Incorporating CE into the design and construction of private housing and public infrastructure

Christophe Le Moing architect



"A dwelling is made of walls pierced with doors and windows, but it is from their void that the use of the house depends.

Thus, man constructs objects, but it is emptiness that gives them meaning. That is why utility comes from being, use comes from non-being. "

TAO TE KING

2 CIRCULAR ECONOMY: A NEW ECONOMIC MODEL

Emergence of the concept

1972: Club of Rome "The limits of growth", "Meadows" report
1976: Walter Stahel, Swiss architect and Geneviève Reday, Swiss socio-economist: report "Jobs for Tomorrow" for the European Commission, present in this report a diagram in loops.
1989: Cradle to Cradle concept (C2C) William Mc Donought American architect and Mickael Braungart German chemist
1990 "Economics of natural resources and the environment" by David W. Pearce and R Kerry Turner, English economists
2002: Publication of the Cradle to Cradle Book.
2011 - Report of the United Nations Environment Program "UNEP 2011 - Decoupling natural resources use and environmental impacts from economic growth”

3 INTRODUCTION

The circular economy is an economic system of exchange and production which, at all stages of the product life cycle (goods and services), aims at increasing the efficiency of resource use and reducing the impact on the environment while developing the well-being of individuals.

It's about doing more and better with less.

The circular economy is a lever for sustainable development.

Its objective is to reduce negative impacts on the environment (resources, pollution, waste) and to create social (employment, lifestyle and consumption) and economic (cooperation and territorial development) value.

The sustainable building can be defined as a structure interacting with its territory, offering a good quality of life, respecting the environment and bringing energy and economic performance.

In terms of housing, the measure of economic value will be given by the real estate market.

The green value impacts the real estate market: a reduction in energy consumption costs is an advantage for the user and allows a higher basic rent for an equivalent overall cost of use.




4 ARCHITECTURAL AND URBAN SPACES

The fundamental raw material of an architectural project is "immaterial": it is the space, the emptiness that surrounds us. This space is "already there", the action of the architect is fundamentally to structure and model it for future expected uses, in order to use the potential.

The influencing factors will be:

- rules of urban planning (height, size, distances imposed with regard to separative limits and ways, density ...)
- climate
- orientations and views
- topography (terrain relief)
- characteristics of the project environment, any existing building, reuse potential analysis
- natural hazards (seismicity, flood, soil and subsoil)
- program of expected uses
- budget

Faced with the threat of depletion of the natural resources needed for global economic development, the circular economy concept invites us to review our habits and practices in a more responsible way. The aim is to do better by considering the limited nature of resources in the broad sense (energy and raw materials), by taking example of nature itself in its diversified processes of regeneration, adaptation and resilience (bio-mimicry).

In this way, we are challenged to respond effectively to the growing need for housing while ensuring the sustainability of the raw material and energy resources needed to manufacture and use them throughout their long life cycle.

Before exploring the different facets of integrating the circular economy into the architectural design of housing, it is important to take into account the housing sector in its heritage dimension.

The residential real estate sector is characterized, for the purchaser, by the search for creation of patrimonial value. Investment in the "stone" is a refuge. This responds to a need for security, for oneself and a need for transmission for our children: through the transmission of our habitat, there is the idea of transmitting a place of life and history to the generations that survive us. The places we inhabit, the personal objects we hold are tangible elements of our memory through which we symbolically survive death.

It is characterized by a long life, transmitting itself from generation to generation.

Depending on the choice of location, it can be valued over time, making it a financial investment.

Well located, benefiting from the proximity of popular services (transport, health, public services) close to employment pools, an apartment or a house, generate rents ensuring the return on capital, generally borrowed. This phenomenon is important to understand the mechanism of attractiveness of cities, concentration and urban densification.

