrower; he looks like actor James Woods in a bow tie. He thinks abstractly, making it equally fascinating and difficult to talk to him, since he turns nearly every contribution one makes to the conversation into a refinement of his theories.” Time Magazine

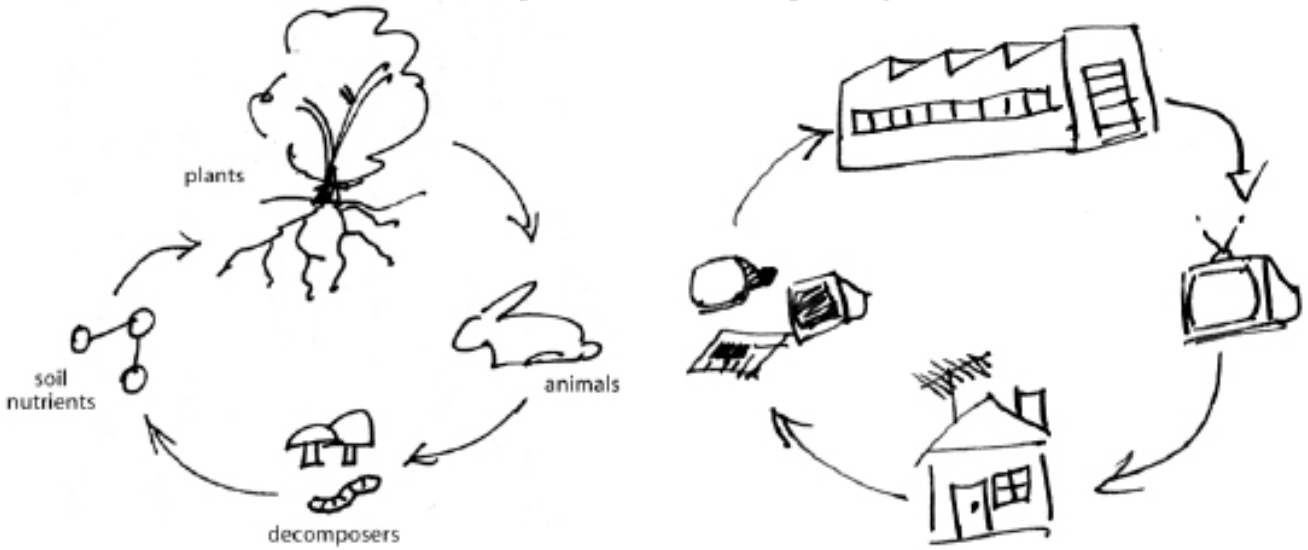
William McDonough and Michael Braungart

"The growth/no-growth argument is specious," he said last week. "Growth is good. The question is, how do you want to grow?" McDonough's guiding principle seems simple enough: the source of our environmental woes is waste. There is nothing wrong with cars, TV sets, and running shoes. What's wrong is the waste—chemicals, heavy metals, CO_2—that's produced when we make them, use them, and, eventually, throw them away.

Eliminate that waste, and you eliminate the problem.

We don't need to make less stuff. We only need to make stuff differently. In McDonough's future, there would be only two kinds of products. The first would be made of natural substances—he calls them "biological nutrients"—and they'd be perfectly biodegradable. Had enough of those pants? Just toss them out the window, like an apple core. The second would be made of "technical nutrients"—steel, plastics, polymers, silicon, glass—and would be endlessly reusable; old shoes would become new shoes, old cars would be turned into new cars. Everything would be raw material for something else.

c2c philosophy



Cradle to Cradle Design™ is based on the living model for sustainability – nature. The flow and cycling of matter in nature does not lead to waste and pollution, but to a dynamic balance of growth and change within ecological systems. The fundamental elements of Cradle to Cradle Design™ are based on the principles that drive these systems in nature:

- Waste = Food
- Use current solar income
- Celebrate Diversity

waste equals food

Waste equals food:

- Design materials and products that are food for other systems. This means designing materials and products to be used over and over in either technical or biological systems.

- Design materials and products that are safe. Design materials and products whose life cycle leaves a beneficial legacy for human or ecological health.

- Create and participate in systems to collect and recover the value of these materials and products.

wool, for example…

Utilizing biological and technical nutrients allows a company to eliminate the concept of waste. Recapturing materials encourages a manufacturer to integrate higher quality materials and focus on the full product life cycle; materials are not fully relinquished to customers when products are sold if the materials and their value are recaptured following product use.

Product cycling among multiple life cycles also creates a mechanism for reconnecting with customers to market the next product generation and provides incentives for return sales.

compostable end product

compostable - yes

Biodegradable
Made from Nature...Returned to Nature Store.com

Vegware

Everything here is made from wheat, potato starch or corn, and can be composted. *It is not plastic…*

BUT if it is NOT composted, then a total WASTE of potential FOOD!

Biofuel: what are the global consequences??

Biofuel is DIFFERENT! It is not composted and still contributes to CO_2 levels as you still BURN it.

When biofuels compete with food production, what happens?
Price of wheat goes up => bread and other basic food items increase in price
Price of corn goes up => processed food prices increase
Price of soybean goes up => beef becomes more expensive

use *current* solar income

Use current solar income:

- The quality of energy matters.
- Use renewable energy.
- But recognize that all renewable energy is not created equal (inferring issues in the manufacture of products like PV; and issues with some hydro generation sources)

celebrate diversity

Celebrate diversity:

• Water is vital for humans and all other organisms. Manage water use to maximize quality and promote healthy ecosystems while remaining respectful of the local impacts of water use.

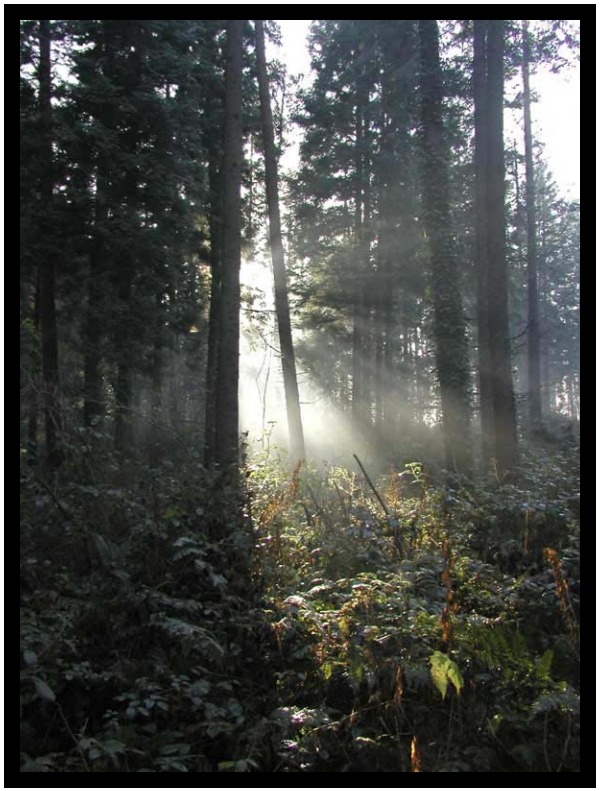
• Use *social responsibility* to guide a company's operations and stakeholder relationships.

c2c vs. cradle to grave

Instead of designing cradle-to-grave products, dumped in landfills at the end of their 'life,' MBDC transforms industry by creating products for cradle-to-cradle cycles, whose materials are *perpetually circulated in closed loops*.

Maintaining materials in closed loops maximizes material value without damaging ecosystems.

c2c vs. cradle to grave



"the cradle"

One of the primary tenets of this philosophy is "grave avoidance".

But beyond that,

REUSE OVER RECYCLING

as reuse requires significantly less expenditure of additional energy and materials and often results in "downcycling" of valuable materials.

"the grave"

certification tracks

There are two tracks for certifying a product:

Cradle to Cradle™ Technical/Biological Nutrient Certification: a binary, pass-fail approach designed for those materials and simple products that are homogeneous in nature. This certification only encompasses the Material and Nutrient (Re)utilization criteria.

Cradle to Cradle™ Product Certification: a three-tiered approach consisting of Silver, Gold, and Platinum levels to reflect continuing improvement along the cradle-to-cradle trajectory. This certification contains the following five categories of metrics: Materials, Nutrient (Re)utilization, Energy, Water, and Social Responsibility.

Both certifications apply to materials, sub-assemblies and finished products.

cradle 2 cradle certification – the idea

Cradle to Cradle Certification provides a company with a means to tangibly, credibly measure achievement in environmentally-intelligent design and helps customers purchase and specify products that are pursuing a broader definition of quality.

Solutia Inc.'s Ultron® nylon 6,6 fiber has been certified as Cradle to Cradle™ Technical Nutrient.

PHOTO COURTESY OF SOLUTIA INC., KENNESAW, GA.

cradle 2 cradle product certification - requirements

This means using:

1. environmentally safe and healthy **materials**
2. design for **material reutilization**, such as recycling or composting;
3. the use of renewable **energy** and energy efficiency;
4. efficient use of **water**, and maximum water quality associated with production;
5. and instituting strategies for **social responsibility**.

1.0 - Materials

MBDC

1.0 Materials

CRADLE TO CRADLE™ CERTIFICATION CRITERIA				
	TN or BN Certification	Silver	Gold	Platinum
1.0 Materials				
All material ingredients identified (down to the 100 ppm level)	●	●	●	●
Defined as biological or technical nutrient	●	●	●	●
All materials assessed based on their intended use and impact on Human/Environmental Health according to the following criteria: ***Human Health:*** Carcinogenicity Endocrine Disruption Mutagenicity Reproductive Toxicity Teratogenicity Acute Toxicity Chronic Toxicity Irritation Sensitization ***Environmental Health:*** Fish Toxicity Algae Toxicity Daphnia Toxicity Persistence/Biodegradation Bioaccumulation Ozone Depletion/Climatic Relevance ***Material Class Criteria:*** Content of Organohalogens Content of Heavy Metals	●	●	●	●
Strategy developed to optimize all remaining problematic ingredients/materials	●	●	●	●
Product formulation optimized (i.e., all problematic inputs replaced/phased out)	●		●	●
Meets Cradle to Cradle emission standards			●	●

1.1 All material components identified (down to the 100 ppm level)

All materials, sub-assemblies, components, etc. present in the finished product at 100 ppm (i.e. 0.01%) or higher are identified. All ingredients present in the materials sub-assemblies, components, etc at 100 ppm or higher are identified by their Chemical Abstract Service (CAS) number and by their relative concentration in the overall material formulation (MBDC will sign Non-Disclosure Agreements to protect any proprietary formulation information). Extremely toxic substances are reported and evaluated at any concentration. LCAs and other certification programs typically only examine ingredients present at 5% (i.e. 50,000 ppm) or higher.

1.2 Defined as a Biological or Technical Nutrient

The product is defined with respect to the appropriate cycle (i.e., technical or biological) and all components are defined as either biological or technical nutrients. If the product combines both technical and biological nutrients, they are clearly marked and easily separable. This is more of a strategic criterion and therefore there is no calculation or metric associated with it.

1.3 All ingredients characterized based on their impact on Human and Environmental Health.

Based on the interpretation of the data for all criteria, chemicals and materials are “scored” for their impact upon human and environmental health. A key factor in this evaluation is the risk presented by the component/chemical, which is a combined measure of identified hazards and routes of exposure for specific chemicals and materials, and their intended use in the finished product. The “score” is illustrated by the following color scheme:

GREEN (A-B)	Little to no risk associated with this substance. Preferred for use in its intended application.
YELLOW (C)	Low to moderate risk associated with this substance. Acceptable for continued use unless a GREEN alternative is available.
RED (X)	High hazard and risk associated with the use of this substance. Develop strategy for phase out.
GREY	Incomplete data. Cannot be characterized.

1.3.1 Human Health Criteria

The criteria are subdivided into Priority Criteria (most important from a toxicological and public perception perspective) and other Additional Criteria.

Criteria	Description
PRIORITY	
Carcinogenicity	Potential to cause cancer
Endocrine Disruption	Potential to negatively effect hormone function and impact development
Mutagenicity	Potential to damage DNA
Teratogenicity	Potential to harm fetus
Reproductive Toxicity	Potential to negatively impact reproductive system

ADDITIONAL	
Acute Toxicity	Potential to cause harm upon initial, short term exposure
Chronic Toxicity	Potential to cause harm upon repeated, long-term exposures
Irritation of Skin and Mucous Membranes	Potential to irritate eyes, skin, and respiratory system
Sensitization	Potential to cause allergic reaction upon exposure to skin or airways
Other	Any additional characteristic (e.g., flammability, skin penetration potential, etc.) relevant to the overall evaluation but not included in the previous criteria

Substances that do not pass the Priority criteria are automatically scored RED and recommended for phase-out/replacement.

1.3.2 Environmental Health Criteria

Criteria	Description
Fish Toxicity	Measure of the acute toxicity to fish (both saltwater and freshwater)
Daphnia Toxicity	Measure of the acute toxicity to Daphnia (invertebrate aquatic organisms)
Algae Toxicity	Measure of the acute toxicity to aquatic plants
Persistence/ Biodegradation	Rate of degradation for a substance in the environment (air, soil, or water)
Bioaccumulation	Potential for a substance to accumulate in fatty tissue and magnify up the food chain
Climatic Relevance	Measure of the impact a substance has on the climate (e.g., ozone depletion, global warming, etc.)
Other	Any additional characteristic (e.g., soil organism toxicity, WGK water classification, etc.) relevant to the overall evaluation but not included in the previous criteria

1.3.3 Material Class Criteria

The following material classes are scored RED due to the concern that at some point in their life cycle they may have negative impacts on human and environmental health. In the case of organohalogens, they tend to be persistent, bio-accumulative, and toxic, or can form toxic by-products if incinerated.

Criteria	Description
Organohalogen Content	Presence of a carbon – halogen (i.e., chlorine, bromine, or fluorine) bond
Heavy Metal Content	Presence of a toxic heavy metal (e.g., Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, Nickel, etc.)

The complete phase-out of all RED components is necessary to achieve a Gold or Platinum product certification.

1.6 Meets Cradle to Cradle™ emission standards

For interior products to achieve Gold or Platinum certification, they must meet the Cradle to Cradle emission standards which are defined as the following:

- TVOC < 0.5 mg/m3 *(total volatile organic compounds)*
- Individual VOCs < 0.1 TLV or MAK values (whichever is lower)
- No detectable VOCs that are considered known or suspected carcinogens, endocrine disruptors, mutagens, reproductive toxins, or teratogens. Based on the lab chosen to do the work what is considered “non-detect” may vary. For the purposes of this certification, anything below 2µg/m3.

Labs approved for testing include Berkley Analytical, MAS, AQS, and Syracuse University. All testing is done according to ASTM D5116 for small chamber and ASTM D6670 for large chamber.

2.0 – Material Reutilization

MBDC

2.0 Material Reutilization/Design for Environment

CRADLE TO CRADLE™ CERTIFICATION CRITERIA				
	TN or BN Certification	Silver	Gold	Platinum
2.0 Material Reutilization/Design for Environment				
Defined the appropriate cycle (i.e., Technical or Biological) for the product and developing a plan for product recovery and reutilization	●	●	●	●
Well defined plan (including scope and budget) for developing the logistics and recovery systems for this class of product			●	●
Recovering, remanufacturing or recycling the product into new product of equal or higher value				●
Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score >= 50	●	●	●	●
Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score >= 70			●	●
Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score >= 85				●

2.1 Defined the appropriate cycle (i.e., Technical or Biological) for the product and developing a plan for product recovery and reutilization

For all certifications, the product has successfully been designed as either a Technical or Biological Nutrient (or both if materials are easily separable); hence, the appropriate materials and chemical inputs have been intentionally selected to support the metabolism for which the product was designed. In addition, the manufacturer is in the process of developing a plan for end of life product recovery.

*2.2 Well-defined plan (including scope and budget) for developing the logistics and **recovery systems** for this class of product*

For Gold and Platinum certifications, there is also a well-defined logistics and recovery system plan for this class of product. The elements of the plan include:

- Scope: how extensive the recovery effort will be
- Timeline: when the actual recovery will begin
- Budget: commitment of resources (e.g., dollars, labor, equipment, etc.)

The plan can include partners outside the traditional supply chain (e.g., recycling partners, recovery/transportation partners, etc.). This does not necessarily mean a product take-back program. That is one potential strategy for closing the loop on the materials/product but there are several other legitimate strategies as well. For example, utilizing design for disassembly (DfD) strategies along with third party regional recyclers may be more effective in recovering and reutilizing materials than a product take back program that requires potentially very disperse products to be sent back to the manufacturer.

2.3 Recovering, remanufacturing or recycling the product into new product of ***equal or higher value***

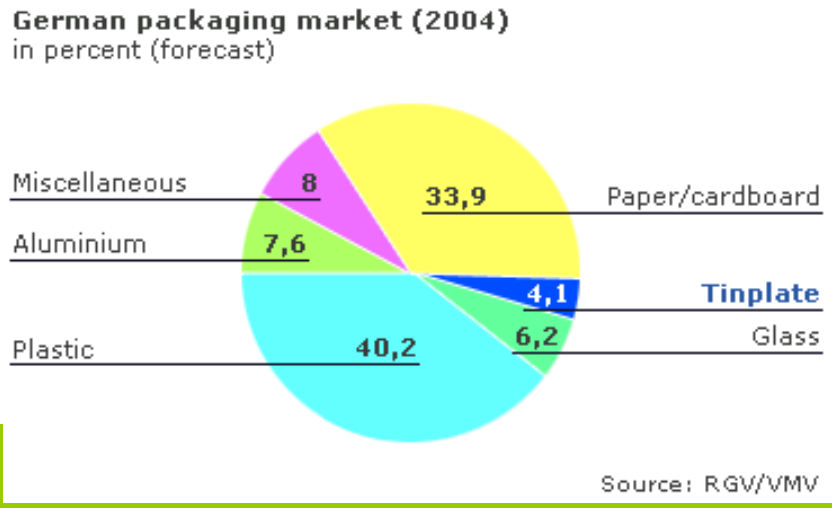
For Platinum certification, the plan developed in 2.2 above has been implemented. As each manufacturing system varies, MBDC will judge the validity and efficacy of each applicants program on a case-by-case basis.

opposite of

DOWNCYCLING

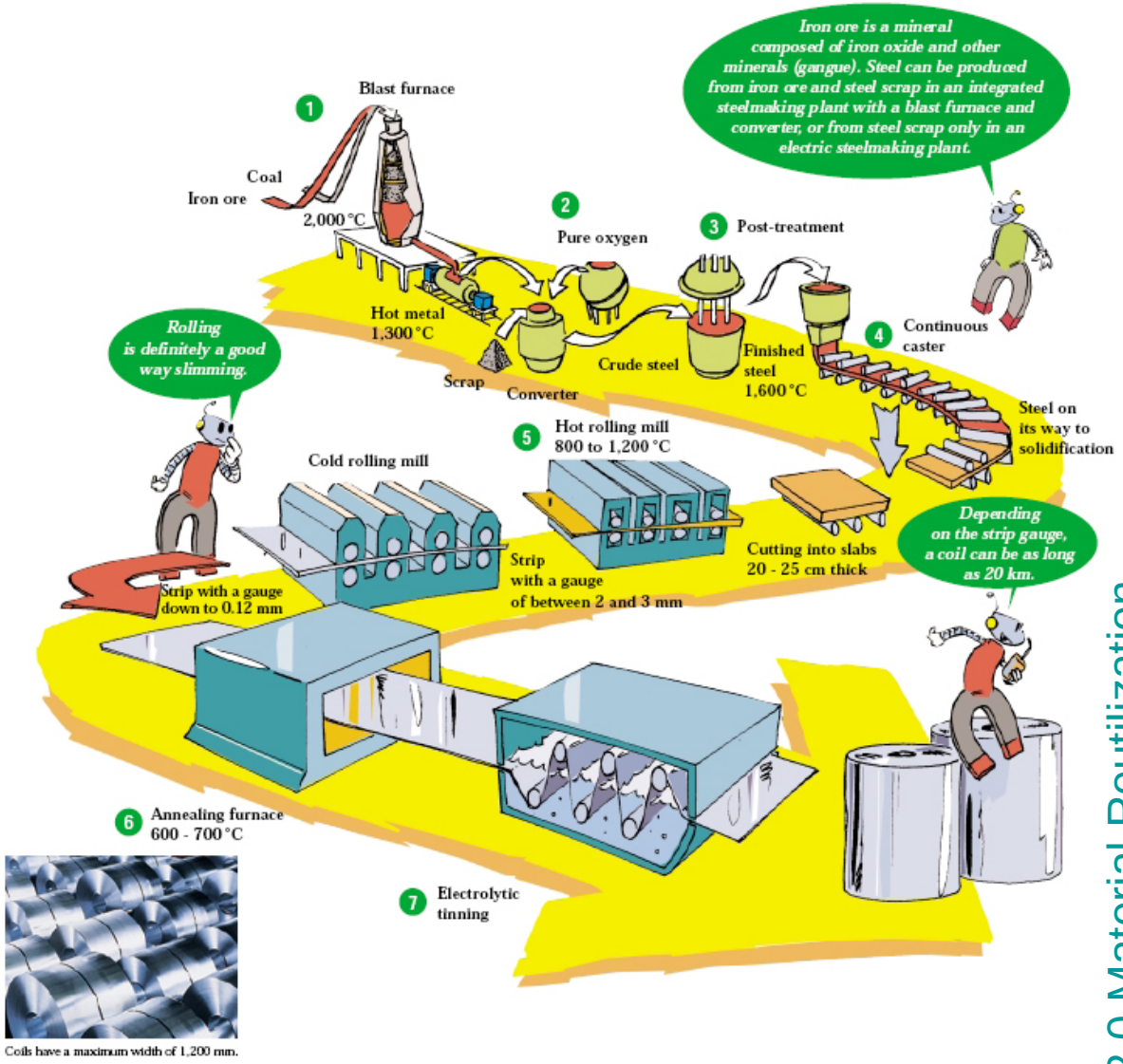
The practice of recycling a material in such a way that much of its inherent value is lost (for example, recycling plastic into park benches). This is true for the majority of major recycling efforts. Products can only be downcycled so many times before their usefulness is completely spent and they end up in landfills.

