



A design handbook for
interior circular economy

九典 BaF

Produced by:



Research and Innovation

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2020/09



Good idea, good business

The **interior circular economy** design handbook is a tool for any interior designer who wants to know how to start the journey of circular design. We hope it can guide you to a more sustainable practice.



Adjustable shelves that work as space divisions at BaF's office.

WHAT IS CIRCULAR ECONOMY?

WHAT IS CIRCULAR ECONOMY?

A circular economy is a new approach to the way our businesses work. It focuses on the premise that waste as resource can be in use, at his highest value, for many lifespans. In the circular economy the priority is to rent, reuse, share, repair, refurbish, remanufacture and recycle.

4 PRINCIPLES OF CIRCULAR ECONOMY

by Ellen Macarthur Foundation

1. Waste equals food
2. Build resilience through diversity
3. Use energy from renewable resources
4. Think in systems

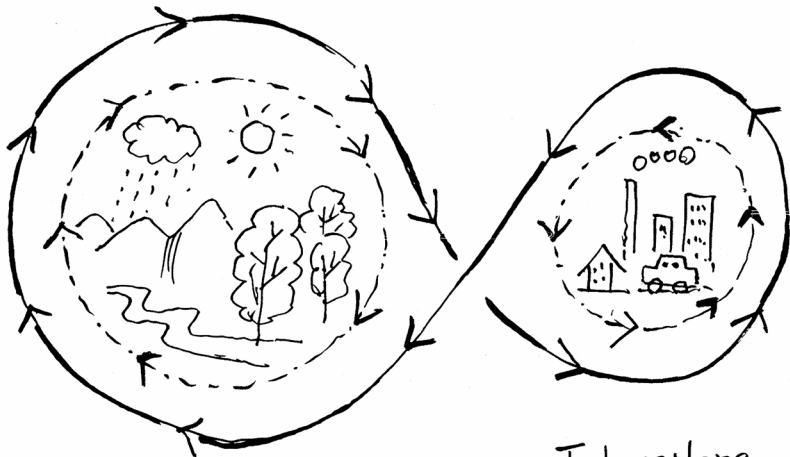
WHY DO WE NEED CIRCULAR ECONOMY

Resources are the thriving elements of an economy. When they fail us, so does our economy. We have recently seen that although some resources are still available we need to understand the impact its extraction has on the natural systems. We need to activate a more sustainable economy.

“The network of life consists of many loops, big and small, all the information and materials are circulated, exchanged in these loops, either inside of lives or outside.

When everything is connected through these loops, the concept of resources vs. waste are diminished; all the raw materials are assembled into something and disassembled afterwards within the loop.”

from the book “BI: the origin of architectural creativity” - BaF



Biosphere .
生態迴圈 .

Technosphere .
工業迴圈 .

The concept of circular economy.