BARNES WARBURG CITY INDEX 2017 :

Établi par BARNES & WARBURG sur la base de critères pratiques, émotionnels et financiers

CLASSEMENT	VILLES
1	New York *(2)**
2	Paris *(5)**
3	Londres *(1)**
4	Los Angeles *(13)**
5	Hong Kong *(11)**
6	Toronto
7	San Francisco
8	Sydney
9	Chicago
10	Berlin
11	Tokyo
12	Munich
13	Washington
14	Stockholm
15	Madrid
16	Lisbonne
17	San Diego
18	Boston
19	Singapour
20	Vancouver
21	Osaka
22	Miami
23	Houston
24	Mexico
25	Dallas

CLASSEMENT	VILLES
26	Hambourg
27	Atlanta
28	Montréal *(Nouvel entrant)*
29	Seattle
30	Vienne *(Nouvel entrant)*
31	Genève
32	Budapest *(Nouvel entrant)*
33	Rome
34	Shanghai
35	Prague
36	Dublin
37	Copenhague
38	Bâle
39	Zurich
40	Québec *(Nouvel entrant)*
41	Guangzhou
42	Le Cap
43	Pékin
44	Oslo
45	Dubaï
46	Moscou
47	Varsovie *(Nouvel entrant)*
48	Shenzhen
49	Sao Paulo
50	Ho Chi Minh Ville *(Nouvel entrant)*

IDEAL HOUSING : WHERE ARE THE BETTER PLACES TO LIVE ?

To the question to which I freely invited you to answer "How do you imagine, by a few simple words or in pictures, your ideal habitat? ", The first criterion will probably be its location and its environment, because we do not live only the private space of our apartment or our house, but also what connects us to the immediate world: a place, a neighborhood, a city , a village, a landscape ...

The most sought-after cities in the world are generally important business centers and financial centers, city-states or capitals, with attractive taxation.

We are far from the cavern or hut of primitive man in nature. Denied of means of transport, of tools, the primitive man found shelter in the hollow of a rock, under the branches and the foliage of the trees.

Today, the home presents extremely contrasting faces, from the illegal shantytown to the exceptional villas, from the Tiny house to the container house, from bars and high-rise houses to suburban housing estates: it reflects the social and cultural economic disparities of our contemporary society, in a context of intensification and globalization of exchanges, mobility, digital revolution.

The permanent improvement of the human habitat, envisaged in a system of circular economy, is influenced today by the following objectives:

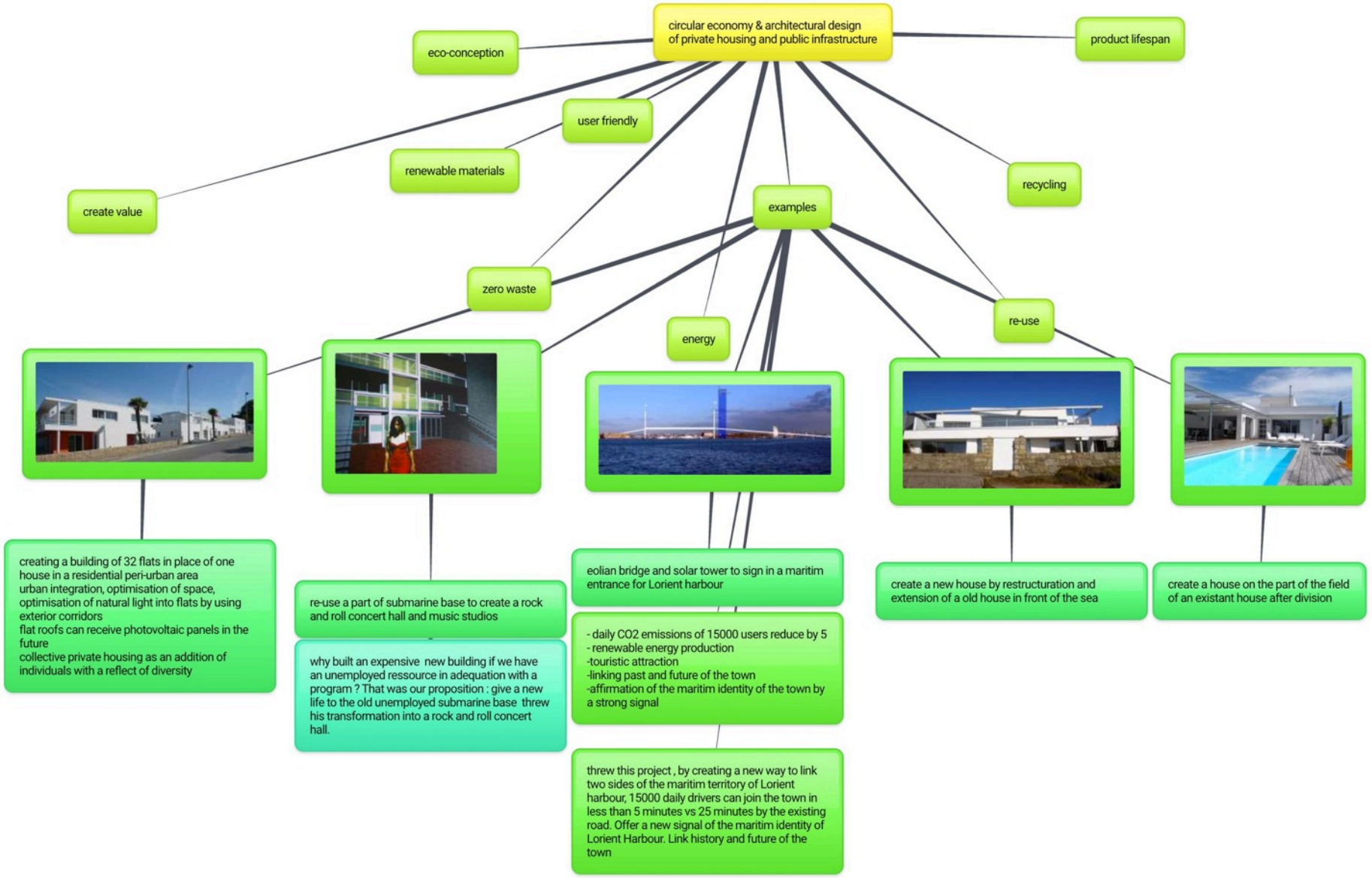
- Preservation of land resources, limitation of urban sprawl
- search for energy autonomy (bioclimatic design, positive energy habitats thanks to the use of renewable energies
- search for a global balance sheet (manufacturing + use + deconstruction) of negative greenhouse gas emissions - connectivity to information networks (which, subject to access to the network, equidistant between rural and urban areas with regard to the global information resources available on the internet)
- minimization of commute to work (choice of location)
- preservation of non-renewable raw materials (use of bio-sourced materials, reuse and reuse of used building materials, recovery, recycled materials)
- waste reduction by considering the reuse of unavoidable waste (the waste of some is considered as a resource for others, by the establishment of appropriate sectors at the local level) - objective Zero waste
- preserve or contribute to the development of bio-diversity
- to provide its inhabitants with a healthy indoor and outdoor environment that does not harm their health (air quality, water quality, non-toxic building materials and components, noise protection)
- Resilience with regard to submersion risks, climatic hazards, seismic risks
- sustainability, flexibility and adaptation to changing uses
- ability to re-use and reuse constructive components at the end of the life cycle

Here is outlined the theoretical roadmap of the ideal habitat from the point of view of the circular economy.