Downcycling does not occur with tinplate.



It is argued that the energy and material expenditure of transforming discarded plastic bottles into plastic wood is not worth the effort – therefore regarded as DOWNCYCLING the material.

Tinplate is steel with a very thin layer of tin to coat its surfaces so that it does not corrode.



Source: http://www.izw.de/fileadmin/Download/Publikationen/verpackung_mit_pfiff_en.pdf

There are two main routes for recycling steel and tinplate

- collection of production waste
- collection of used tinplate

Steel recycling is environmentally friendly, as it reduces the consumption of iron ore. Every year, more than 500 million tons of iron ore are saved worldwide by the use of steel scrap. The steel industry uses about one million tons of scrap every day to make steel around the world. This corresponds to about 42,000 t per hour or 12 t per second.

2.4 Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score≥ 50

For Technical/Biological Nutrient and Silver certifications, the Nutrient (Re)utilization Score is 50 or higher.

The **Nutrient (Re)utilization Score** is a combination of the recyclability/compostability and recycled/renewable content of the product and is calculated as follows:

$$\frac{(\%\text{ of the product considered Recyclable or Compostable}) * 3 + (\%\text{ Recycled or Rapidly Renewable Content}) * 1}{4}$$

Example – Product X is made up of components that are 80% recyclable and it contains 40% recycled content

$$\text{Nutrient (Re)utilization Score} = \frac{[(80) * 3] + [(40) * 1]}{4} = 70$$

3.0 - Energy

MBDC

3.0 Energy

CRADLE TO CRADLE™ CERTIFICATION CRITERIA				
	TN or BN Certification	Silver	Gold	Platinum
3.0 Energy				
Characterized energy use and source(s) for product manufacture/assembly		●	●	●
Developed strategy for using current solar income for product manufacture/assembly		●	●	●
Using 100% current solar income for product manufacture/assembly			●	●
Using 100% current solar income for entire product				●

3.1 Characterized energy use and source(s) for product manufacture/assembly

For Silver, Gold, and Platinum certifications, a general understanding of the energy quantity and quality for product manufacture/assembly is required. To meet this requirement the amount of energy used per unit product is calculated along with the energy mix, or sources, for that energy (i.e. what percent comes from renewable vs. non-renewable sources).

3.2 Develop strategy to use current solar income for product manufacture/assembly

The ultimate goal of Cradle to Cradle Design is to have all energy inputs come from what we term “current solar income”. Forms of current solar income include wind, biomass, hydro (in certain circumstances – to be determined on a case-by- case basis) and of course solar. Once the manufacturing/assembly energy has been quantified in 3.1 above, a strategy is developed to supply that energy via current solar income. The strategy contains a timeline as well as measurable goals and milestones.

4.0 - Water

MBDC

4.0 Water

CRADLE TO CRADLE™ CERTIFICATION CRITERIA				
	TN or BN Certification	Silver	Gold	Platinum
4.0 Water				
Created or adopted water stewardship principles/guidelines		●	●	●
Characterized water flows associated with product manufacture			●	●
Implemented water conservation measures				●
Implemented innovative measures to improve quality of water discharges				●

Controlling runoff into watershed areas

4.1 Create or adopt water stewardship principles/guidelines

For Silver, Gold, and Platinum certifications, create or adopt a set of principles or guidelines that will inform your facility's future strategies for protecting and preserving the quality and supply of water resources.

Examples include:

- World Business Council for Sustainable Development – Water Principles (http://www.wbcsd.ch/web/publications/sinkorswim.pdf) pg 11

- Hannover Principles: Design for Sustainability – Water (http://www.gemi.org/water/resources/hannover.htm)

- Water Management Principles of the Ministry of Water, Lan Protection from the Government of British Columbia (http://wlapwww.gov.bc.ca/wat/wtr_cons_strategy/basics.htm

4.2 Characterize water flows associated with product manufacture

Water Source(s):

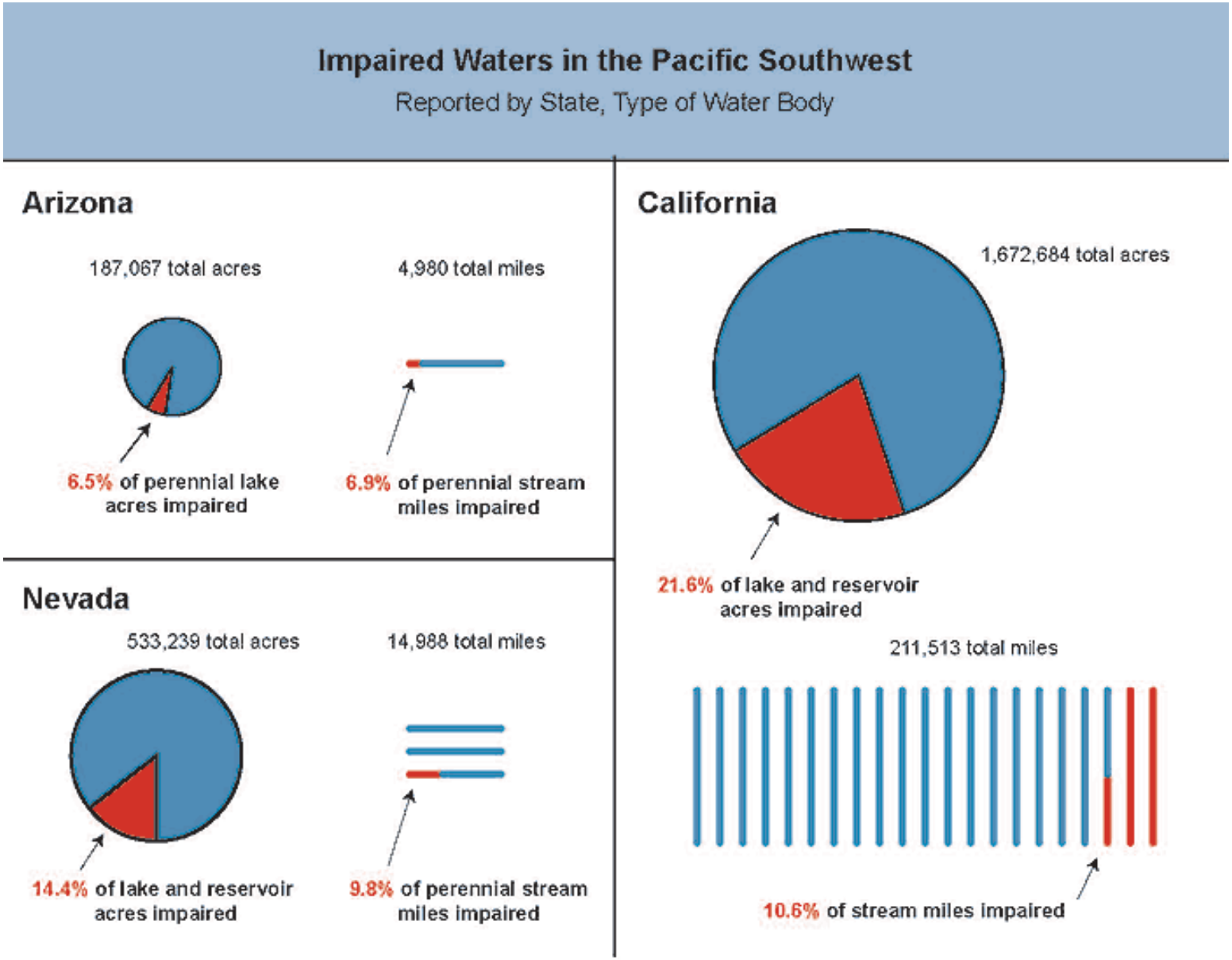
- Describe the types of water sources the facility(ies) relies upon.
- Determine whether or not the facility is located within or adjacent to a listed wetland
- Define the watershed. Document the following information:
  - Does the facility withdraw or discharge effluent to a water source that is listed as impaired by the EPA, state or local authorities? What are the water concerns for the area and how does the facility impact these concerns?
  - Ask the local or regional water authority whether the facility is considered a major or minor user of water relative to other users in the watershed region.

Water Usage:

- How much water is used per unit product produced?
- What measures have been taken to conserve water resources?

Water Discharges:

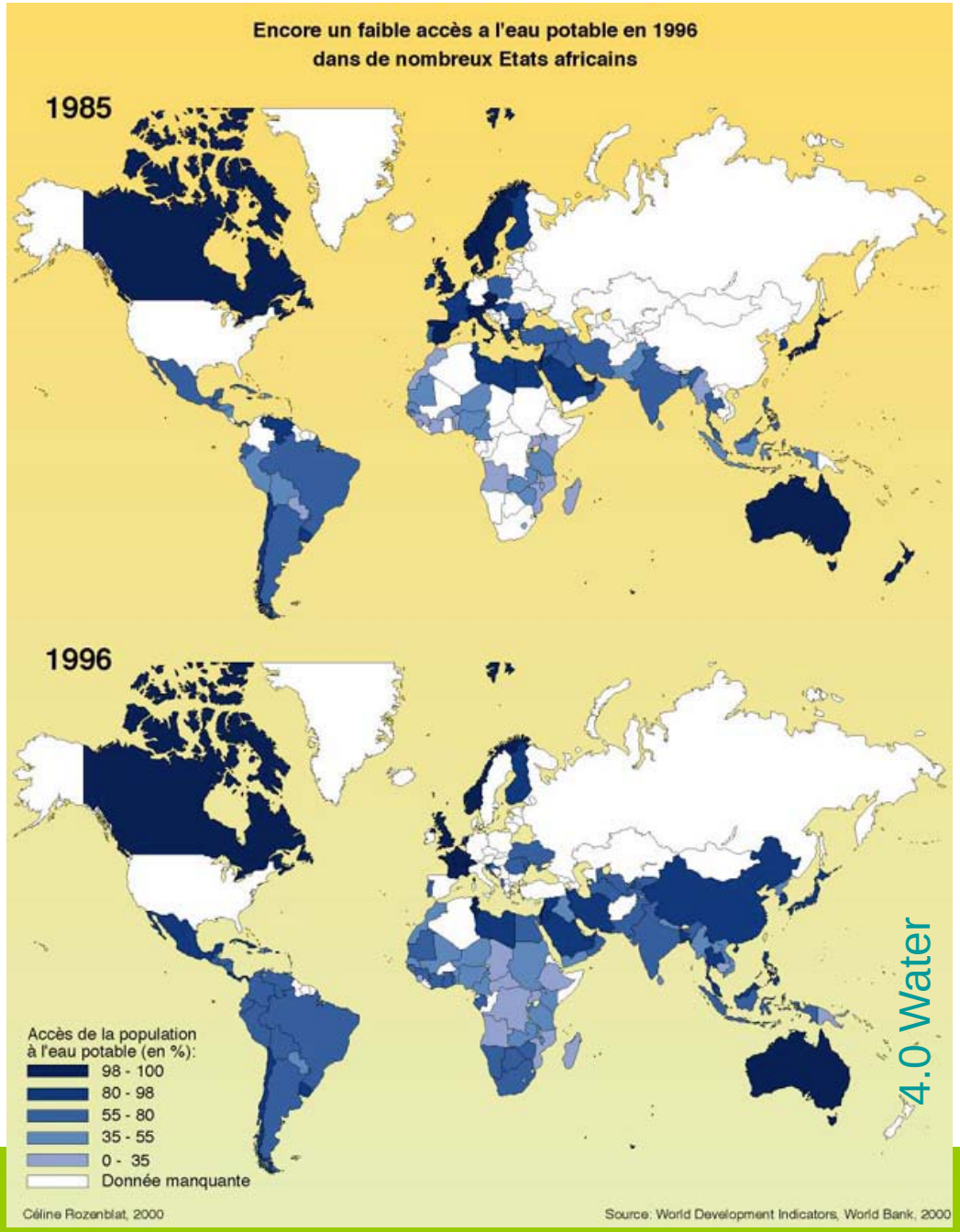
- Meets or exceeds EPA and state water quality regulations as required under EPA's National Pollution Discharge Elimination System (NPDES).


Impaired Waters in the Pacific Southwest
Reported by State, Type of Water Body
Arizona
187,067 total acres
4,980 total miles
6.5% of perennial lake acres impaired
6.9% of perennial stream miles impaired
California
1,672,684 total acres
21.6% of lake and reservoir acres impaired
211,513 total miles
10.6% of stream miles impaired
Nevada
533,239 total acres
14,988 total miles
14.4% of lake and reservoir acres impaired
9.8% of perennial stream miles impaired

The idea behind “Water” is to promote clean water sources and to prevent the dumping of any chemicals whatsoever into any water source.

This applies not only to Industrialized Western countries, but developing countries as well.

Many Western companies have their products manufactured in the “Third World”, where/because standards are lower so profits can be higher.



5.0 – Social Responsibility

MBDC

5.0 Social Responsibility

CRADLE TO CRADLE™ CERTIFICATION CRITERIA				
	TN or BN Certification	Silver	Gold	Platinum
5.0 Social Responsibility				
Publicly available corporate ethics and fair labor statement(s), adopted across entire company		●	●	●
Identified third party assessment system and begun to collect data for that system			●	●
Acceptable third party social responsibility assessment, accreditation, or certification				●

cradle 2 cradle certification – “reward”

Steelcase Inc.'s Think™ chair has been certified Cradle to Cradle™ Silver.

PHOTO COURTESY OF STEELCASE INC., GRAND RAPIDS, MICH.

If a candidate product achieves the necessary criteria, it is certified as a Silver, Gold or Platinum product

…

Haworth Inc.'s Zody™ office chair has been certified Cradle to Cradle™ Gold.

PHOTO COURTESY OF HAWORTH INC., HOLLAND, MICH.

Pendleton Woolen Mills Inc.'s Classic Wool Flannel has been certified Cradle to Cradle™ Biological Nutrient.

PHOTO COURTESY OF PENDLETON® WOOLEN MILLS INC., PORTLAND, ORE.

…or as a Technical/Biological Nutrient (available for homogeneous materials or less complex products), and can be branded as Cradle to Cradle.

Victor Innovatex Inc.'s Eco Intelligent® Polyester fabric has been certified Cradle to Cradle™ Technical Nutrient.

PHOTO COURTESY OF VICTOR INNOVATEX INC., SAINT-GEORGES, QUEBEC, CANADA

biological nutrient vs technical nutrient

Utilizing *biological nutrient* and *technical nutrient* definition allows a company to virtually eliminate the concept of waste and recover value, rather than creating a future of solid waste liability and relinquishing material assets by simply delivering a physical product to a customer without a coherent relationship to the potential inherent in the product itself as a potential long term asset for the customer, nature, industry or the company itself. Cradle to Cradle Design™ turns contingent liabilities into assets.

BIOLOGICAL NUTRIENT

A *biodegradable material* posing no immediate or eventual hazard to living systems that can be used for human purposes and can safely return to the environment to feed environmental processes.

TECHNICAL NUTRIENT

A material that remains in a closed-loop system of manufacture, reuse, and recovery (the technical metabolism), maintaining its value through many product life cycles.

http://www.mbdc.com/certified_producttype.htm#

The '**optimized by MBDC**' five-dot optimization scale, based on MBDC's 'five steps to eco-effectiveness,' indicates the following:

1. "Free of... This is a market-induced product improvement, removing a substance widely perceived as environmentally unfriendly. MBDC does not lend its logo to these products.

2. Preferable. A 'preferable' product is one that exhibits environmental vision and leadership, but without a complete human health and environmental characterization of its material and chemical makeup. A 'preferable' product may still have environmental flaws, but it begins to move toward Cradle to Cradle Design in some significant way.

3. Fully Assessed. A 'fully assessed' product has been evaluated using MBDC's Cradle to Cradle Design Protocol for Material and Chemical Assessment. All chemical and material inputs are known, and have been assessed according to the criteria of the Protocol. At a minimum, substances of the greatest concern within the Protocol have been eliminated or replaced with substances of less concern.

4. Optimized. An 'optimized' product has been fully assessed and, to the extent feasible, optimized for material health and safety according to MBDC's Cradle to Cradle Design Protocol for Material and Chemical Assessment. The product is designed for optimal value recovery within closed-loop systems (true recycling and/or return to the biological metabolism).

5. Fully Eco-Effective. In MBDC's optimization scale, a 'fully eco-effective' product is one that incorporates as completely as possible all of the material, process, energy, and other aims of Cradle to Cradle Design, as described by MBDC.

other considerations

Special considerations will be applied to certain classes of products (e.g., VOC emission standards will be applicable to indoor products only, reutilization criteria will be applied to the substrate, rather than the material, for paint and other coating products, etc.).

In the case of technical nutrient products where a take back system is in effect and there is a well-defined chain of custody, certain rare, high value, but potentially toxic substances (e.g., cadmium, silver, etc.) may be appropriate and effective substances as defined in use.

DfD

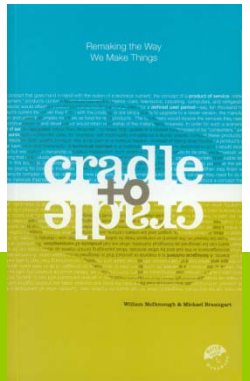
design for disassembly

DESIGN FOR DISASSEMBLY
Designing a product to be dismantled for easier maintenance, repair, recovery, and reuse of components and materials.

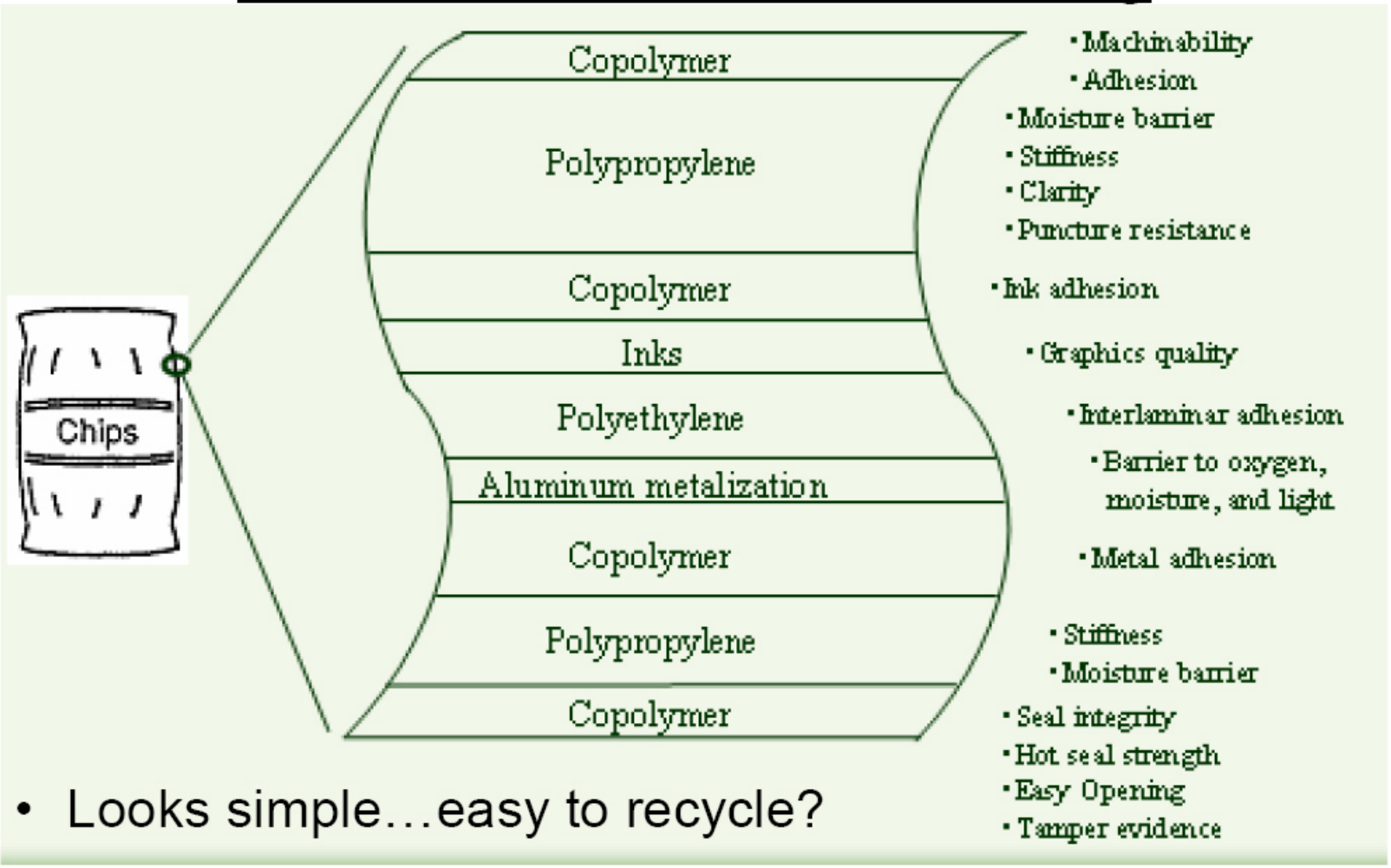
“Why take something as exquisite as a tree and knock it down? Trees make oxygen, sequester carbon, distill water, build soils, convert solar energy to fuel, change colors with the seasons, create microclimates and provide habitat.