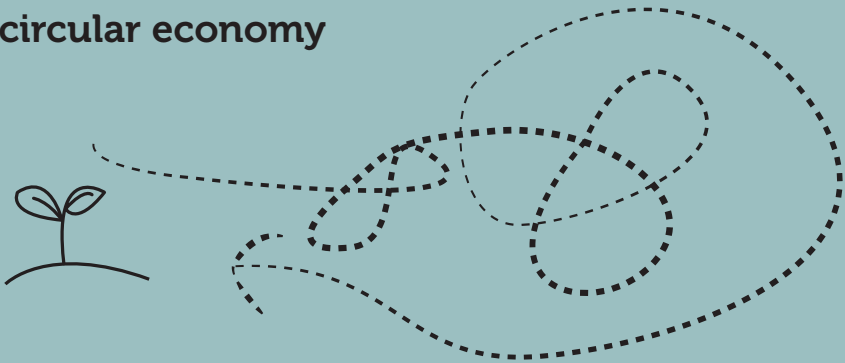
linear economy



recycling economy



circular economy

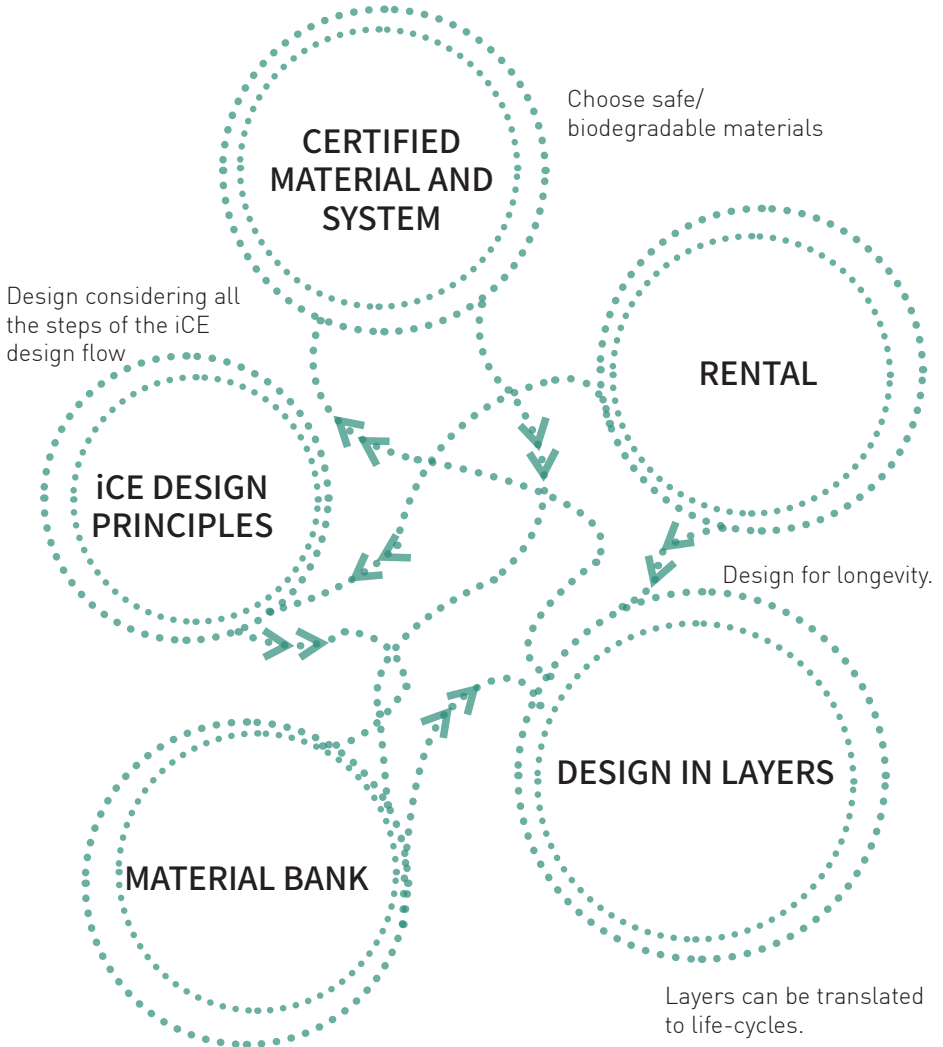


The circular economy goes beyond a recycling economy.

DESIGN THINKING

iCE design flow

The circular design thinking is a design flow that considers all the elements in no specific order but an integrated approach.



A platform to store information about materials. This platform can be used to trade/rent in order to keep the materials in use and retain their value.



Modular design of a housing unit of Taisugar Circular Village, by BaF.

DESIGN IN LAYERS

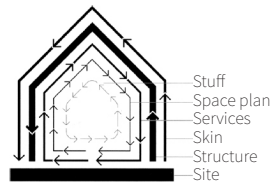
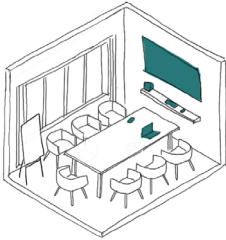


Diagram by Stewart Brand from the book: *How Buildings Learn: What Happens After They're Built*, shows the shearing layers.

Layers are fundamental tools for circular design. When thinking in layers we can more accurately group elements into their lifecycles and design how they end from the beginning.

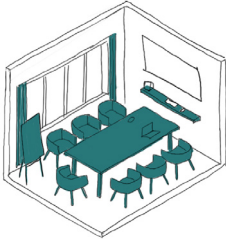


SHELF LIFE

1 to 5 years

APPLIANCES

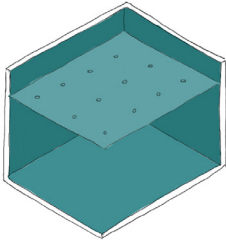
- ELECTRICAL EQUIPMENT
- KITCHEN APPLIANCES
- DECORATION
- STUFF



1 to 10 years

FURNITURE

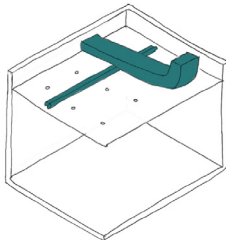
- FIXED FURNITURE
- LOOSE FURNITURE
- CURTAINS
- TAPESTRY



10 to 30 years

FINISH

- WALLS / PARTITIONS
- FLOOR
- CEILING



10 to 30 years

SERVICES

- PLUMBING
- MEP
- HVAC
- LIGHTING



OFFICE INTERIOR IN LAYERS

When designing in layers it is possible to more efficiently group the components into different lifespans. This enables to keep the value of each layer independent from each other.