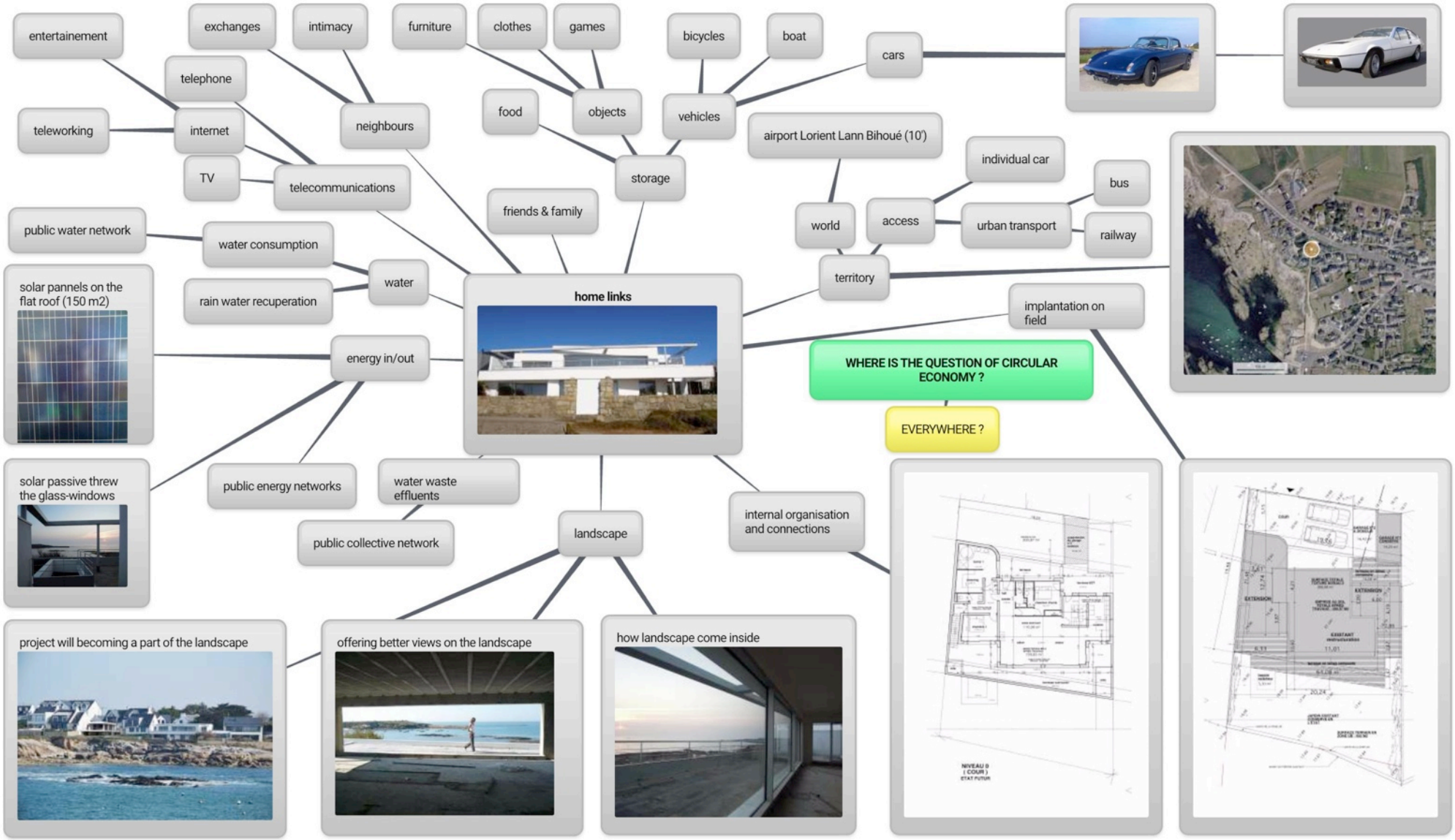
EXPLORING THE WAYS TO INTEGRATE CIRCULAR ECONOMY INTO ARCHITECTURAL DESIGN

Here are some concrete or conceptual examples of the answers given to these issues by architects around the world, even if, according to the UIA (International Union of Architects), only 2% of construction in the world is realized with their support . I make myself the spokesman of my colleagues in the field: our role is often poorly identified, the society of the show often reduces the perception of the public to the prestigious buildings, inaccessible to the common people. These buildings are our common pride. However, to qualify this partial vision, I chose here the path of humility: architecture at the service of everyday men ... This architecture speaks to us, it is close to us, human, generous and accessible.