My book "Cradle to Cradle," which I wrote with Michael Braungart, is printed on pages made of plastic resins and inorganic fillers that are infinitely recyclable. They're too heavy, but we're working with companies now to develop lightweight plastic papers. We have safe, lightweight inks designed to float off the paper in a bath of 180 degrees—hotter than you would encounter under normal circumstances. We can recapture the inks and reuse them without adding chlorine and dioxins to the environment. And the pages are clean, smooth and white.”

- William McDonough



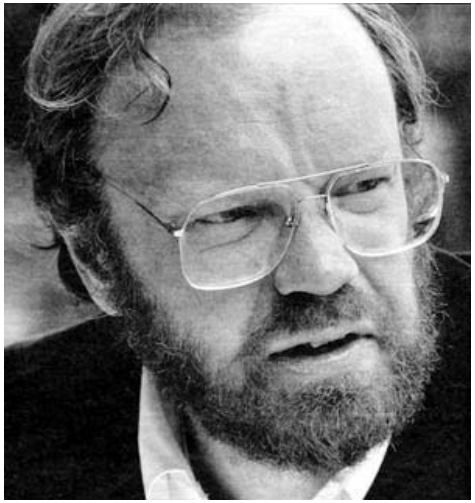
Cross-section of a Snack Bag



Source: http://www.eng.uc.edu/~pbishop/69

This product is neither easy to recycle nor suitable for composting.

philosophy of design for disassembly (DfD)



Jonathan Larson

DFD is a subset of the emerging environmental redesign movement which assumes that:

a) humans cause pollution (apes and dolphins may be bright but they have never caused a toxic waste dump)
b) humans are conscious beings
c) pollution is caused by the conscious acts of these humans
d) the more difficult the act of humans, the more planning it takes
e) the truly difficult pollution problems are caused by acts of significant planning and design.

Therefore:

Pollution is a function of design!

source: http://www.elegant-technology.com/TVnewide.html

POLLUTION IS AN ACT OF DESIGN

Remember, EVERYTHING that is called 'disposable' was DESIGNED from day one to be garbage--as its PRIMARY and overriding design consideration."


EVEN THIS BUILDING!
GATE 1
HITACHI
NO PARKING

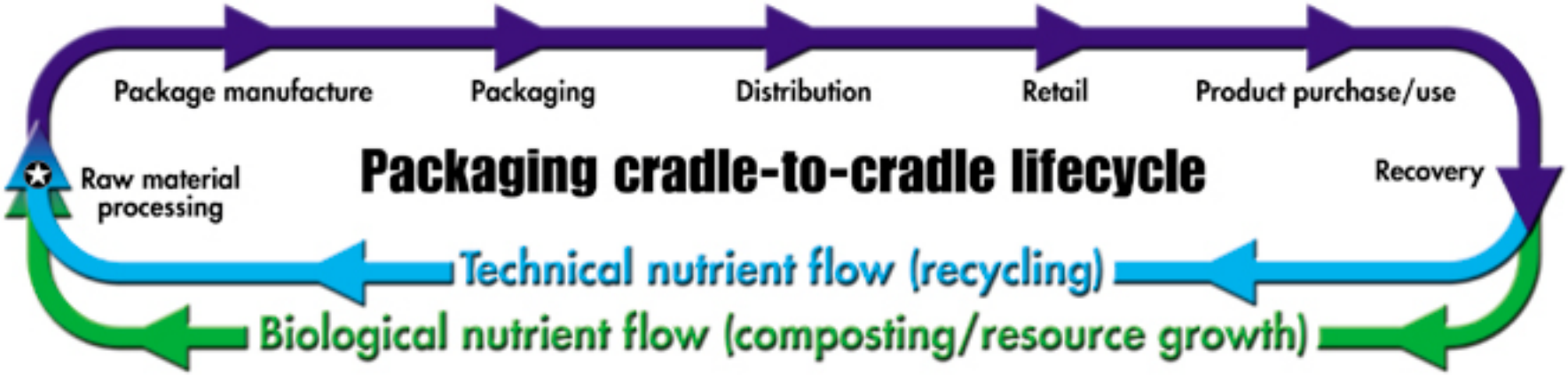
pollution is an act of design

“Nuclear power and the resulting waste problems were brought to us by the creative genius of scientists, inventors, and design engineers. Global warming is the product of planning by geologists, mining engineers, shippers, civil engineers, automotive designers, and the clever folks who solved the problems of mass production. The ozone hole is courtesy of organic chemists who were merely trying to give the world a safe way to preserve food and medical products with refrigeration. In fact, virtually every thing that can be considered pollution is the product of intense planning and design--down to the last bubble-pack and plastic milk carton clogging our waste dumps.

Remember, EVERYTHING that is called 'disposable' was DESIGNED from day one to be garbage--as its PRIMARY and overriding design consideration.”

this was ALL designed

packaging



Packaging accounts for a significant amount of pure waste in the Modern World. The c2c philosophy agues for more/more durable packaging that can be reused.

Alternatively, manufacture packaging that does not contain toxic elements so that it can be cleanly burned as a fuel source.

c2c looks at traditional versus eco-effective packaging

…how would you design this differently to make it more eco-effective??

The traditional way: eco-efficient packaging	The cradle-to-cradle way: eco-effective packaging
Minimize the amount of packaging materials to reduce impact on environment.	Use as much packaging as is desired to protect and differentiate the product because that package will become a biological or technical nutrient after its first use.
Discourage littering because materials don't break down for decades; and, if they do, toxic additives can enter the environment.	Discarded biodegradable packaging that incorporates soil nutrients would actually benefit the environment, not harm it.
Consumer is left with the liability of package disposal after product is consumed.	Consumer no longer has disposal liability because package will become a technical or biological nutrient after its first use. Customer is left with a positive impression of the product and the manufacturer.
Recycled-content packaging can result in reduced performance and attractiveness.	By positively selecting the right additives and inks, packaging can be cheaper to recycle in a true, 100% closed-loop process with no loss in performance.
Recycling often requires consumers to distinguish among unfamiliar types of materials, such as various types of plastics.	Consumers pitch all recylables in a single bin and biodegradables in another, letting modern sortation technology do the work.
Deposits may be mandated by law.	Packagers can create their own deposit systems to recover expensive, desirable packages.
Packaging materials must be as cheap as possible, often leading to multilayer composites or laminates that are difficult or impossible to reuse or recycle.	Returnable packaging reduces or eliminates the need to create hybrids that don't readily disassemble into technical or biological nutrients.

…how would you design THIS to make it more eco-effective?

Recent enviro-packaging developments

Below is a partial list of recent commercial developments in environmental packaging, most of which happen to be plastic. Of course, environmental advantages have also been associated with paper, glass, and metal packaging.

Company	Technology
Amcor PET Packaging	SuperCycle™ recycling technology now handles multilayer PET
Cargill Dow	NatureWorks™ biodegradable resin from renewable resources
CCL Plastic Packaging	Plastic tubes with up to 35% post-consumer recycled (PCR) content
DuPont	Biomax® biodegradable polyester coatings and films
Earthshell	Biodegradable foodservice packaging
Eastman Chemical Co.	Eastar Bio® biodegradable resins
Shell Chemical	Biodegradable solvents for coatings and printing inks
UCB Films	NatureFlex™ biodegradable films
Zed Industries	Biodegradable skin packaging

Visit **packworld.com/go/w068** *for a more complete list, including Web links to the above items.*

Fact is…

It was successfully “designed for disassembly”

real men are environmentalists too

“It's Your Creation. The joy of inventing and building is clear to those who have done it--it makes a man feel like a god. The process of turning a synaptic flash of an idea into the products of industrialization defines much of male creativity. Because technology is almost exclusively the offspring of men, much of the demonization of technology is nothing more than male-bashing. Yet some criticism is legitimate for like irresponsible fathers, we have not nurtured our creations. Like sex, technological creation is more fun than maintenance of the offspring--for some reason, sex until dawn is more invigorating than caring for a sick child all night. Like with humans, technology is also more enjoyable when it is young than when it is old and dying.”

-Jonathan Larson 1997

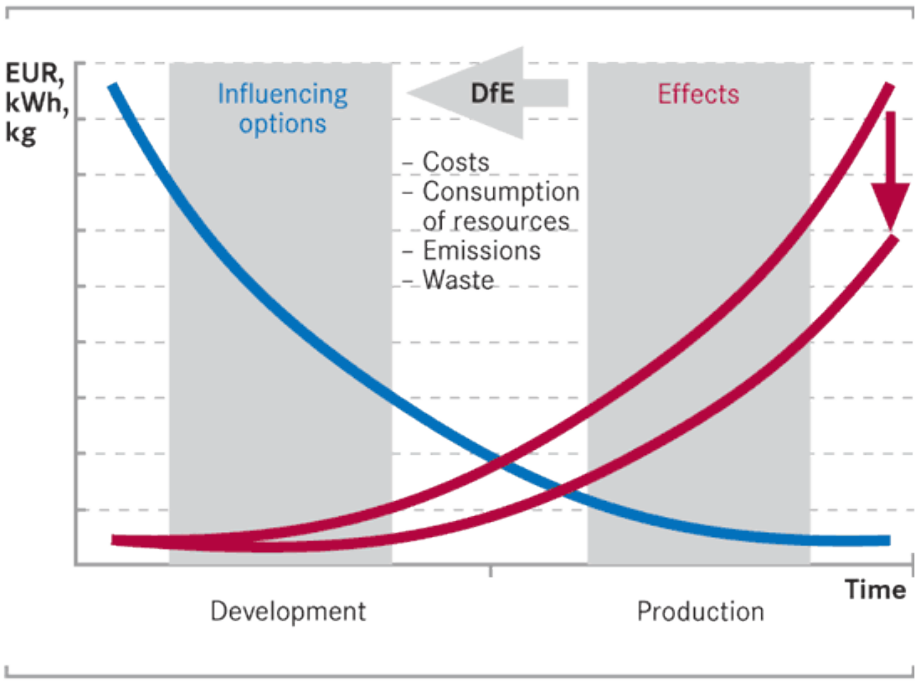
the Germans have already done it

“The Germans, who are no slouches when it come to technological creativity, have passed what may be the world's most interesting environmental law. Because they are running out of places to hide their garbage, they now require manufacturers to take responsibility for recycling. The principle is: You made it--you figure out what to do with it when its useful life has ended. Three general strategies to cope with this legislation have emerged: Some products are designed for easy disassembly and resource recovery, others are being reformulated to biodegrade on their own, while other products and processes are designed out of the system altogether. By assigning total product life responsibilities on the original technological creators, the Germans are forcing into existence a whole new generation of industrial excellence.”

- Jonathan Larson

mercedes benz + DfE

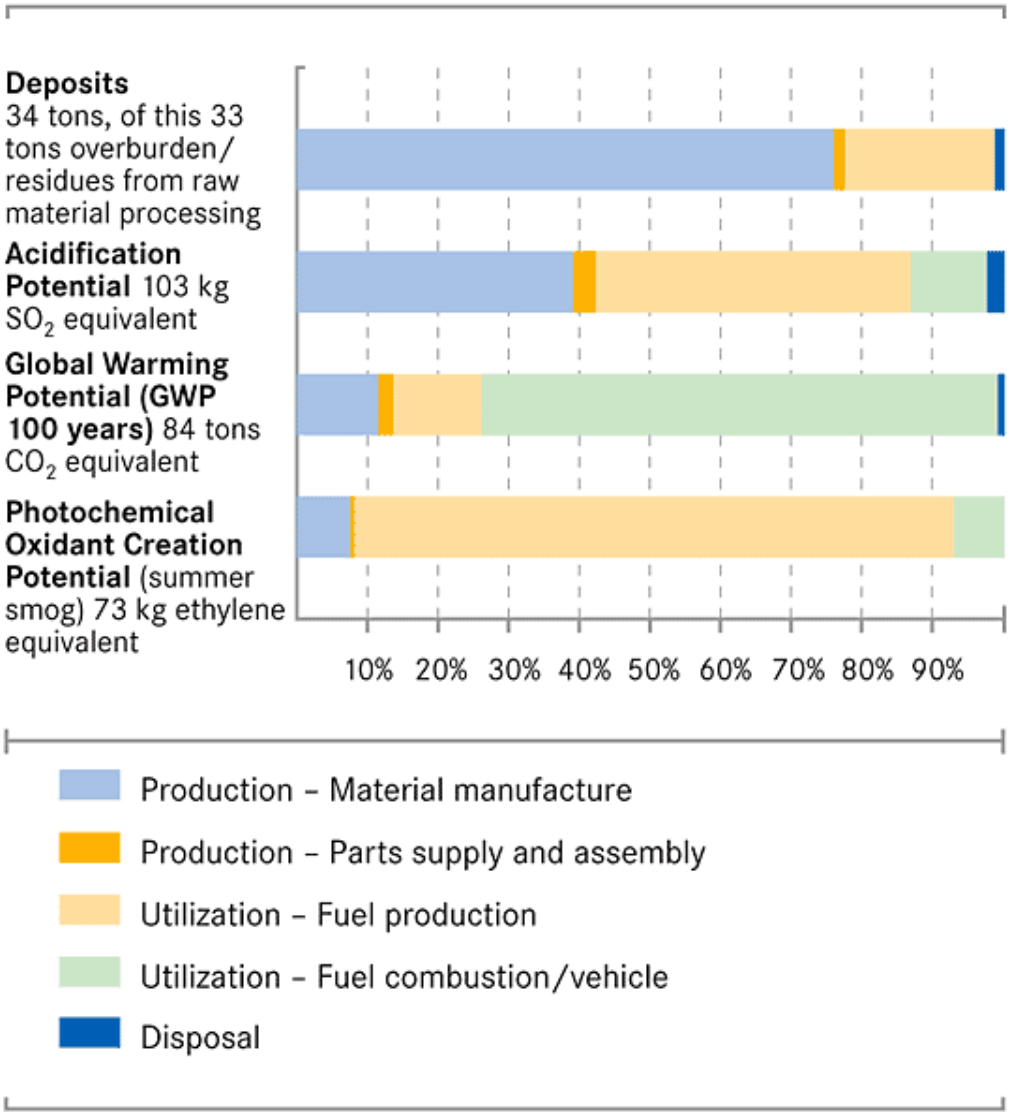
Influence and effects of Design for Environment (DfE)



DfE starts as early as the early development stages. This is because even minor measures taken at this early point in time can have significant effects at a later stage – and yield tangible reductions in the consumption of resources, in emissions, in waste volumes and in costs. By contrast, it is extremely difficult and costly to modify a vehicle component at an advanced stage of development or as late as the production stage.

DfE = Design for the Environment

Environmental impact on the lifecycle stages of a passenger car using the example of the Mercedes-Benz E-Class



Renewable materials in the new E-Class station wagon

Raw materials	Used in
Flax, sisal, hemp	Door trim, backrest cover driver's seat
Coconut fiber/latex compound	Seat backrests and upholstery
Wood veneer	Trim strips, panels
Wool, cotton	Seat and head restraint covers
Reprocessed cotton	Insulation, seat cushions, parcel shelf brackets in sisal/cotton compound with plastic matrix

Recycling applications in Chrysler Group vehicles

Component	Recycled material (100 %)
Spare tire protector	Crumb rubber
Transmission oil filter	Polyamides (PA66)
Headlamp bezels; I/P top cover; speaker grille	Polycarbonates (PC)
Lamp housing	PC/acrylonitrile-butadiene-styrene
Battery case; splash shields, wheel house	Polypropylene (PP)
Package shelf tray, door trim panel	PP with wood (fiber/flour)
Mirror bracket	Polyethylene terephthalate (PET)
Acoustic pad	Resinated cotton
Air dam	Thermoplastic olefin TPO

A house is likely not even as complex, when you really get right down to it…

“The Germans produced DFD regulations because they understood the importance of production issues and environmental issues coming together. It is the logical outcome of the Red (Social Democrat) Green coalition. The Social Democrats believe that for workers to prosper, industry must prosper. The Green Party believes that for industry to prosper, it must be environmentally sustainable. The combining strategy is industrial **redesign**.

In some ways, it is not surprising that the Germans would reach such a conclusion. For them, industrial design is a valued profession. Mies Van der Rohe said that "Form follows function" in the 1920s and they have believed him ever since. If Germans could be convinced that environmental sustainability is simply a design target, and they have been largely convinced, then industrial-environmental design is the necessary logical outcome. It is why 1992 German cars already conform to DFD regulations, and automakers have established sophisticated recycling facilities, while in the U.S., DFD is still an essentially unknown concept.”

-Jonathan Larson

“The European environmentalists I know consider the American infatuation with consumerist strategies to be utterly infantile. If the last twelve years have taught us anything, it is that peoples and nations who know how to successfully produce, eventually dominate those who merely know how to shop.”

-Jonathan Larson

DfD – the rules…

Design for the Environment encompasses many issues including Design for Disassembly and Design for Recycling. There are a number of benefits of achieving efficient disassembly of products as opposed to recycling a product by shredding, which include:

- Components which are of adequate quality can be refurbished or reused.
- Metallic parts can be separated easily into categories which increases their recycling value.
- Disassembled plastic parts can be easily removed and recycled.
- Parts made from other material such as glass or hazardous material can easily be separated and reprocessed.

Although most products can be disassembled eventually, lengthy disassembly does not make for economic recycling as the cost of disassembly is likely to be much larger than the revenue gained through recycling the parts and materials from the product. It is for this reason that designing products for easy disassembly has increased in popularity enabling more of the product to be recycled economically.

source: http://www.co-design.co.uk/design.htm

The most comprehensive work on Design for Disassembly has identified the more detailed areas associated with Design for Recycling, these are:

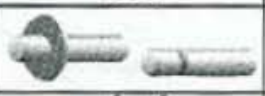
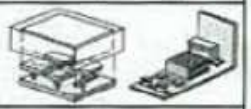
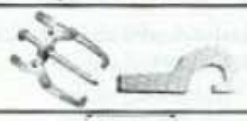
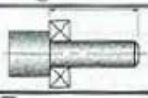
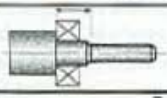
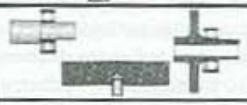
- Designing for ease of disassembly, to enable the removal of parts without damage.
- Designing for ease of purifying, to ensure that the purifying process does not damage the environment.
- Designing for ease of testing and classifying, to make it clear as to the condition of parts which can be reused and to enable easy classification of parts through proper markings.
- Designing for ease of reconditioning, this supports the reprocessing of parts by providing additional material as well as gripping and adjusting features.
- Designing for ease of re-assembly, to provide easy assembly for reconditioned and new parts.