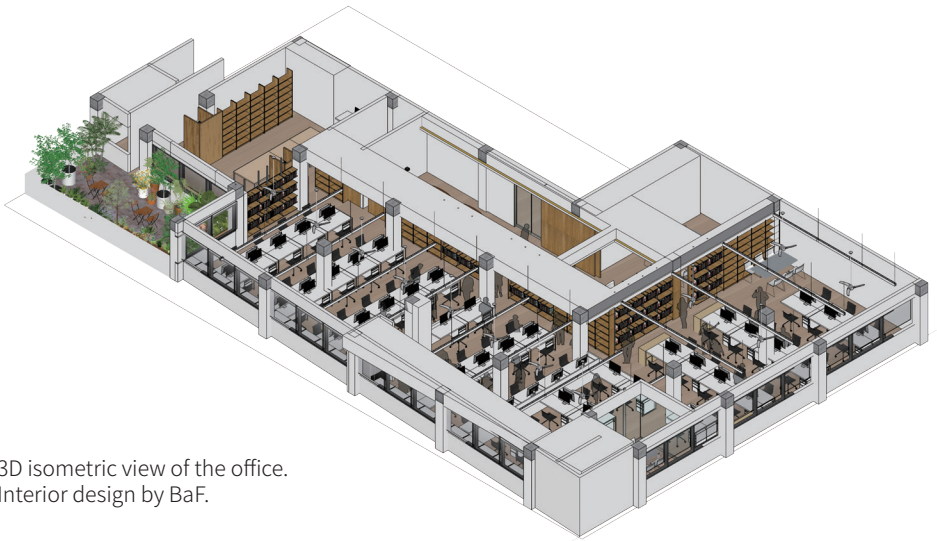
Below is the example of BaF's office. This interior design renovation was driven by the use of green building materials (such as biodegradable flooring), the reuse of old furniture whenever possible, and the repurpose of different materials.



Privacy and flexibility are achieved by the use of modular sliding panels that can turn one meeting room into two.

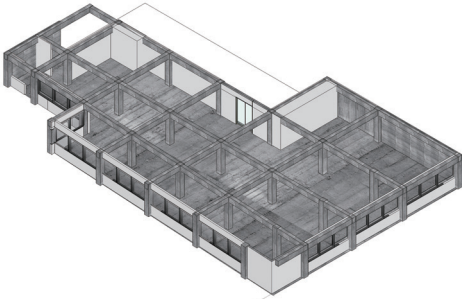


Lamp made of cardboard paper tubes.

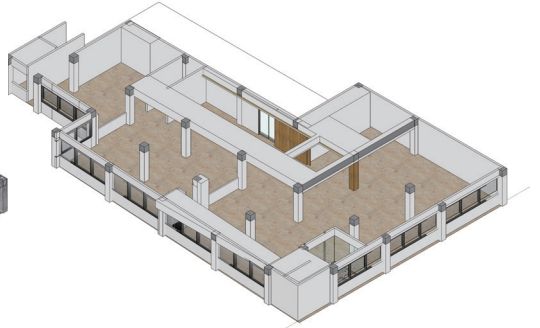


3D isometric view of the office.
Interior design by BaF.