SPACE: A "RESOURCE" TO OPTIMIZE AT DIFFERENT SCALES AND STRATEGY DEGREES



Exploration of housing links and connections



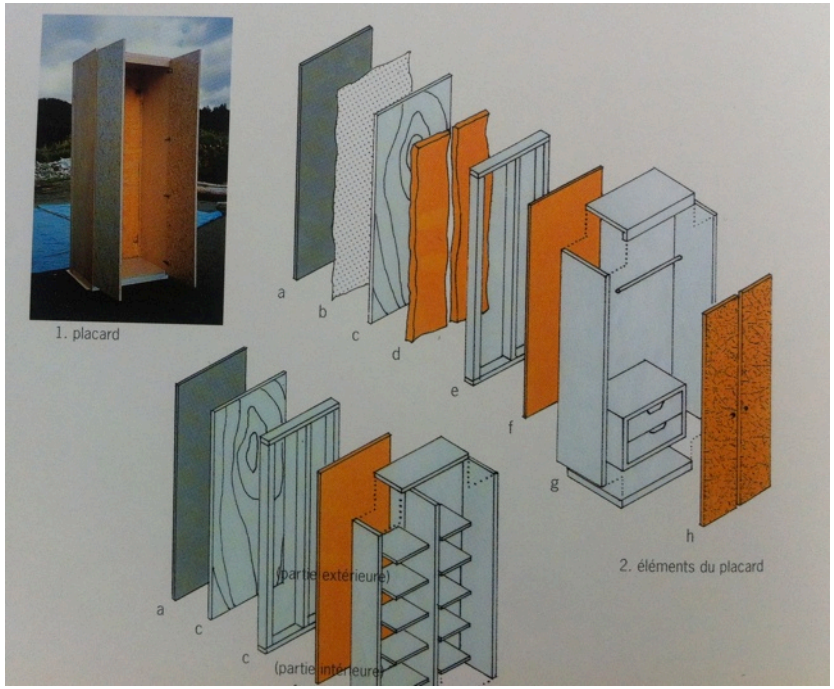
STANDARDIZED INDUSTRIAL PREFABRICATION + TRANSPORT OR DEVELOPMENT OF LOCAL MATERIALS AND LOCAL KNOW-HOW?

What options should be encouraged and favored? Are they opposed? Can they combine?

Bamboo, earth, adobe, wood, bio-based materials

Container houses and prefabricated houses...

High tech and low tech can work together...



Shigeru Ban architect

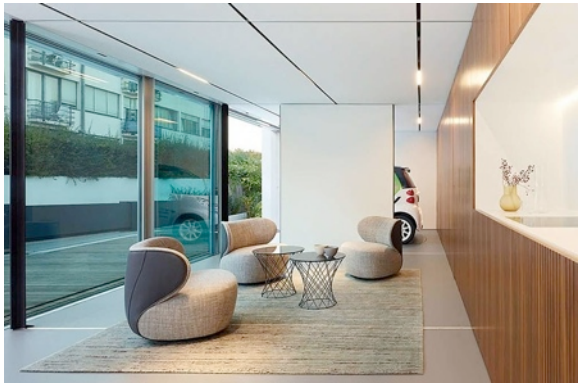
POSITIVE ENERGY, MOBILITY AND CONNECTIVITY :

Industrial strategies: convergence of automotive / housing solutions (Tesla, Mercedes, Nissan) electric car + solar photovoltaic, hydrogen fuel cell

relocation of the resource supply dependency problem for the digital industry, photovoltaics, domestic electricity storage (95% of the rare earths are exploited in China)

Smartgrids, a mix of urban housing and offices to balance electricity use ranges in a local production environment. Smart cities optimize their production and energy consumption by networking their buildings that can generate energy, store it and redistribute it.