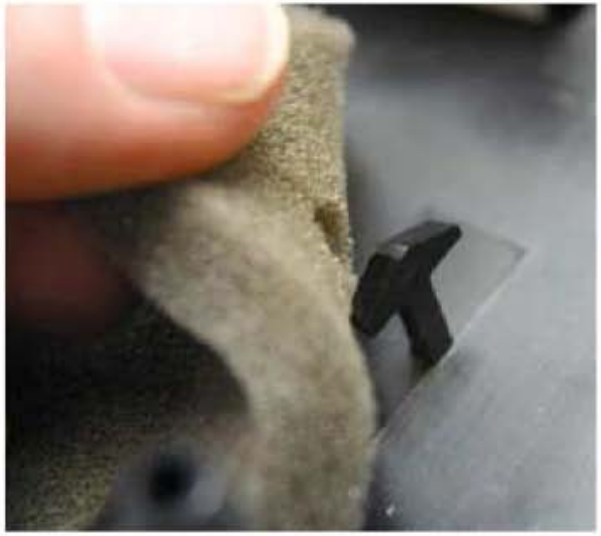
Three categories which are related to the three important areas of disassembly and recycling, these are:

- Materials, enabling the disassembled materials to be easily recycled but the principles can apply equally to disassembled parts for Re-manufacture or reuse.
- Fasteners and Connections, enabling easy and quick disassembly.
- Product Structure, enabling rapid and economic disassembly.

as simple as  vs  ?

Joints suitable for Disassembly

Guideline	Don't	Do
Use attachments that are easy to disassemble		
Minimize the number of fasteners		
Use the same fasteners		
Ensure easy access for disassembly		
Use simple standard tools		
Avoid long disassembly paths		
Design for damage free dissassembly		
Use the same tools for assembly and disassembly		
Use one disassembly direction to avoid reorientations		
Design for multiple detachments with one operation		

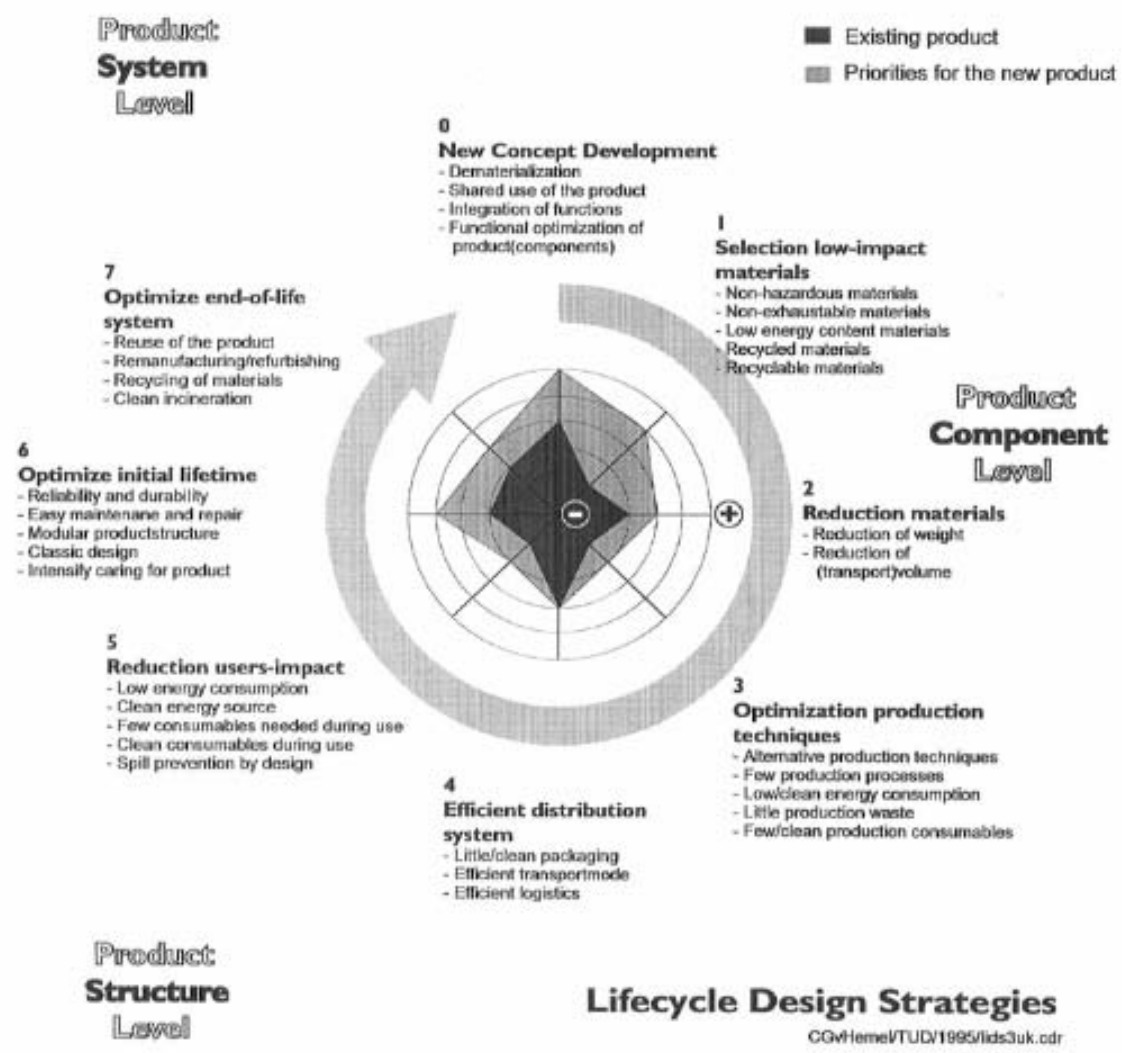


"Design for environment surprisingly coincides very well with design for manufacturability"

- Development engineer at IBM

Source: http://www.moea.state.mn.us/publications/betterbydesign.pdf

lifecycle design strategies



DfD - benefits

Designing for disassembly can have the following benefits:

- Facilitate maintenance and repair, thereby reducing costs.
- Facilitate part/component re-use, thereby recovering materials and reducing costs.
- Assist material recycling, thereby avoiding disposal and handling of waste.
- Assist product testing and failure-mode/end-of-life analysis.
- Facilitate product take-back and extended producer responsibility, thereby reducing liability and assisting in regulatory compliance.

source: http://dfe-sce.nrc-cnrc.gc.ca/dfestra/dfestra7/dfestra7_2_e.html

DfD – attempt to…

Factors, such as the life span of parts/components, their standardization, maintenance requirements, and instructions for servicing and re-assembly, play a major role in designing for disassembly. In general, designers should attempt to:

- Use detachable joints such as snap, screw or bayonet instead of welded, glued or soldered connections.
- Use standardized joints so that the product can be dismantled with a few universal tools, e.g., one type and size of screw.
- Position joints so that the product does not need to be turned or moved for dismantling.
- Indicate on the product how it should be opened non-destructively, e.g., where and how to apply leverage with a screwdriver to open snap connections.
- Put parts that are likely to wear out at the same time in close proximity so they can be easily replaced simultaneously.
- Indicate on the product which parts must be cleaned or maintained in a specific way, e.g., colour-coded lubricating points.

DfD- evaluate ease of disassembly

Evaluate the ease of disassembly. Consider assigning a weighting and scoring system to the list. *(based upon an industrial model – adapt to architecture…)*

What are the bonding and fastening methods of parts and components?

- insert moulding
- cohesion
- adhesion
- mechanical fastening
- friction fitting

What are the additional operations required for disassembly?

- fracturing
- drilling
- ungluing
- heating
- lubricating

What are the tools required for disassembly?

- special tool
- simple tool
- by hand

What is the tool motion required for disassembly?

- complex
- turning
- straight line

What is the level of difficulty for disassembly?

- technician needed
- assistant needed
- deformation required
- hold-down required
- heavy
- small
- resistant
- difficult access
- difficult to grasp
- difficult to view

What are the hazards during disassembly?

- •chemical
- •electrical
- •sharp edges/corners

Where are the instructions for disassembly?

- •provided integrally
- •provided separately

Table I DFD design rules

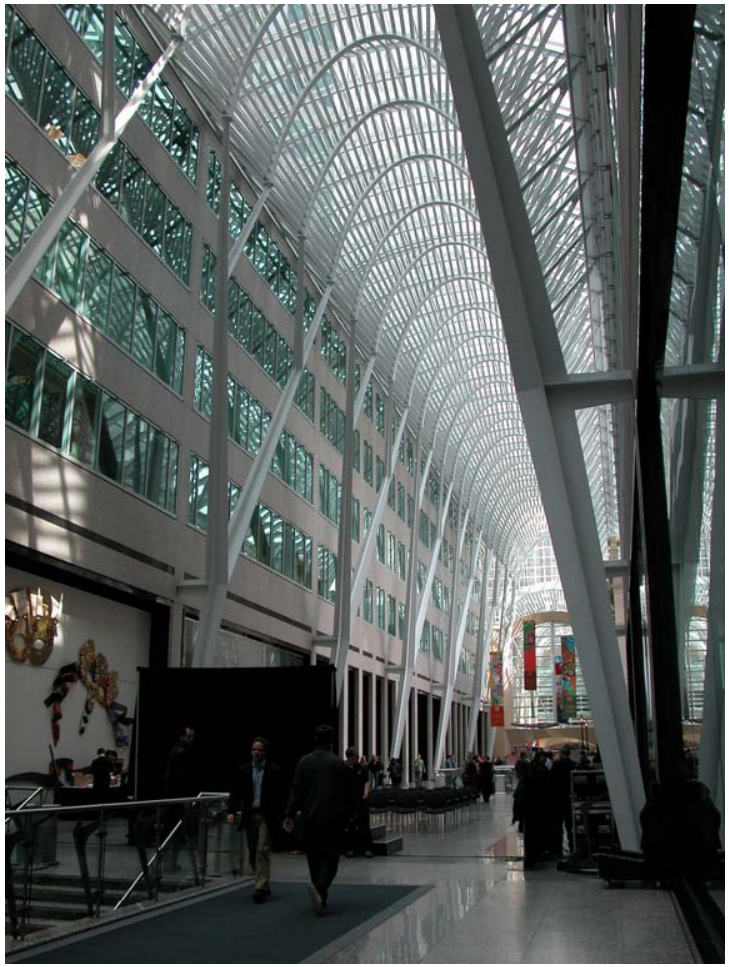
Factors affecting the disassembly process	Guides to improve disassembly
Product structure	Create a modular design
	Minimise the component count
	Optimise component standardisation
	Minimise product variants
Materials	Minimise the use of different materials
	Use recyclable materials
	Eliminate toxic or hazardous materials
Fasteners, joints and connections	Minimise the number of joints and connections
	Make joints visible and accessible, eliminate hidden joints
	Use joints that are easy to disassemble
	Mark non-obvious joints
	Use fasteners rather than adhesives
Characteristics of components for disassembly	Good accessibility
	Low weight
	Robust, minimise fragile parts
	Non hazardous
	Preferably unpainted
Disassembly conditions	Design for automated disassembly
	Eliminate the need for specialised disassembly procedures
	DFD with simple and standard tools

disassembling architecture

Utah School of Architecture – reinforced concrete

?

Is one of these inherently easier or better to disassemble?



BCE Place – structural steel

The sheet steel industry is proactively promoting their product as being simpler to reuse | recycle than the alternate – wood frame.

And although this steel framed building might be easy to disassemble and reuse…

It won’t be when it is destined to be sprayed with “Shot-crete”…

Even though precast concrete systems might be easy to *assemble*, careful examination is required to see if their disassembled parts are easily reused, retooled or recycled/upcycled.

disassemble a typical wood frame house

The typical 2 x 6 wood frame wall as a building enclosure type fulfills the functions of a building enclosure in the following way:

1. Support function provided by 2 x 6 wood members nailed together.
2. Thermal control function provided by fiberglass batt insulation fit into cavities of odd sizes.
3. Air intrusion control provided by plywood sheathing nailed 8” o.c. to framing.
4. Water intrusion control provided by an exterior facing that is built up of many small individual pieces (siding), all nailed to the sheathing.
5. Finish function (on interior) provided by gypsum board that has all the fasteners covered and easily breaks with handling.
6. Distribution function provided within wall cavity, totally inaccessible.

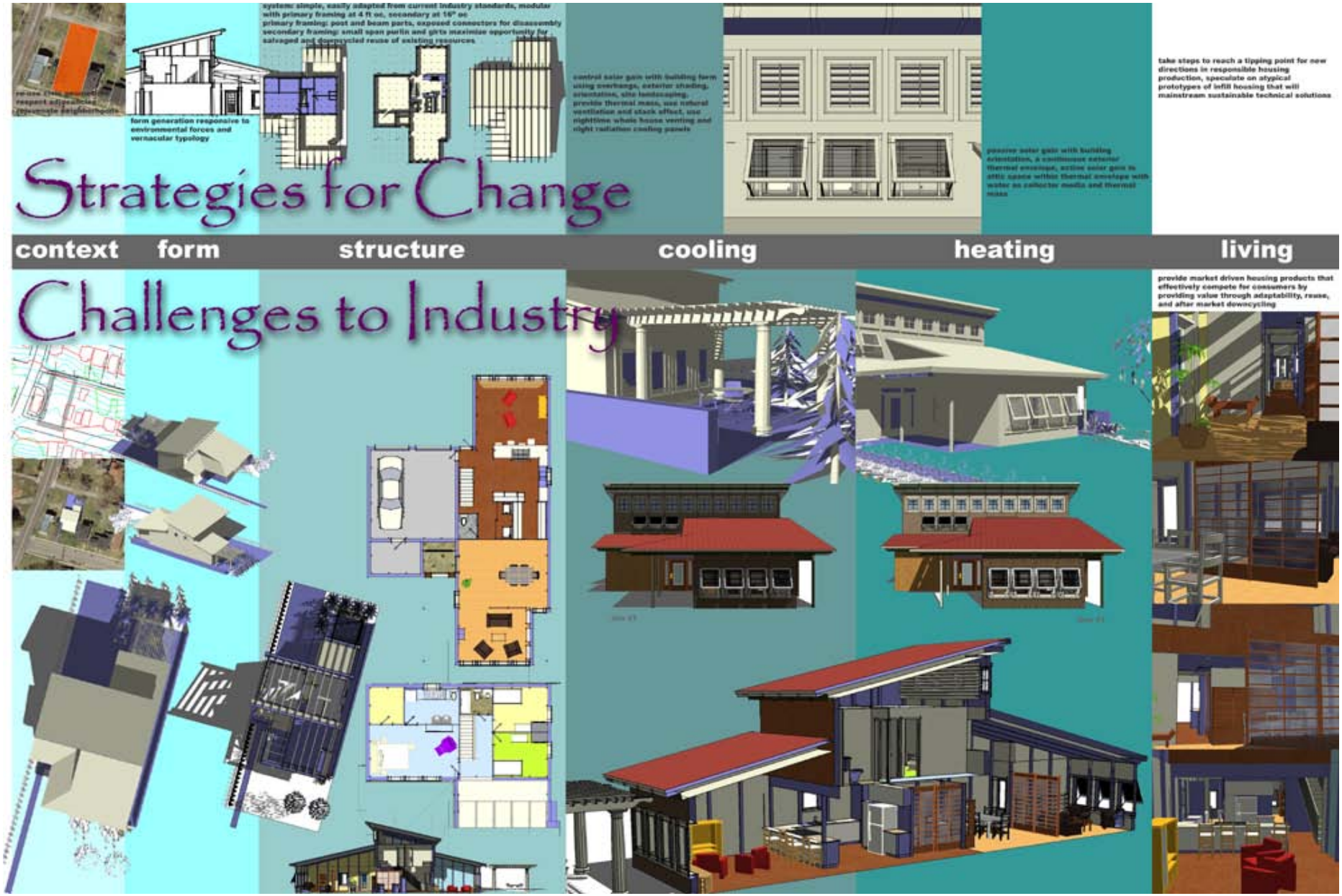
All of the components assembled to fulfill the building enclosure function are fastened together. They are fastened in such a way, assembled in such a way, that disassembly is not practical. The end result is no re-use, just “waste”.

Excerpted from essay by James Arvai

disassemble a c2c wood frame house

1. Support function provided by hybrid “post and beam” 4 ft. o.c. wood frame with exposed standardized metal connectors.
2. Thermal control function provided by an insulating panel (4 ft. wide) that is placed exterior to the frame with removable fasteners.
3. Air intrusion control function provided by a wood sub-framing of salvaged (re-molded or down cycled) wood framing (a 2 x 2 will span the 4 feet) covered with a 4 ft. wide sheathing.
4. Water intrusion control function provided by 4 ft. wide panelized facings of various materials with gasketed joints.
5. The finish function (on interior) provided by leaving the wall assembly exposed in most cases (wood post and beam framing is an enhancement in our current housing market).
6. Distribution function provided outside and independent of wall assembly. This would facilitate repairs and modifications to the key components of a house that are currently the most repaired and modified components in our current housing market.

The whole assembly could be easily disassembled, the material re-used.


Strategies for Change
context
form
structure
cooling
heating
living
Challenges to Industry

housing…

Prefabricated housing for disassembly is already being done in China. Can we not do better than this????

… the foldable house…

The house is made up of roof, floor and fronton frameworks. The frontons on both sides can be folded and it is easy to transport or preserve. The houses can be connected or combined into two floors, with flexible room layout according to environments and practical needs.

www.cdph.com.cn

This house in Atlanta, Georgia, funded by the EPa was successfully “designed for disassembly”

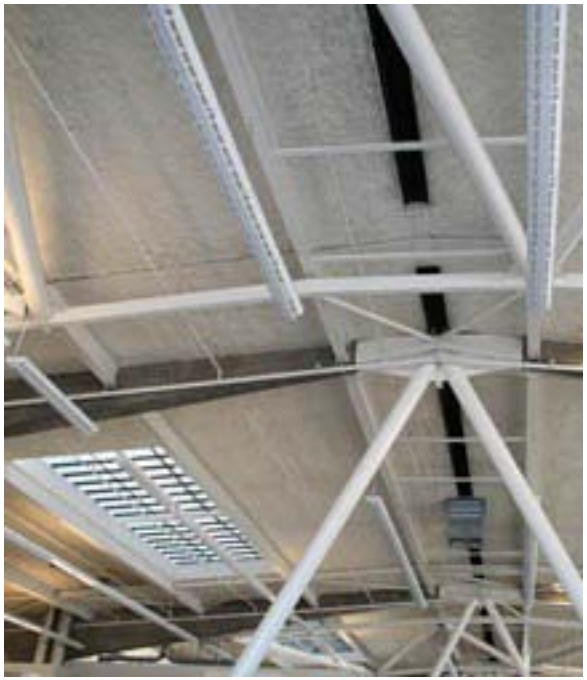
The home's DfD features include structural insulated panel (SIP) walls, which can be made from agricultural fiber such as wheat straw, providing a renewable framing and insulating alternative to foam core. Interior wall panels are framed by light-gauge metal, allowing them to be repositioned, reused, or combined. In addition, wall-to-wall bamboo flooring was installed before the walls, which means floors don't need to be re-patched when walls are moved. Furthermore, bamboo is not only less expensive and more resilient than typical wood flooring, but it also takes only a few years to reach maturity.

source: http://www.epa.gov/osw/inforesources/news/2006news/07-dfd.htm

Design for Building Disassembly
State College, PA; Atlanta, GA; Monterey, CA (2004-2005)

Project Team: Brad Guy, Nicholas Ciarimboli, Cecilia Da Rocha

Partners: Community Housing Resource Center, Pinnacle Custom Builders, US EPA Region IX, US EPA **Region IV, Chartwell School, EHDD Architecture**, Resource Venture, Inc., King County, WA



The ultimate goal of this initiative is extending a building's life beyond its original use; the construction of future buildings from renewable, reused and re-useable materials; and the ready means to recover materials at all stages of a building's life. Taking form in a series of design for disassembly case studies, theoretical designs, and guidebooks, we are exploring the precedents, techniques, details, implementation, and education of the architecture community for the creation of buildings designed to minimize the materials-use impacts over the entire life-cycle of buildings.

factor 10 house

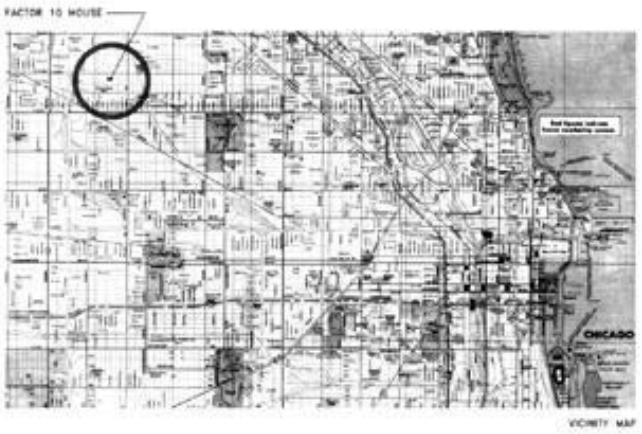
source: hopes.uoregon.edu/system/files?file=design_for_deconstruction.pdf

Overview
Location: Chicago, IL
Building type(s): Single-family residential
New construction:
1,830 sq. feet (170 sq. meters)
Project scope: 2-story building
Urban setting
Completed August 2003

F10's design is a straightforward response to four primary considerations: a narrow City site with adjacent buildings, a a modular design, an open 1,234-ft2 floor plan plus a 605-ft2 conditioned, unfinished basement, and a solar chimney incorporated into the stairwell.