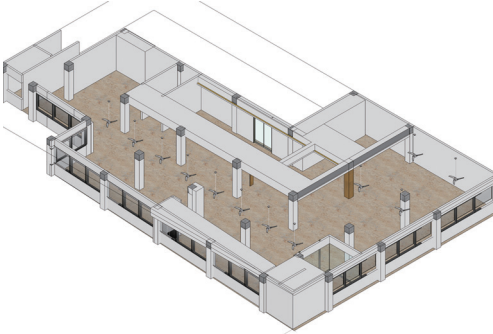
Structure



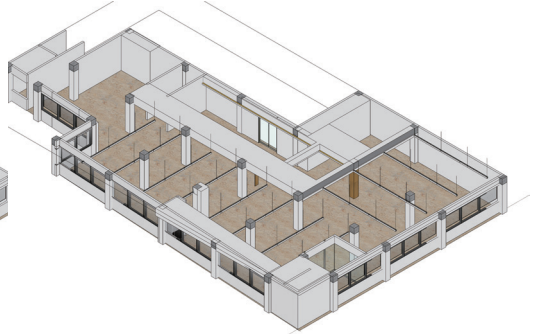
Partitions



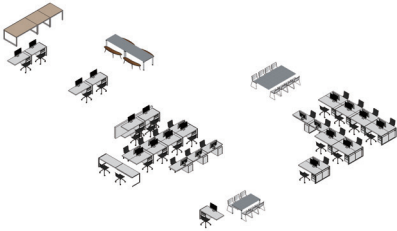
Reused fans



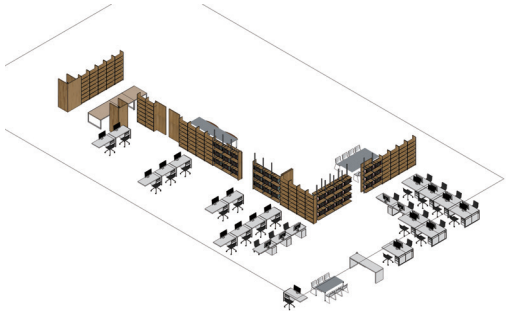
Lighting



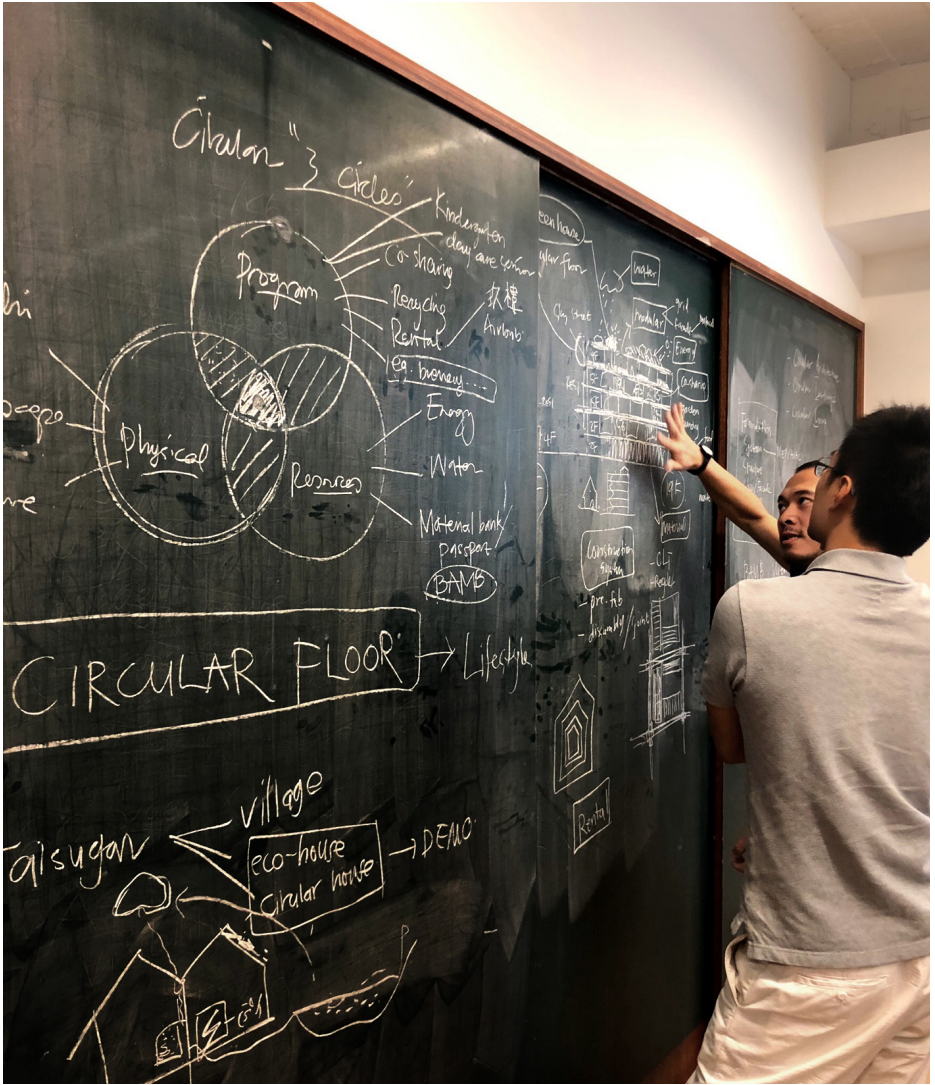
New furniture



Old furniture



Design based on the consideration of layers and shelf life.



Brainstorming for a circular project at BaF.

DESIGN PRINCIPLES

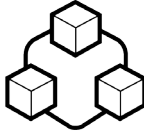
The 4 principles for interior circular economy are the foundation to reach a successful and therefore circular design.