Designed by architect Werner Sobek, the B10 is likely to become a model of housing an ecological and responsible future. It is not only well insulated or eco-designed, but it produces twice as much energy as it consumes, leaving no impact in the event of demolition. Result of the mobilization of dozens of architects and building experts, it is described as one of the first "active" houses in the world. A simple prototype for research and testing to date, the B 10 habitat, inaugurated for the first time in 2014, aims to position itself on the triple-zero line: 0 energies, 0 emissions and 0 losses.



B10 house- Werner Sobek architect

In Japan :

https://resources.realestate.co.jp/buy/the-present-and-future-of-net-zero-energy-houses-in-japan/#.WmyUMYJ499E.facebook

CITY AND NATURE, URBAN AGRICULTURE, BIOMIMICRY (Urban air quality, zero carbon)

"Biomimicry is learning from and then emulating nature's forms, processes, and ecosystems to create more sustainable designs." (source https://biomimicry.net)

Vincent Callebaut architect

One of the most important challenge was to create an anti-seismic tower. To ensure a completely safe environment, EPS isolation cushions, of the same grade is used for US roads and bridges, have been employed in accordance with the shock resistant design of the 4th nuclear power plant in Taiwan. The design can resist a peak ground acceleration of 400gal and provide maximum protection against 7 grade earthquakes (maximum strength in Taiwan). The structure remains elastic and does not incur damage.

EMERGENCY HABITAT DISASTERS AND RECONSTRUCTIONS

(Source : http://www.floornature.eu)

The architect Shigeru Ban in the service of the emergency

There are many examples of his experience in the architectural projects sector, in order to provide an immediate response to housing requirements by using the materials found on site. He has proved by his work the infinite architectural potential of economic and quite natural materials, such as paper, cardboard and bamboo, and he was already authorized in 1990 to use cardboard as a construction material. .

One of the humanitarian initiatives of architect Shigeru Ban is that he carried out in refugee camps in Rwanda after the war, where he used cardboard tubes to support the tents provided by the High Commissioner's Office. UN for refugees. This solution made it possible to avoid the destruction of other trees for the manufacture of wooden pillars.

After the Kobe earthquake in 1995, architect Shigeru Ban designed fifty shelters for Vietnamese refugees. "The bases were made of crates of beer full of sand, which made it possible to avoid making concrete foundations. Having convinced the local priest of the efficiency and strength of the cardboard, he also made a church with cardboard tubes. For those who have doubts about the strength of this material, it is enough to think that several temporary structures made of cardboard then became permanent ".

Shigeru Ban also intervened after the 1999 earthquake in Turkey, where temporary shelters were made in insulating cardboard, given the low temperatures that characterized the region. After the terrible earthquake of 2004, followed by the tsunami in Sri Lanka, the architect Shigeru Ban designed permanent houses for a fishing village and after the recent earthquake and tsunami in Japan, he managed to develop simple solutions inside reception structures, subdividing available spaces so as to give each family their own space and thus preserve their privacy.

Shigeru Ban architect (Japan)

SMALL IS BEAUTIFUL

Less space = less raw materials:

the voluntary reduction of inhabitants' surface needs also contributes to the objectives of the circular economy

(less space = less storage capacity for consumer goods)

also corresponds to an evolution of the way of life (nomadism)

Recreational habitats

House boats

Brittany is full of unusual accommodation. It even becomes a regional specialty as there are proposals on the internet. It will soon be necessary to add the floating house of Lorient, produced by Lorientaise SeaLoft. The concept is not entirely new, but this company, one of whose specialties is seawater resistance, designed and produced its first floating house in direct contact with the ocean.