Factor 10 House

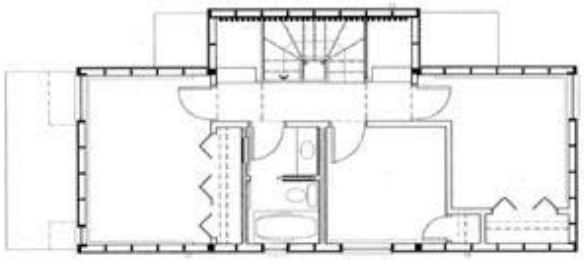
source: http://www.eere.energy.gov/buildings/database/site.cfm?ProjectID=271



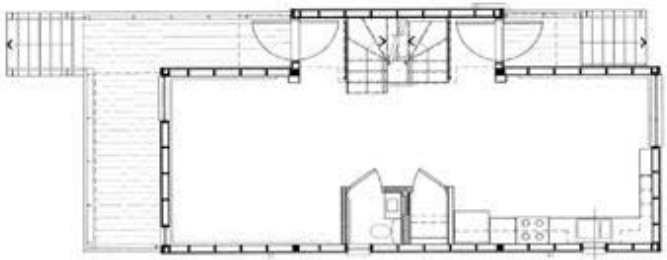
F10 strives to reduce life-cycle environmental impacts by a factor of 10 compared to the average home built in America today.

Esherick Homsey Dodge & Davis Architects
Chicago, IL
http://ehdd.com

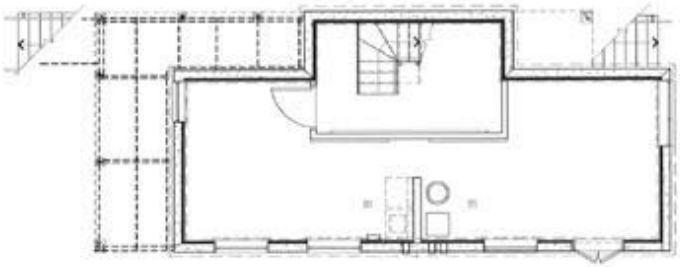
Factor 10 House



SECOND FLOOR PLAN



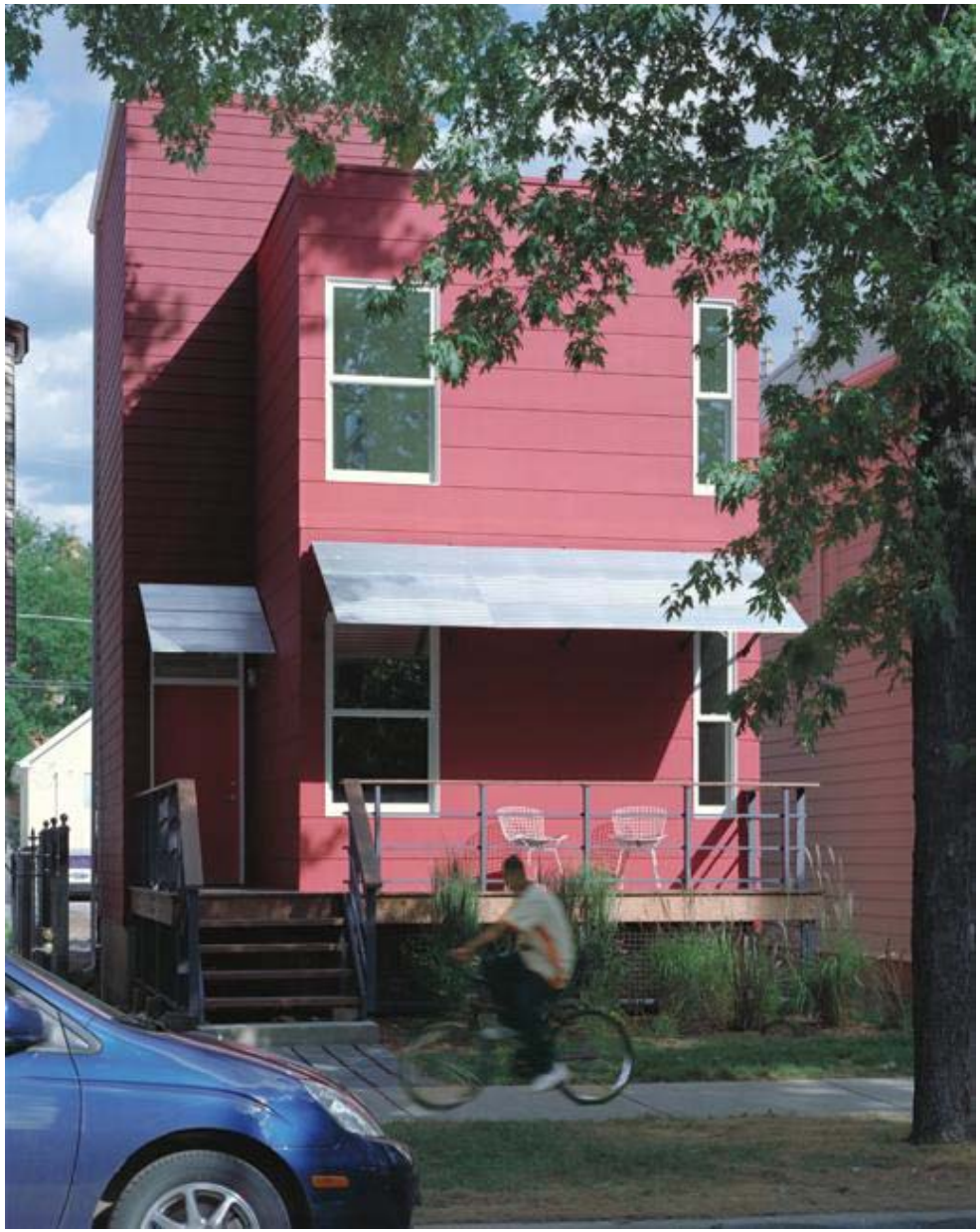
FIRST FLOOR PLAN



BASEMENT PLAN

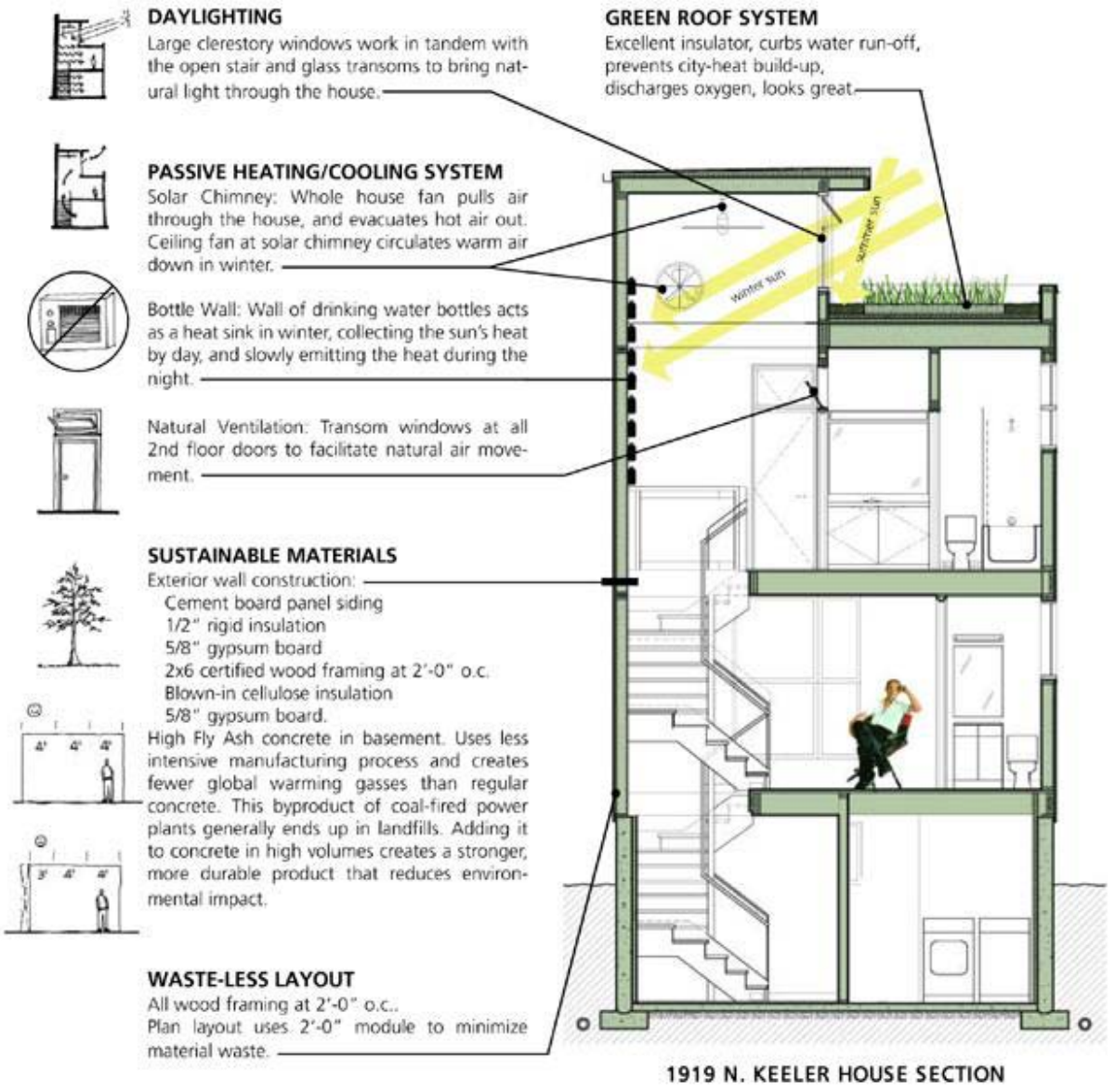
The modular design works within industry's dimensional constraints, minimizing waste and allowing off-site assembly. The open floor plan enhances cross ventilation, and the window placement maximizes reflected light into the interior of the home while reducing glare.

Factor 10 House



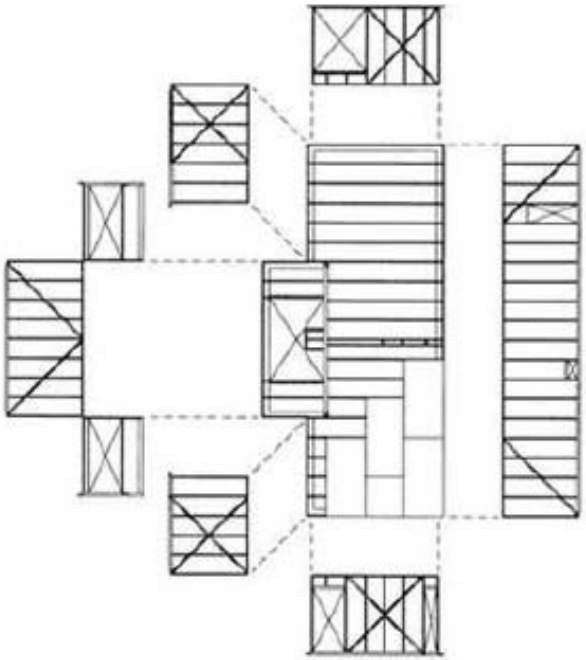
The 125’ x 25’ lot is oriented east-west. It includes a rear alley and is surrounded by single-family, detached residential buildings. F10 should be socially and visually integrated into the community. F10 is intentionally small to allow for future growth on the lot and to keep the building’s site coverage low. All setbacks were within zoning guidelines; the front setback was consistent with other homes on the street. F10 was raised 4’ above grade with a basement in order to raise the porch and steps to fit in with the other houses and foster community interaction on the street. F10’s form and mass are consistent with neighboring dwellings.

Factor 10 House

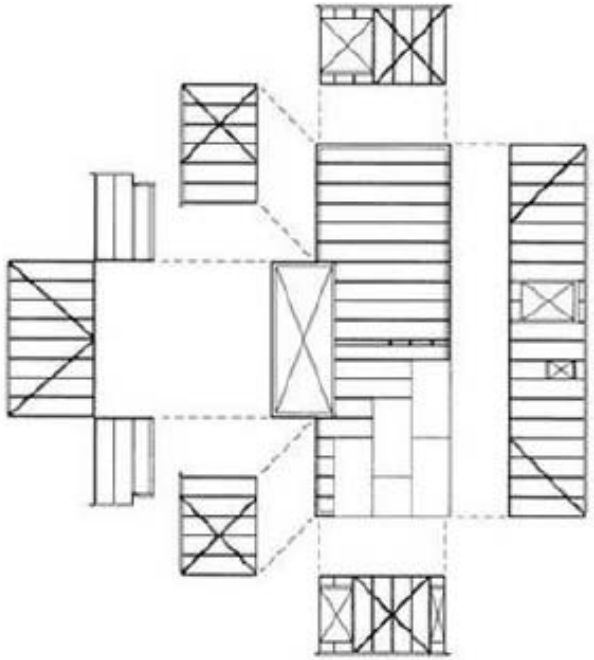


1919 N. KEELER HOUSE SECTION

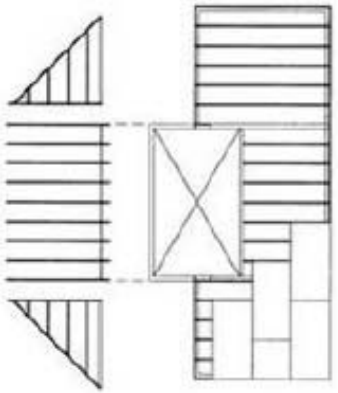
Factor 10 House



1 framing



2 framing



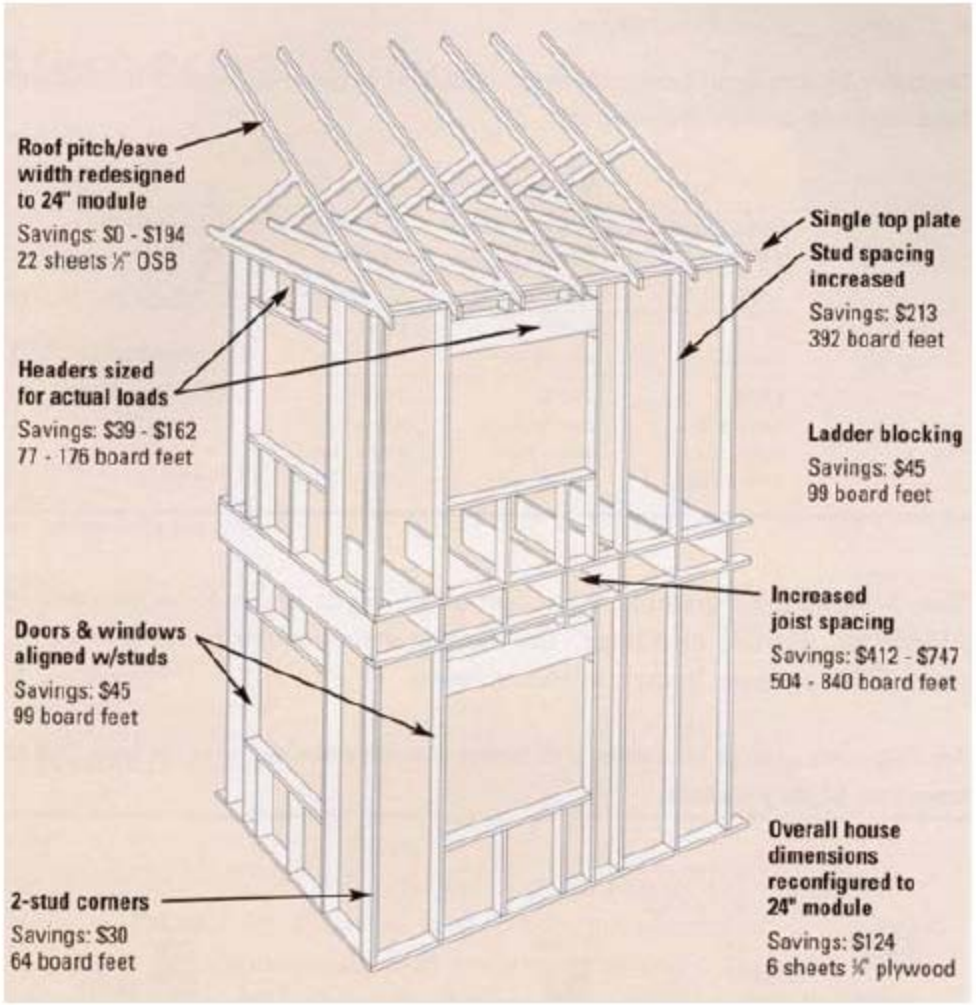
3 framing

F10 HOUSE | CHICAGO, ILLINOIS

EHDD ARCHITECTURE

Factor 10 House

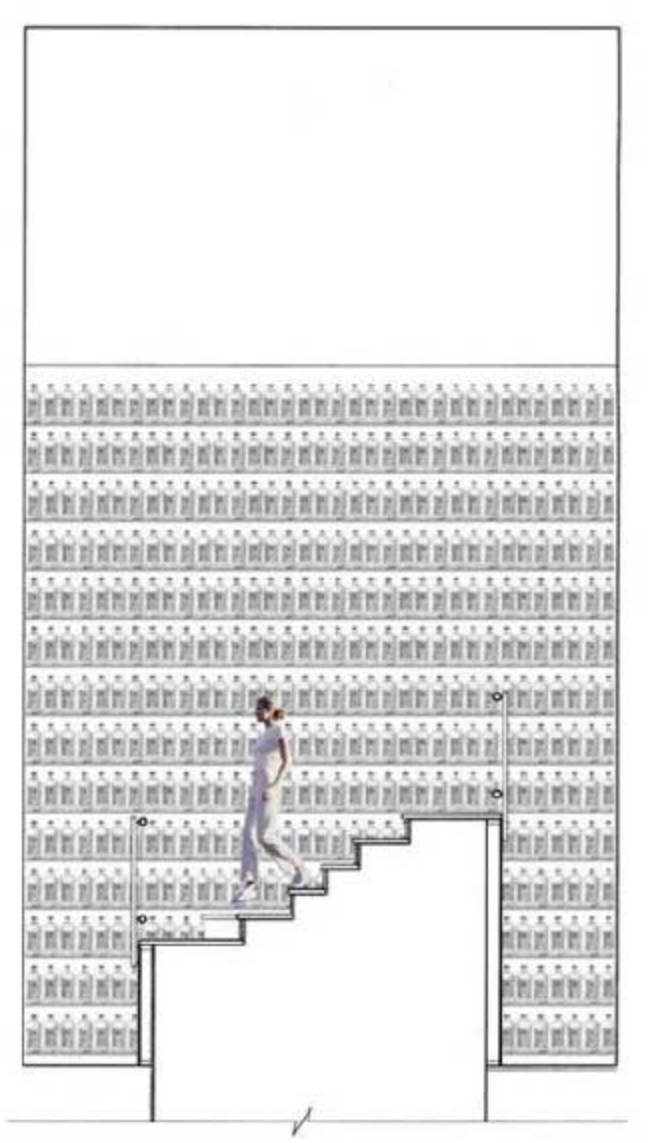
Efficient Wood Use in Residential Construction, NRDC, Edminster