MATERIALITY



In the circular economy system, waste equals food and materials are kept valuable as long as possible. The use of biodegradable and safe materials for the environment is paramount.

MODULARITY & DISASSEMBLY



A modular design enables the separation and replacement of parts that are used intensively or need repair, not having to compromise the whole.

RENTAL



The transition from products to services is becoming a reality, and it will prove to be more beneficial both for manufacturers and users.

MATERIAL BANK



A Material bank is a platform that works as a depository of information about materials. This inventory can then be used to swap/sell, reuse, repurpose or recycle the materials.

MATERIALITY

Designers are responsible to choose materials and therefore it is vital to have a deep understanding of which are the important elements for a material to be considered 'safe'. Below are the following qualifying categories to score materials by *Cradle to Cradle*.



MATERIAL HEALTH

Knowing the chemical ingredients of every material in a product, and optimizing towards safer materials.



MATERIAL REUTILIZATION

Designing products made with materials that come from and can safely return to nature or industry.



RENEWABLE ENERGY

Envisioning a future in which all manufacturing is powered by 100% clean renewable energy.



WATER STEWARDSHIP

Manage clean water as a precious resource and an essential human right.



SOCIAL FAIRNESS

design operations to honor all people and natural systems affected by the creation, use, disposal or reuse of a product.

✓ Building Supply & Materials (195) ▾
Fire Safety (2)
Flooring (1)
Architectural Glass (13)
Building Exteriors (32)
Concrete, Cement, and Masonry (13)
Daylighting & Shades (20)
Doors (1)
Drywall (3)
Electrical (6)
Floors (11)
Floor Adhesives (1)
Garden & Landscape (3)
Heating, Cooling, & Ventilation (11)
Insulation (11)
Paint, Finishes, & Coatings (17)
Partition Walls (17)
Plumbing, Pipe, & Fixtures (3)
Roofing & Rainwater Management (7)
Specialties and Miscellaneous Applications (12)
Structural Building Materials (5)
Transportation Elements (4)

source: cradle to cradle, William Mc Donough

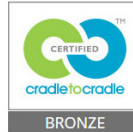
how to?

Visit c2ccertified.org - cradle to cradle products innovation institute. Here you can find certified products and their specific score description.

Cradle to Cradle Certified™ Products Registry

Mobile Walls

ESPERO B.V.



Certification Standard [Version 3.1](#)

Renewal Date: 21 April 2021

[Download Certificate](#)

LEED Credits

✓ LEED Material Ingredient Disclosure Credit Eligible

Where to Find:

[Product Website](#)

Manufacturer Contact:

Information

info@espero.nl

+31 (0)416 33 89 55

[Company Website](#)



Description

Espero mobile walls are designed to improve the function and efficiency of space within a building, creating flexibility and movement but without making a single concession to the form.

The following product lines are covered in group: ESPERO Mobile Walls:

Sonico 85 is a slim-line version.

Sonico 100 is a heavy-duty version.

Sonico 110 is a version with concealed aluminum profiles.

Sonico 120 is a version with concealed aluminum profiles and the highest sound value of Rw = 58dB.

Cradle to Cradle Certified Product Scorecard

MATERIAL HEALTH	Bronze
MATERIAL REUTILIZATION	Bronze
RENEWABLE ENERGY & CARBON MANAGEMENT	Bronze
WATER STEWARDSHIP	Bronze
SOCIAL FAIRNESS	Bronze
OVERALL CERTIFICATION LEVEL	Bronze

[What's this?](#)

Filed under: [Building Supply & Materials](#), [Partition Walls](#)

source: cradle to cradle, William Mc Donough

MODULARITY & DISASSEMBLY

Modular design improves flexibility, is easier to produce and assemble and faster to repair or replace.

Modular construction is prefabricated and assembled on site. The ability to organize and combine the entities in a number of different ways is a clear advantage of modular design.

Design for disassembly means that when two or more components are put together they must be put apart without incurring any damage to the material.

IMPROVED FLEXIBILITY

Modularity enables easier inclusion of extra parts to the design or adaptation to future changes.

FASTER CONSTRUCTION

Since there is a building system in modular design its assembly is done quickly.

PREFABRICATED & DRY CONSTRUCTION

Modularity allows for modules to be manufactured off-site reducing the amount of construction waste.

JOINTS

Connections allow for multiple assembly and disassembly and are within comfortable reach.