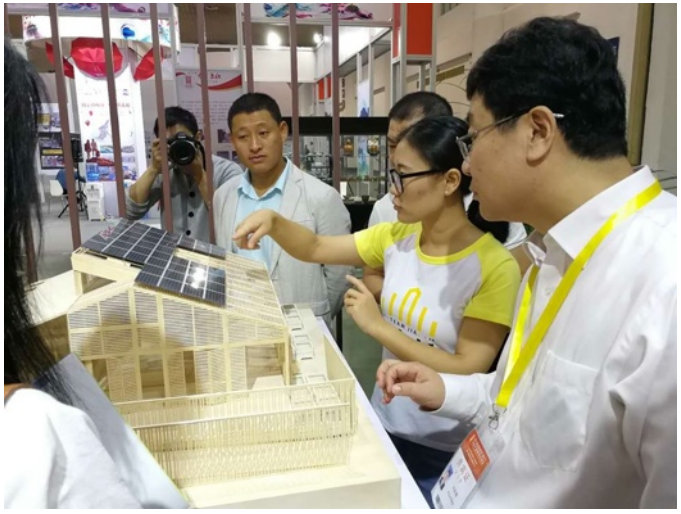
Cabanes...a desire to come back to an elementary relation with nature ...and maybe threw this way, our nature.

Tiny houses (boom following the subprime crisis in the USA) ... a desire of independance, freedom and autonomy.

EDUCATION AND COOPERATION

https://www.facebook.com/projetabcd/ A french young architect , Justine Duval , come to Cambodia for a human project of valorisation of local material : bamboo

https://www.facebook.com/Team-Solar-Bretagne-Solar-Decathlon-1422573711322154/



International competition Team Solar Decathlon China 2018 : a cooperation between french and chinese students in competition for the “olympics games” of sustainable housing.

CERTIFICATION C to C (Cradle to Cradle) :

According to Michael Braungart and William Mac Donough, a building "cradle to cradle" is
"A building that contains definite elements that add value and praise innovation and enjoyment by significantly improving the quality of materials, biodiversity, air and water, by using solar power, being deconstructible and recyclable, and creating diverse practical functions that enhance the well-being of its stakeholders. "

Based on the three basic principles of "cradle to cradle", ie waste is resources, solar energy is used and diversity is valued, the "cradle to cradle: criteria for the built environment" standard provides to the building owners of the criteria of orientation for the development of a building with measurable "cradle to cradle" functionalities.

The purpose of these criteria is to maximize the beneficial effects instead of just minimizing the negative effects.

Thus any project of a building "cradle to cradle" begins with a reflection to determine beforehand the expected benefits of the realization in terms of positive impacts and the steps to be carried out with regard to the three basic principles of "cradle to cradle" to achieve the desired objectives.

CONCLUSION

The diversity of contexts calls for specific answers that naturally follow:

Each place has a history. Cities, villages are so many texts, co-written, rewritten, unfinished, with passages sometimes sublime, sometimes average and others downright disastrous ...

If cinema is a writing with moving images and sounds, architecture is a writing with spaces, full, voids, sounds, lights, shadows, rhythms, textures, movements .. .architecture is a writing intended to be inhabited ... not only seen, viewed from the outside ... We have an intimate relationship with architecture: we inhabit it.

- space, light, movement, narrativity ...: "raw" materials, resources of architectural design in the construction of the project in dialogue with a context
- consideration of the diversity of human habitats and the factors influencing this diversity (climate, culture, topography, heritages, knowledge, available materials etc ...)
- attention to what is "already there", in a project situation, and to its potential for re-employment, adaptation to new uses, transfiguration etc ...
- finally, to live together, because to live overflows the limits of the strictly private space, to extend outside, in public spaces that we share (spaces of mobilities, exchanges, shared events, and then these "places" or we take pleasure to walk, to take the time to stop ...

If we want to avoid the planned obsolescence of our living environments, the participation of those who live in their writing / rewriting is probably a guarantee of sustainability because they have had a creative relationship to their environment (even if they take the train on the move) and that they will know how to protect it, perpetuate it and transmit its

intimate meaning and memory. This is for me a fundamental element of optimizing the "life cycle" of our habitats, regardless of the technical equipment that will come to perfect, over the technological developments, comfort and economy of use, and decoration to change from time to time depending on the weather.
It is in this regard that I wish to mention the UFO concept "unlimited cities" which provides an original answer to the questions of governance and collaborative management of urban projects: http://www.unlimitedcities.org/