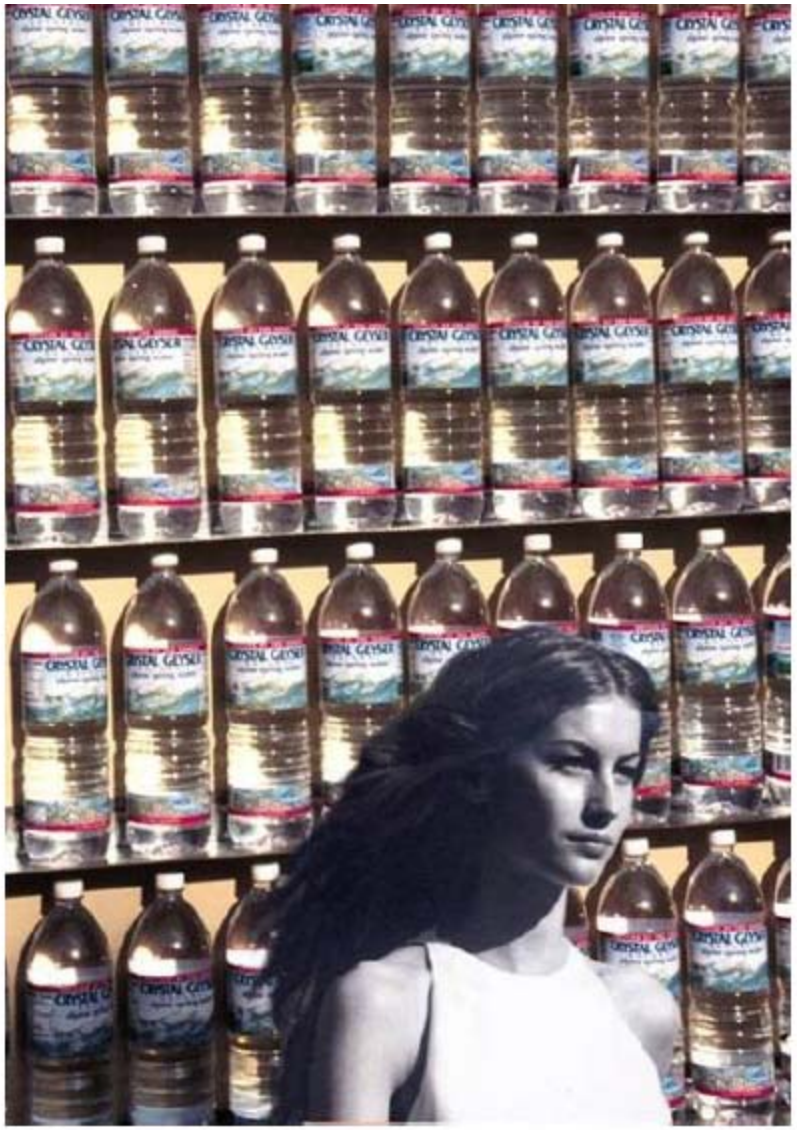


F10 HOUSE | CHICAGO, ILLINOIS

EHDD ARCHITECTURE

Factor 10 House





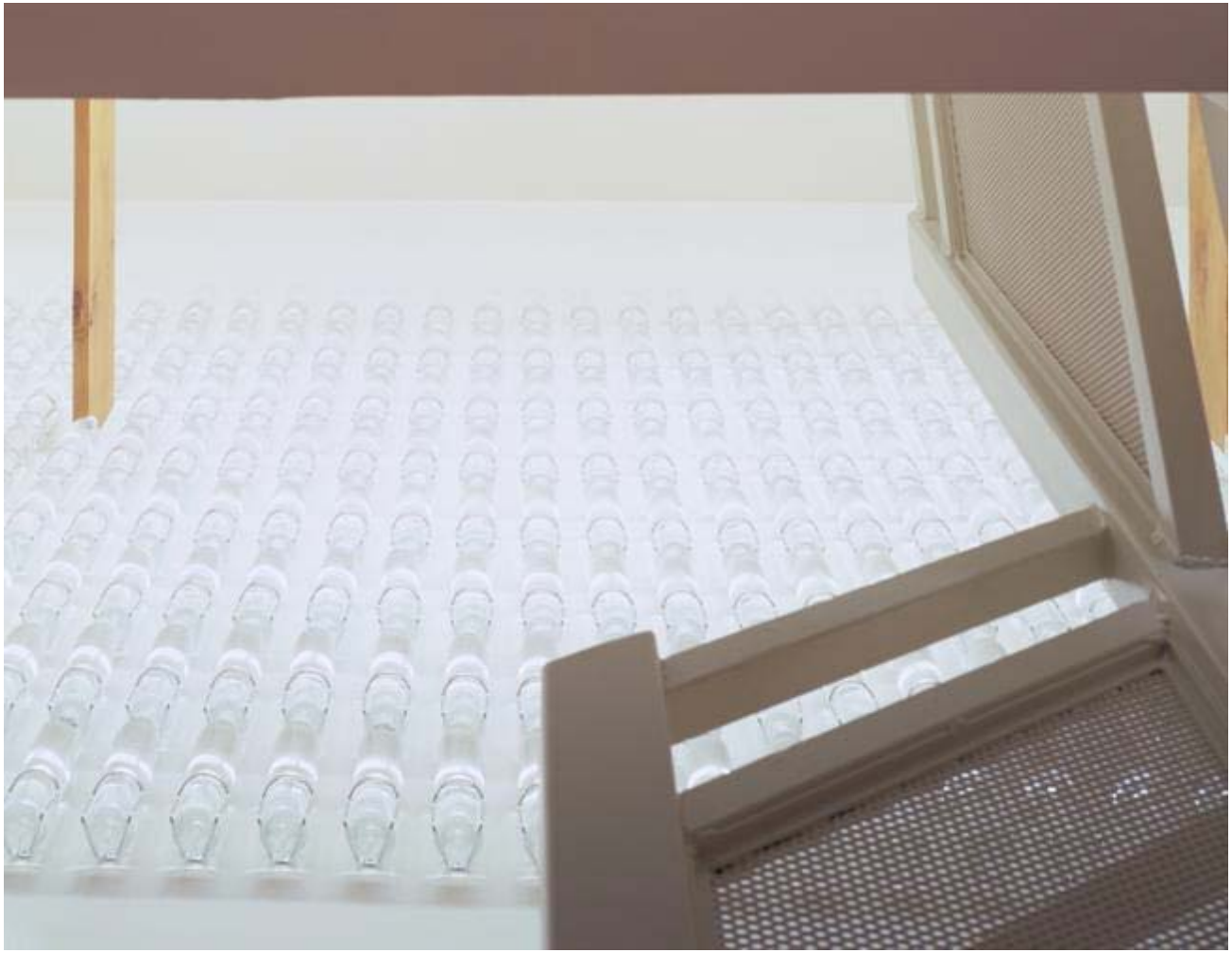
F10 HOUSE | CHICAGO, ILLINOIS

EHDD ARCHITECTURE

Factor 10 House

Also paramount to F10 was the minimization of stormwater runoff. The area of the lower roof (400 ft2) is planted with sedum, which retains stormwater and absorbs heat.

Factor 10 House



The wall of water bottles, shown here (looking up), acts as a heat sink in the solar chimney. Augmented by a whole-house fan, the shaft will pull warm air up and out of the house in the summer, and push warm air down in the winter.

Factor 10 House

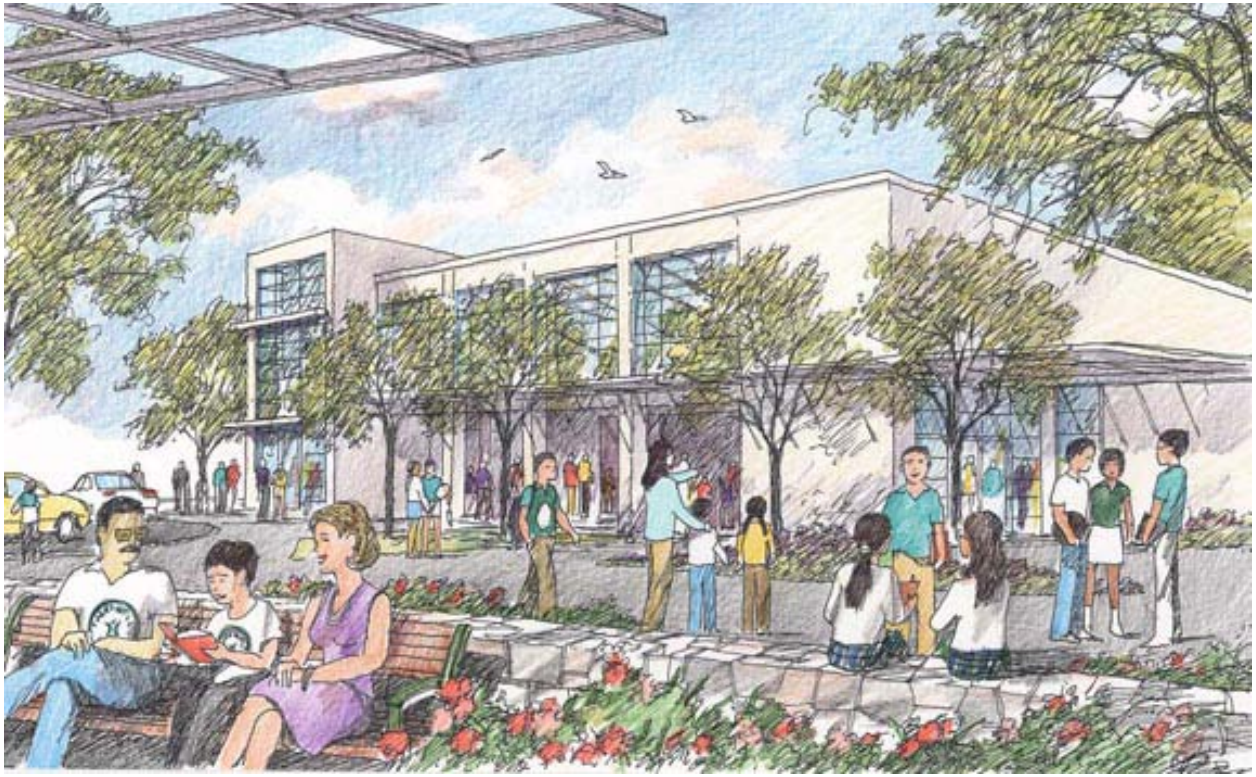
Energy

F10's building envelope is super-insulated to handle the severe Chicago climate. It utilizes a vertical shaft with south-facing operable clerestory glazing to reduce primary energy consumption. The solar chimney brings light into the center of the house and supplements the daylighting. The chimney also collects heat in its upper strata in the winter for distribution throughout the house. In addition, a wall of water bottles on the north wall (facing south) acts as a heat sink, storing a small amount of heat to be given off later in the evening when ambient temperatures begin to drop.

Factor 10 House

chartwell school

source: hopes.uoregon.edu/system/files?file=design_for_deconstruction.pdf



DfD Project:

Hamer Centre +
EHDD Architecture

The Hamer Center is engaged with local governments, housing agencies, environmental organizations, and architects in an international initiative to develop principles and practices of “Design for Building Disassembly” (DfD). This initiative includes discussions with Canadian counterparts to make design for building disassembly part of mainstream architectural practice. Building DfD is design that uses methods and materials of design and construction to allow buildings to be flexible, adaptable and dismantleable at all stages of their lives. This includes formal design, and design processes, and also re-examining materials selection and connection details in light of facilitating materials recovery and continued life of the materials.

source: http://www.hamercenter.psu.edu/gallery/project_3_index.htm

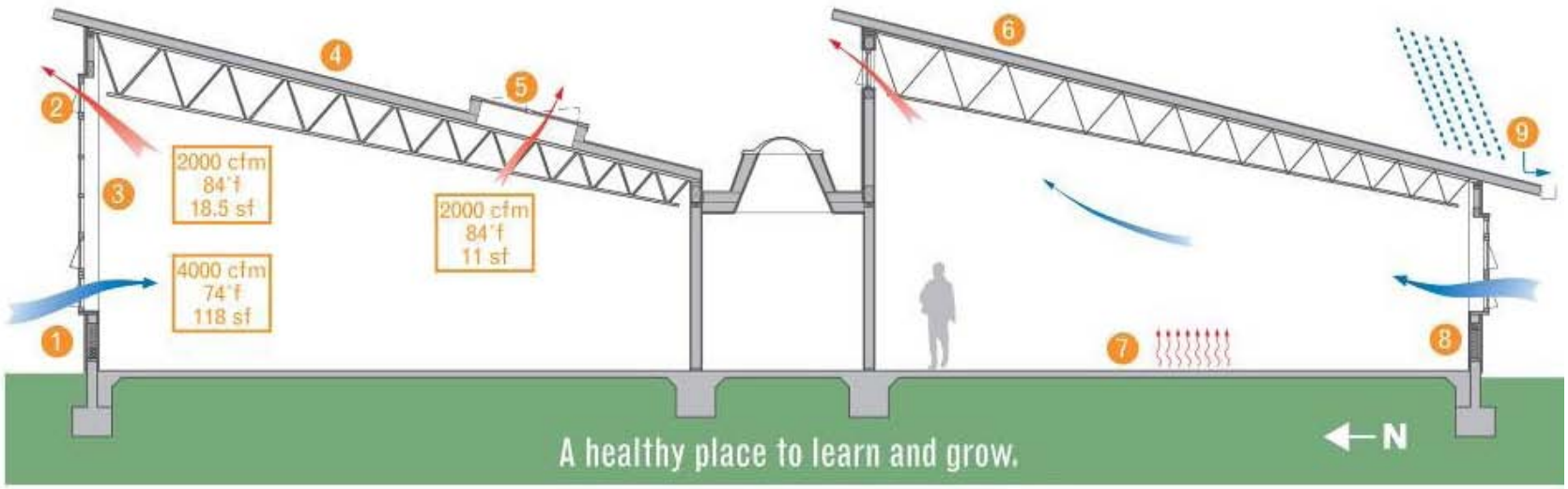
Chartwell School

Chartwell School

Chartwell School Site Plan

EHDD ARCHITECTURE

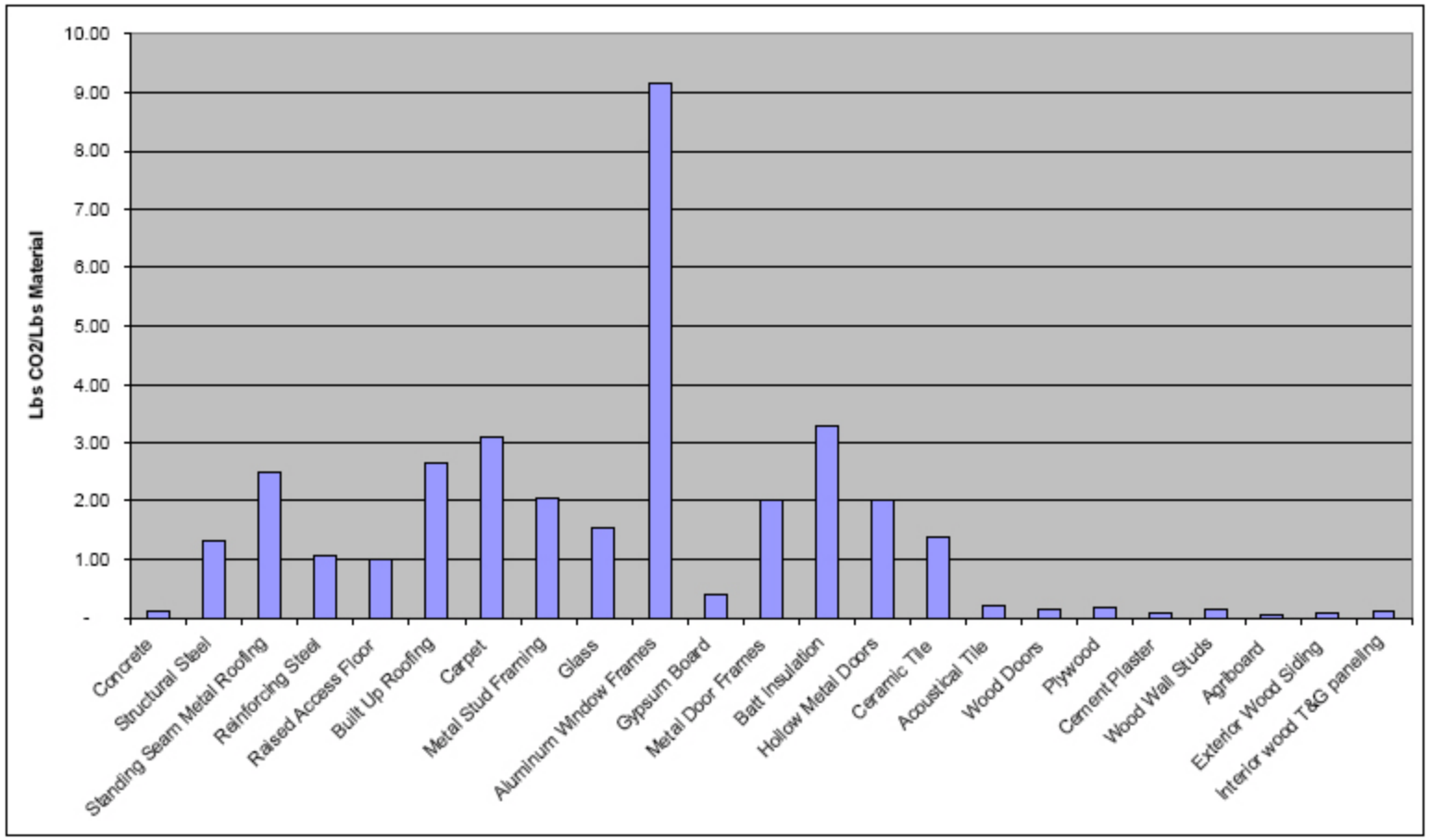
Chartwell School



Classroom Framing Section

EHDD ARCHITECTURE

Chartwell School

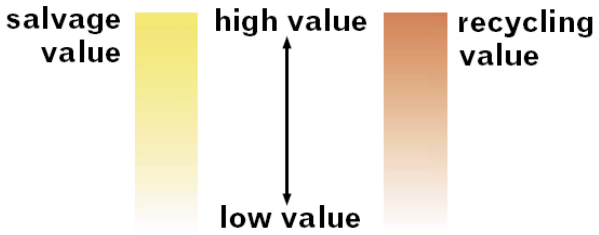


Materials Embodied Carbon Emissions

EHDD ARCHITECTURE

Chartwell School

Design for Recovery:



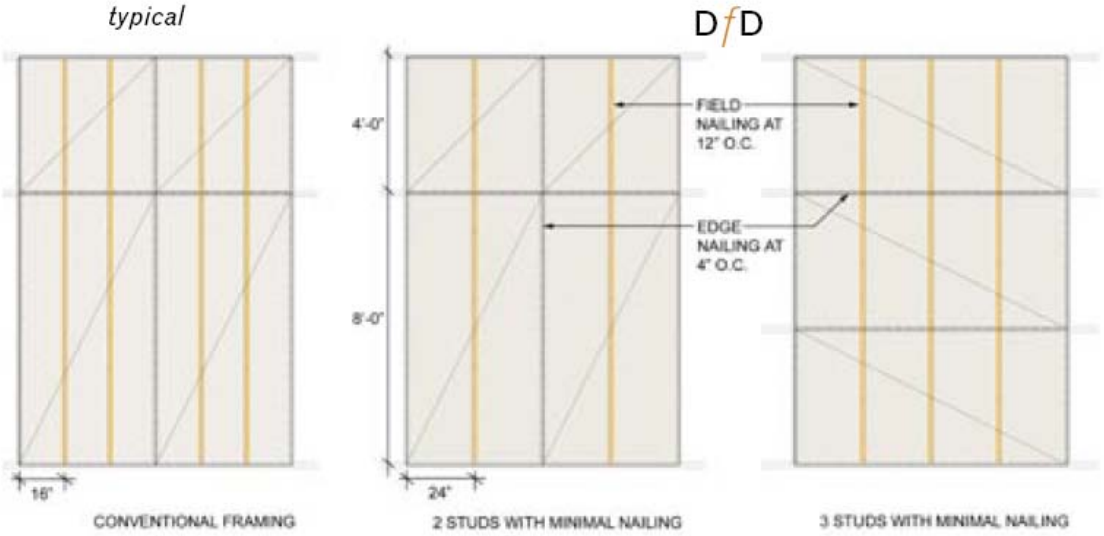
SPEC SECTION	COMPONENT	EXPECTED LIFESPAN *	EASE OF RECOVERY AS DETAILED	SALVAGE OR RECYCLING?	VALUE AFTER RECOVERY	QUANTITY OF MATERIALS	WEIGHT PER UNIT	ACTUAL WEIGHT OF MATERIALS	EMBODIED CO_2/TON PER UNIT	TOTAL EMBODIED CO_2	SALVAGED MATERIALS AVAILABLE?
3300	Concrete Slab on Grade	100	easy	recycling	low	538 cy	2.025 tons/cy	1085 tons	0.15	163 tons	yes (aggregate and fly ash)
3320	Concrete Site Paving	50	medium	salvage	low	413 cy	2.025 tons/ cy	836 tons	0.15	125 tons	yes (aggregate and fly ash)
5100	Reinforcing Steel	100	easy	recycling	medium	28,443 lf	.88 lbs/ sf of concrete	9.5 tons	1.05	10 tons	no
6120	Agriboard	100	easy	salvage	medium	16372 sf	13 lbs/sf (8" panel)	106 tons	0 **	0	no
6170	Wood - Wall Studs	100	medium	salvage	medium	21,000 LF (or Board Feet)	27 pcf (Fir)	23.6 tons	0	0	yes
6200	Exterior Wood Siding	50	easy	salvage	high	2900 board feet or 241.5 cf	26 pcf (Redwood)	3.14 tons	0	0	yes
6200	Interior wood T&G paneling	100	easy	salvage	high	1167 board feet = 63.6 cf	26 pcf (redwood)	0.83 tons	0	0	yes
6410	Plywood for Casework	50	medium	salvage	medium	892,069 cu. In	.022 lbs/cu in	9.8 tons	0	0	no
7210	Batt Insulation	50	medium	recycling	low	15,000 sf (wall) 4,500 sf (roof)	.28 psf (R-19)	3.1 tons	1.5	4.7 tons	no
7412	Standing Seam Metal Roofing	25	easy	recycling	medium	11660 sf 8745 lf	2.2 lbs / lf	9.6 tons	1.05	10.1 tons	no
8212	Flush Wood Doors	50	easy	salvage	low	12 doors (3'x7') 252 sf	5.3 lbs/sf	.67 tons	0	0	yes
8800	Glass	50	medium	recycling	low	7870 sf	3.28 psf	12.9 tons	1.3	16.8	no
9220	Cement Plaster	50	hard	NA	NA	9800 sf	12 psf	58.8 tons	0.2	11.8 tons	no
9250	Gypsum Board	50	medium	recycling	low	38,500 sf	2 lbs/sf	38.5 tons	0.2	7.7 tons	no
9300	Ceramic Tile	75	medium	salvage	low	1300 sf	2.5 psf	1.63 tons	1.4	2.3 tons	yes
9648	Bamboo Flooring	50	medium	salvage	high	4,609 sf	2.04 psf	4.7 tons	0	0	no
9688	Sheet Carpet	25	easy	recycling	low	11,896 sf	120 oz/yrd	14.9 tons	3.1	46 tons	no

* assuming adequate maintenance of weather envelope ** wood and other agricultural products sequester carbon

Chartwell School

EFFICIENT FRAMING

Efficient framing design utilizes larger framing members spaced at 24"o.c. instead of 16" o.c. This achieves not only an initial reduction in material use but eases disassembly as well.