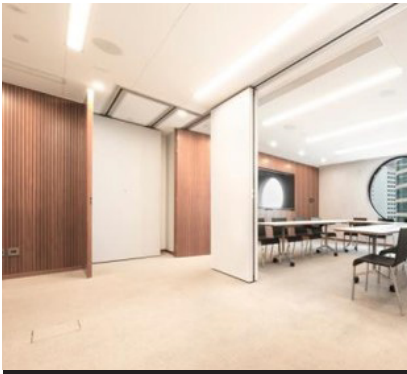
M923 modular wall panel system
- Maars living walls



Nadura flooring (no adhesive, no glue)
- Meister

how to?

Design modular systems that can be easily assembled and with the possibility of disassembly.



Modular, flexible and demountable wall
- Clestra Hauserman



Ceiling acoustic panel (material fabric)
- Archiexpo



Nails damage
the material.



Use screws, pins, nut and
bolts.



Fasteners can be found in
all shapes and size.



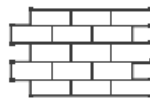
Use common and similar
fasteners.



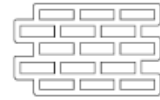
Avoid glue and sealant.



Use easy dissolvable
binders.



Portland cement is
impossible to disassemble



Use lime mortar instead.

RENTAL

Is ownership really necessary? Rental is an effective new system that is beneficial to both parties - the user and the manufacturer. This product-service system (PSS) is ideal to our fast paced world. Acquire the latest technology without having to discard the old. The idea of maintenance and upgradability is endless.

REPLACE CONSUMER TO USER

The client turns into user instead of owner, and the manufacturers become responsible to maintain and repair the product so that its lifecycle is as long as possible.

INCREASE MATERIALS LIFESPAN

It is beneficial to both parties that the products stay longer in use. The manufacturers will make sure to design for longevity and easy repair.

USER INFORMATION/NEEDS

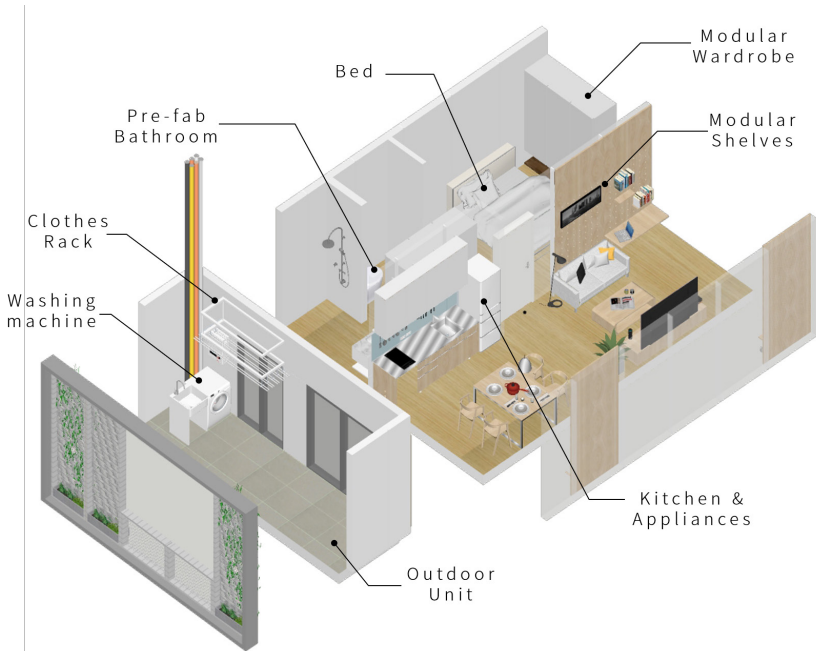
When designing with constant user feedback it is possible to improve the quality and adjust to the users demands.



Taipei 101, 35th floor renovation using IKEA rental furniture by BaF.

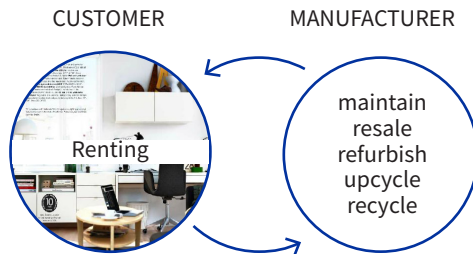
how to?

Look for rental companies that can provide maintenance and repair to furniture/ electrical appliances you would choose for your design.



Rental services in Taisugar Circular Village, project by BaF.

IKEA and Philips are examples of rental providers. The method of rental guarantees that both parties are invested in making products last longer in use and can provide assistance in maintenance and refurbishment.



MATERIAL BANK

A material bank is an information platform where all the details regarding the materials are kept. This information can be used as a trading platform of products.

INFORMATION

All the data should be accessible for all the involved parties during the entire process.

DESCRIPTION

Each material should be labeled with a specific ID for easy recognition. This ID should have a full description of the material and its current condition.

PRESERVATION

When modifications to the material are made, this information should be updated.

DEPOSITORY

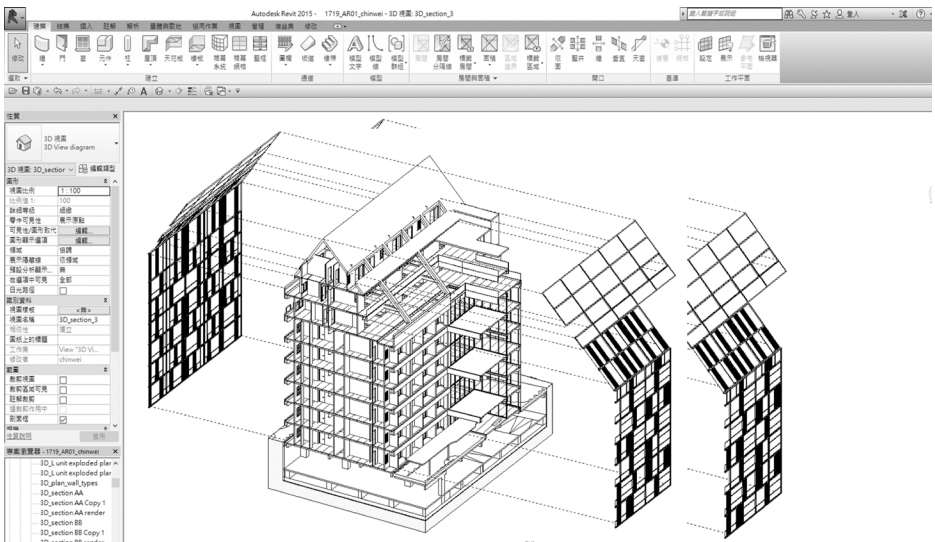
Document how materials should be handled and stored.



“Waste is a material without an identity” Thomas Rau (Chairman of the Madaster Foundation)

how to?

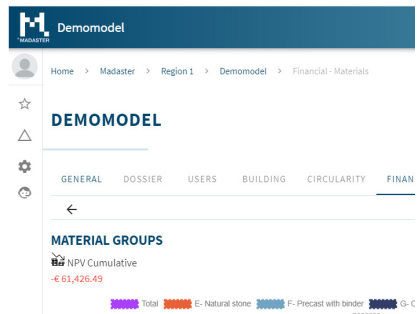
Create your own material platform - if possible.
 Information about what products/furniture you have and their current situation are critical to know how they can be refurbished or reused.



BIM is an important tool for the extraction of information for the material bank. Above, the BIM model of Taisugar Circular Village, project by BaF.



Art Bank run by the National Taiwan Museum of Fine Arts is a rental model that supports contemporary Taiwanese artists. Images from National Taiwan Museum of Fine Arts.



Madaster online platform

#safe
#recycle
#biodegradable
#flexibility
#modularity
#green
#repair
#pre-fab
#renewable
#upcycle
#local
#nuts+bolts
#movable
#rental
#exchange
#demountable
#connection
#circular
#remake
#resource
#longevity
#repurpose

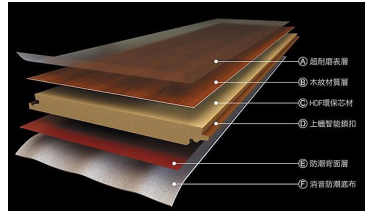


circular resources

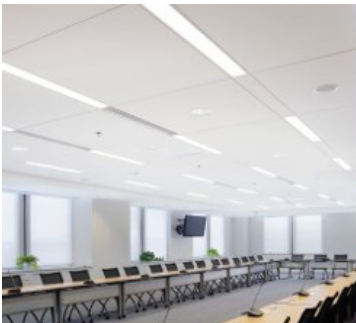
materials + case studies + initiatives



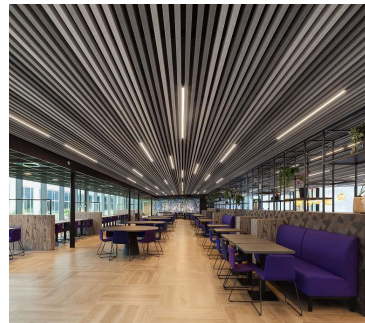
Recessed, Surface Mounting,
Suspending LED Panel aluminum
LED ceiling light fixture