Chartwell School

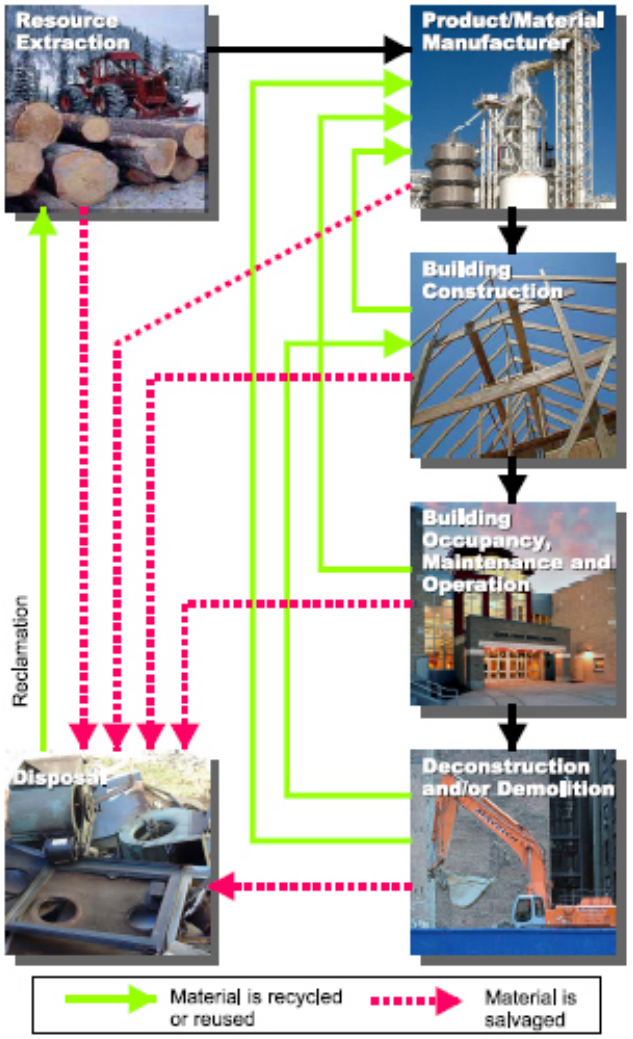
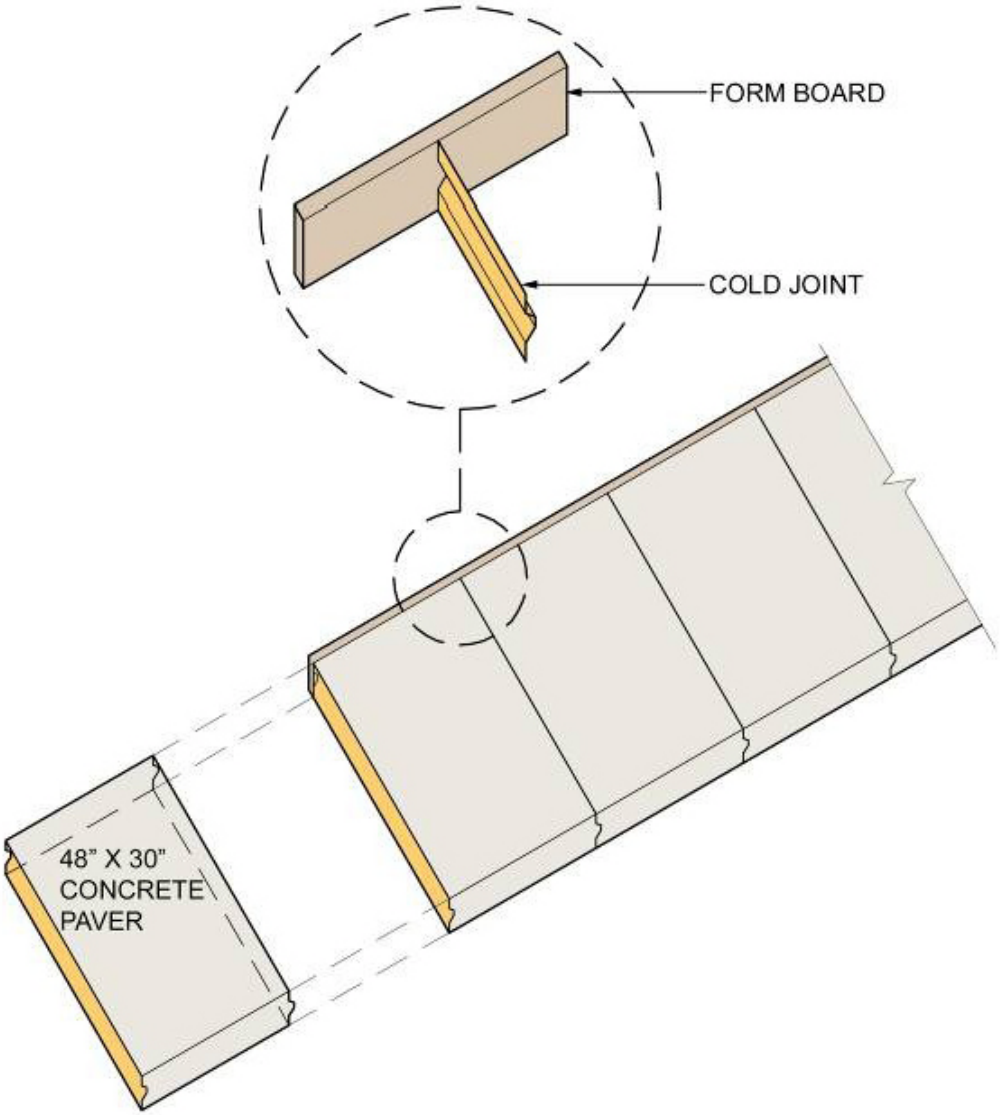


Figure 26 – Life-Cycle of Building Materials

source:
http://www.chps.net/



Concrete Reuse?