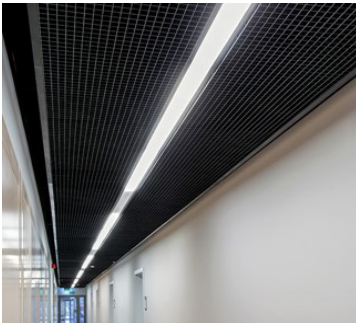
parquet
-友壯工程有限公司



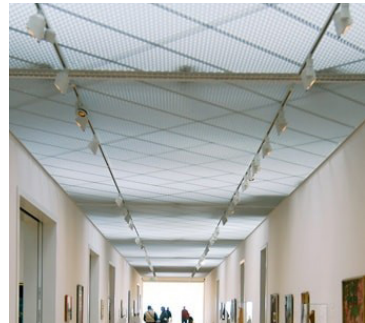
Mineral Fiber Ceilings
- Armstrong world industries



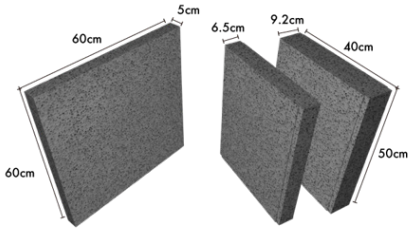
Acoustic Ceilings, Linear Ceilings
- HeartFelt



Metal Open Ceilings
- Hunter Douglas



Cell Ceiling Tiles
- Hunter Douglas



AH Lightweight insulation block



Wood-fiber acoustic panels
- Enviroacoustic



Recycled acoustic product
- Renato lab



Recycled carpet
- Bolon



Linoleum flooring
- Forbo



Taipei 101 35th Floor by BaF



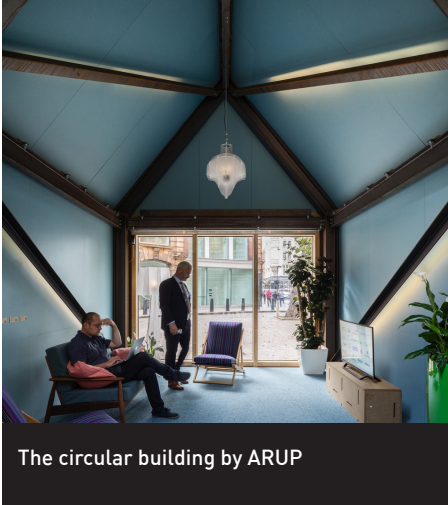
Circular Project Alliander by Gispen



Taisugar Circular Village by BaF



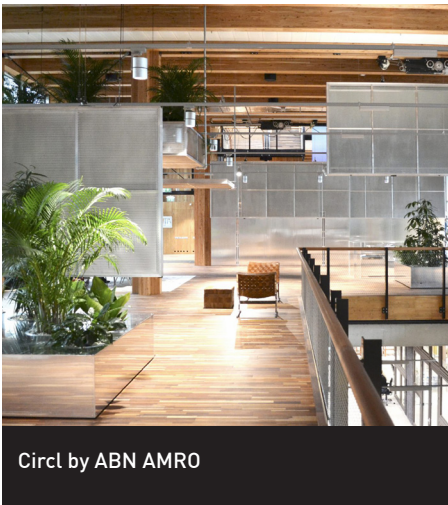
Circular Pavilion by Encore Heureux



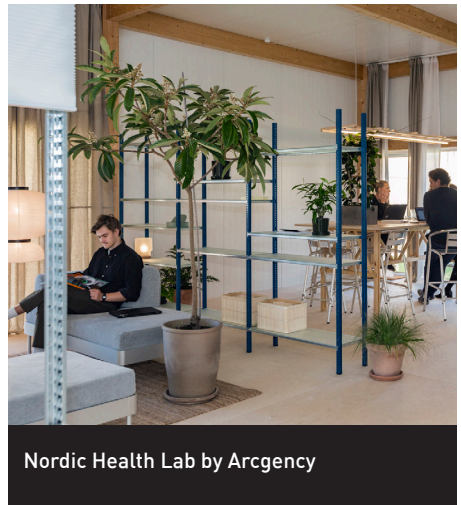
The circular building by ARUP



Wikkelhouses by Fiction Factory



Circl by ABN AMRO



Nordic Health Lab by Arcgency



William McDonough + Partners
Architecture and Community Design

and more...



九典 B a F

聯合建築師事務所
Bio architecture Formosana



renato lab

and more...

CIRCULAR RESOURCES
local initiatives

九典 BaF

聯合建築師事務所

Bio architecture Formosana