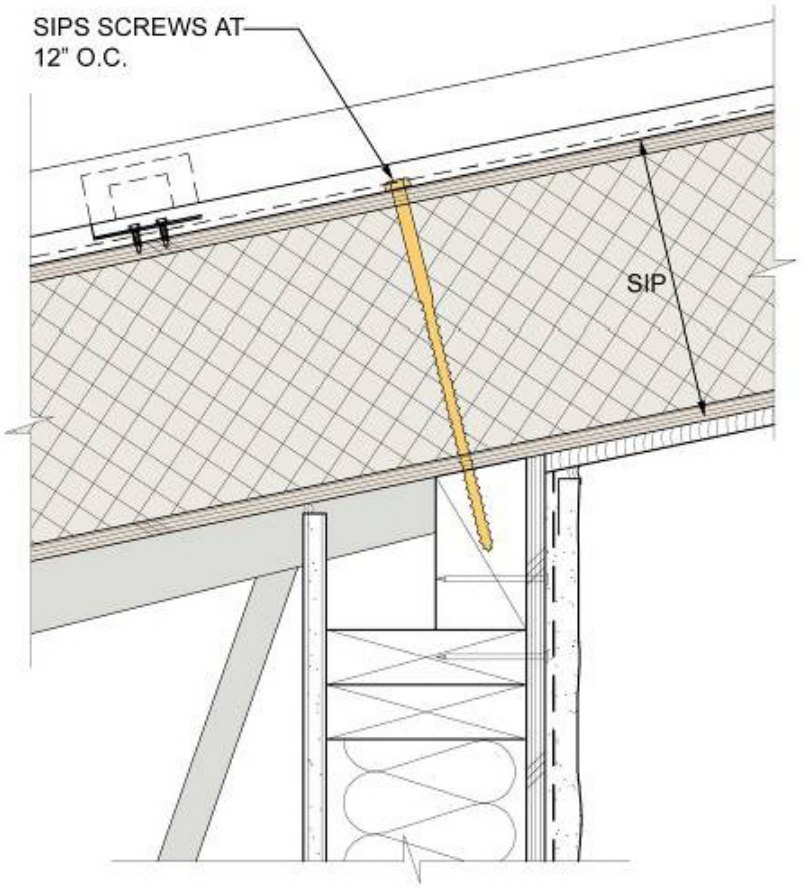
EHDD ARCHITECTURE

Chartwell School

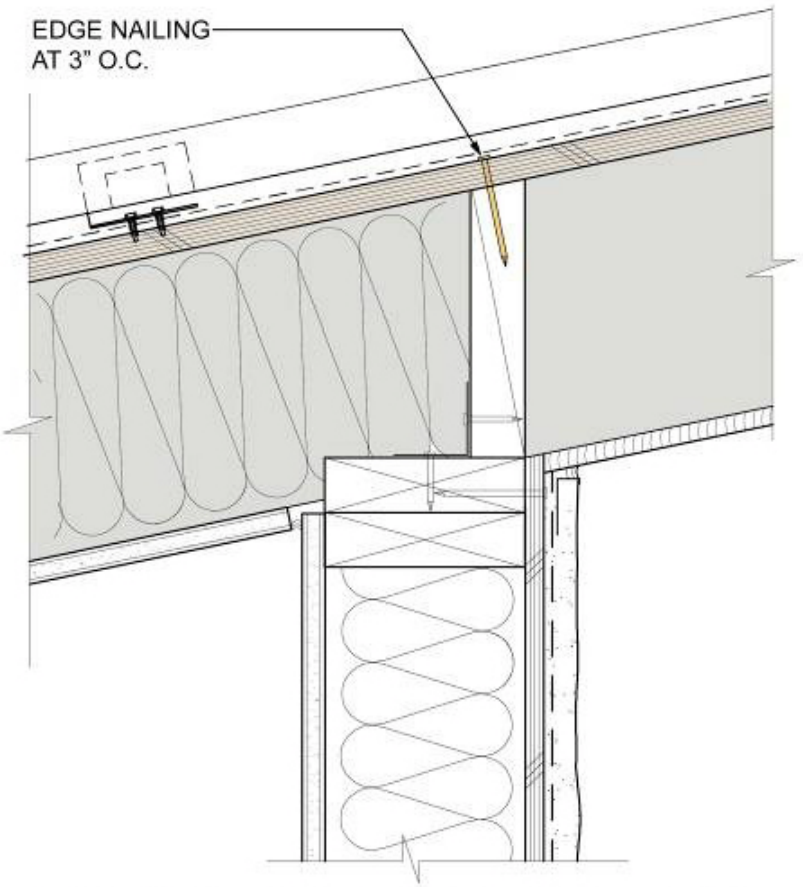
Roof Construction

EHDD ARCHITECTURE

Chartwell School



STRUCTURAL INSULATED PANELS (SIP) W/
SIP SCREWS OVER COMPOSITE TRUSSES

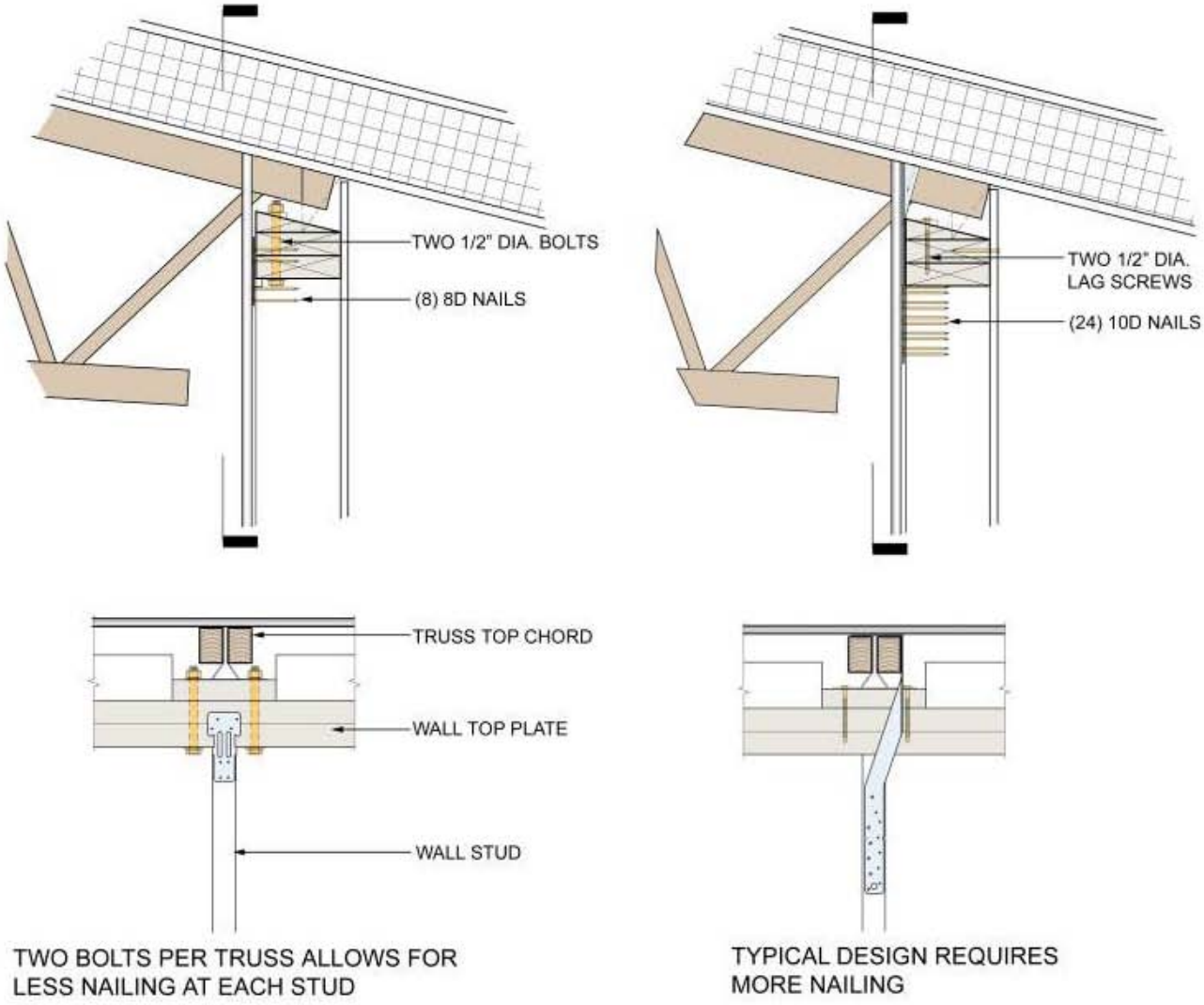


PLYWOOD SHEATHING W/ EDGE NAILS OVER
WOOD JOISTS AND INSULATION

Chartwell School

SIPS Connection

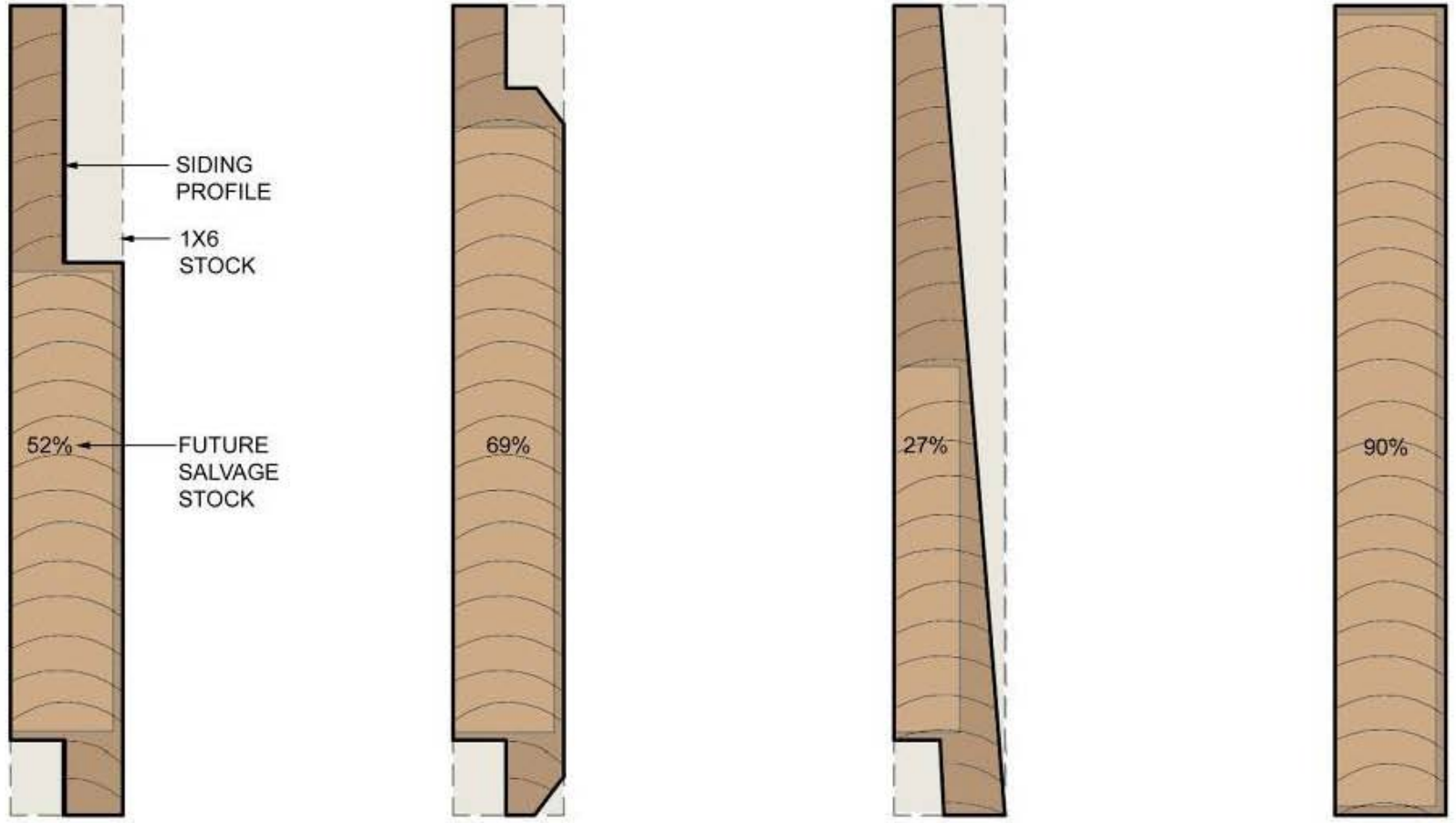
EHDD ARCHITECTURE



Truss Connection

EHDD ARCHITECTURE

Chartwell School

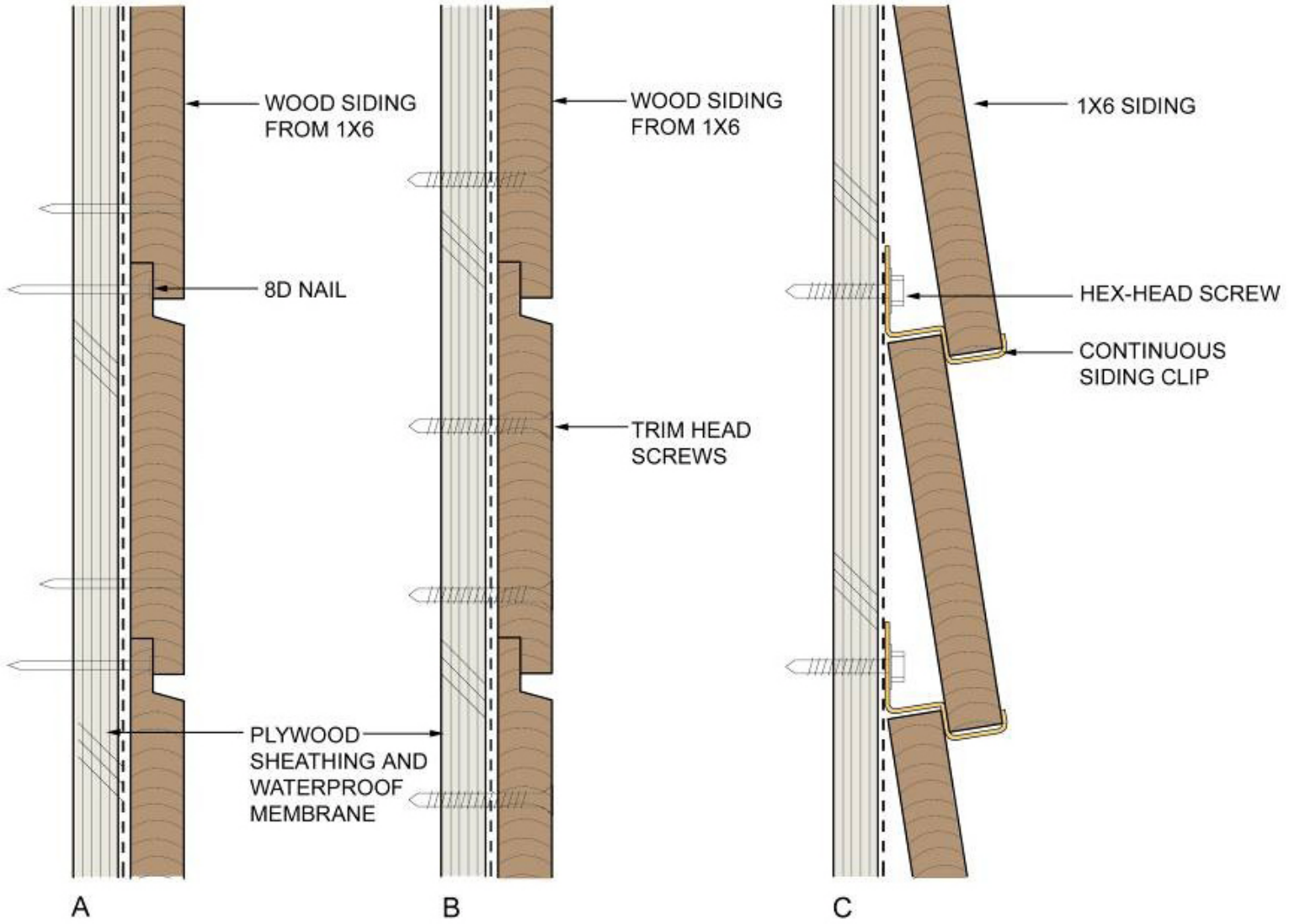


SIDING PROFILES

Efficiency of Various Siding Options

EHDD ARCHITECTURE

Chartwell School



Removable Siding Options

EHDD ARCHITECTURE

Chartwell School

Removable Siding Options

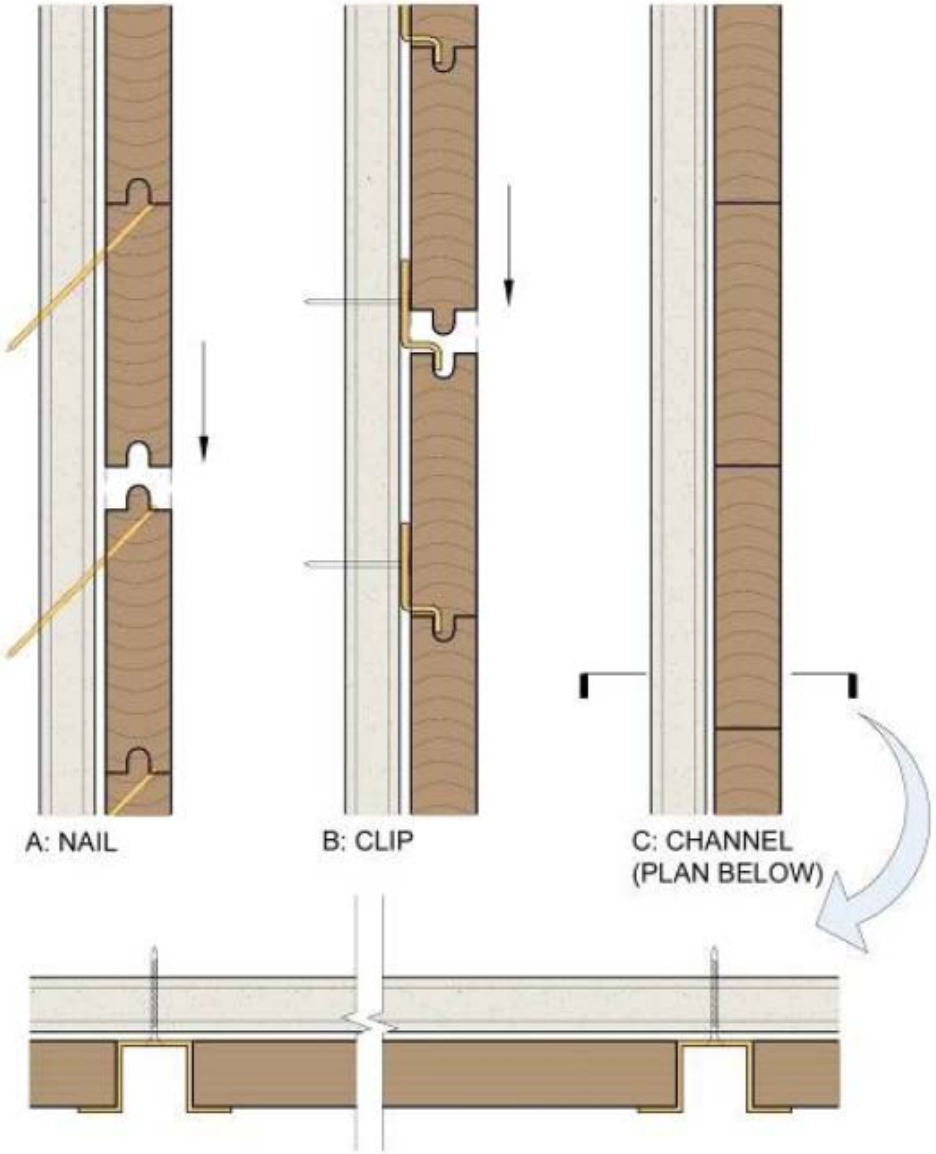
EHDD ARCHITECTURE

Chartwell School

Removable Siding Options

EHDD ARCHITECTURE

Chartwell School



Removable Interior Wood Paneling

EHDD ARCHITECTURE

Chartwell School

Removable Interior Paneling

EHDD ARCHITECTURE

Chartwell School

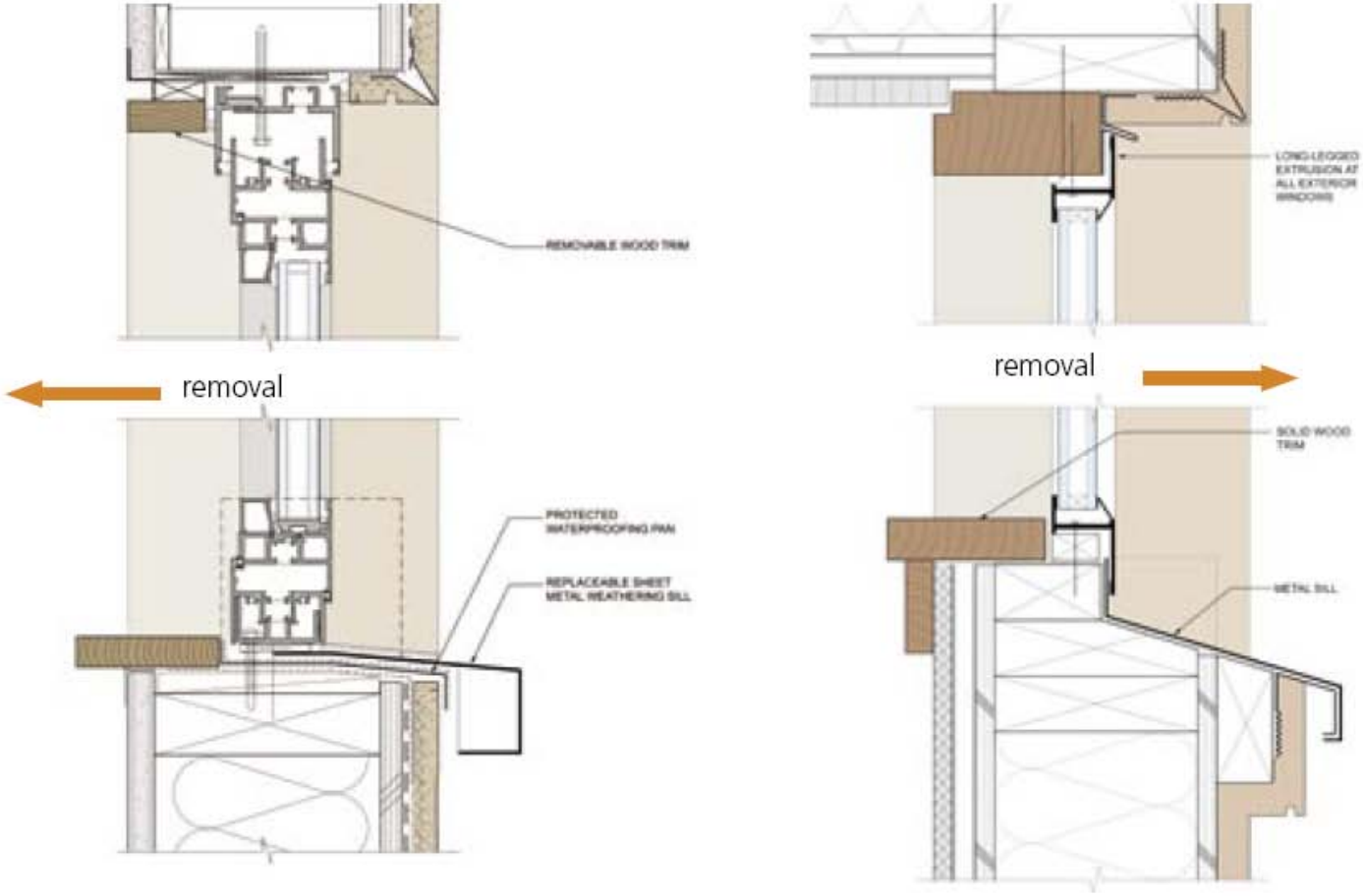
Removable Interior Paneling

EHDD ARCHITECTURE

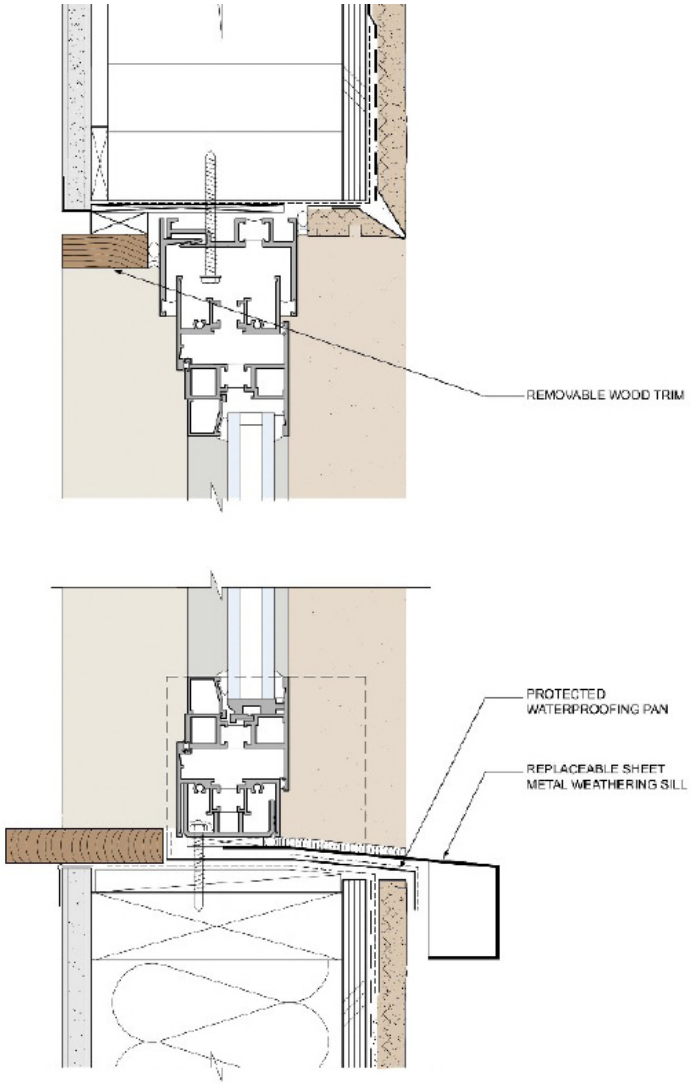
Chartwell School

WINDOW DETAILING

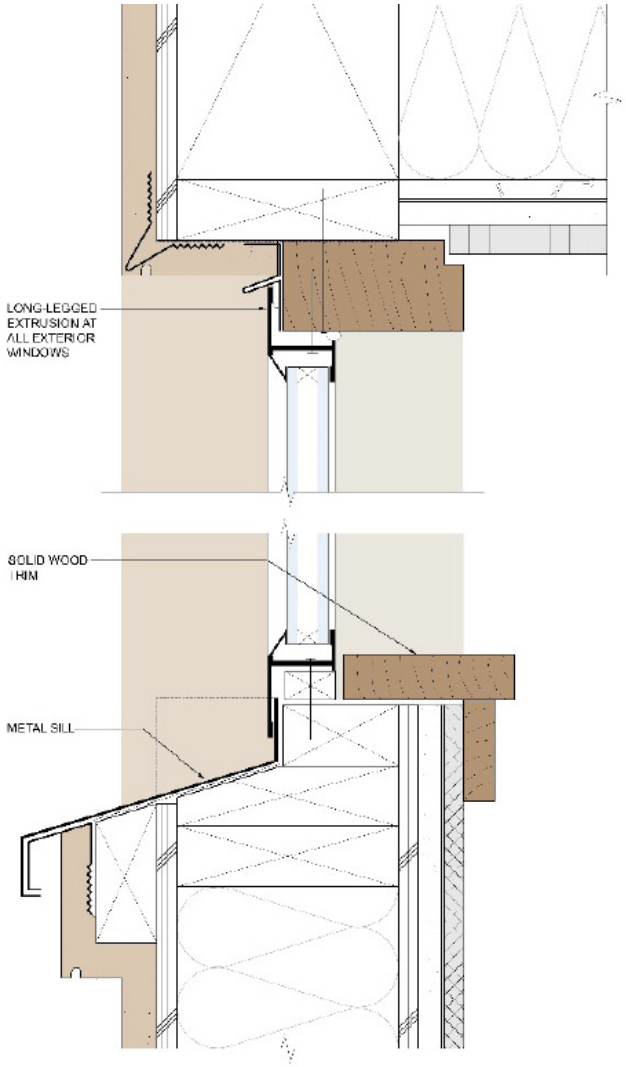
Windows are replaced on average every 25 years. Designing openings so that windows can be removed without damaging exterior cladding or interior finishes will reduce renovation costs and construction waste over time.



Chartwell School



REMOVABLE WINDOW : DETAIL A



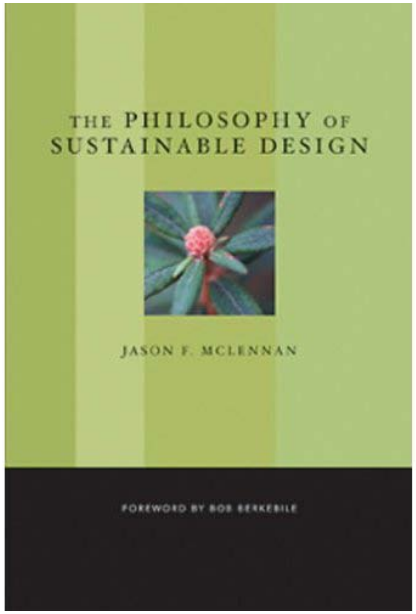
REMOVABLE WINDOW : DETAIL B

Removable Window Details

EHDD ARCHITECTURE

Chartwell School

the philosophy of sustainable design



Jason F. McLennan

“Will we be able to face our children and assure them that we did not lack the courage to face these difficult questions, did not lack the stamina to pursue the correct solutions?”

– Pierre Elliott Trudeau

table of contents

…the philosophy of respect…

…the six governing principles of sustainable design…

respect for the wisdom of natural systems – the biomimicry princple

respect for people – the human vitality principle

respect for place – the ecosystem/bio-region principle

respect for the cycle of life – the “seven generations” principle

respect for energy and natural resources – the conservation and renewable resources principle

respect for process – the holistic thinking principle

respect for the wisdom of natural systems – the biomimicry princple

"For a long time we thought we were better than the living world, and now some of us tend to think that we are worse…but neither perspective is healthy. We have to remember how it feels to have equal standing in the world, to be "between the mountain and the ant…part and parcel of creation.""

- Janine Benyus

respect for people – the human vitality principle

"The biggest tragedy is not the waste of natural resources, though it is tragic. The biggest tragedy is the waste of human resources."

- Oliver Wendell Holmes

respect for place – the ecosystem/bio-region principle

"Can we not create, from a beautiful landscape, an environment inhabited by man in which natural beauty is retained, man housed in community?"

-Ian McHarg
(author of Design with Nature)

respect for the cycle of life – the “seven generations” principle

“Injustice anywhere is a threat to justice everywhere. We are caught in an inescapable network of mutuality – tied to a single garment of destiny – whatever affects one directly affects all indirectly.”

- Martin Luther King

respect for energy and natural resources – the conservation and renewable resources principle

"If we keep going the way we are going, we are going to end up where we are headed."

- Groucho Marx

respect for process – the holistic thinking principle

"Most people are more comfortable with old problems than with new solutions."

- Charles Browe

a philosophy of sustainable design

\+ DfE

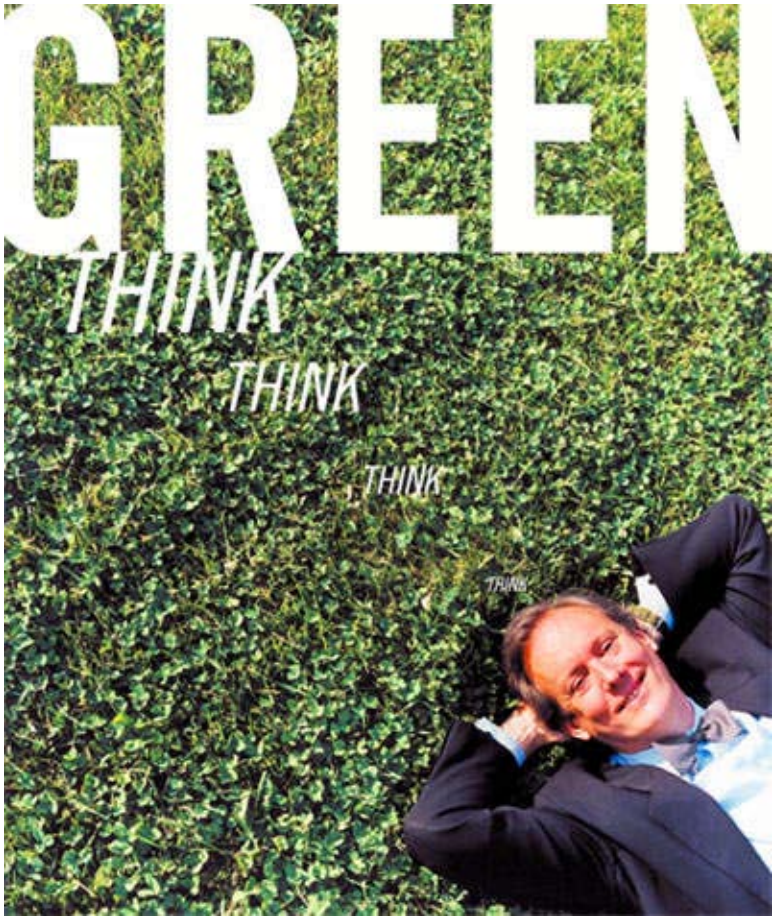
\+ DfD

\+ respect

so …the new design assignment

- Build buildings, that like trees, produce more energy than they consume and purify their own waste water
- Factories that produce effluents that are drinking water
- Products that when their useful life is over do not become waste but can be tossed onto the ground to decompose and become food for plants and animals and nutrients for the soil; or that can return to industrial cycles to provide high quality raw materials for new products
- Billions of dollars of worth of materials that can be accrued for use each year
- Transportation that improves the quality of life while providing service
- A world of abundance, not one of limits, pollution and waste.

- William McDonough


GREEN
THINK
THINK
THINK
THINK