Architectural narrative

Preface

The world is continually changing and that makes people change too. People want to control every aspect of their lives. This applies on buying, designing and building houses as well. It is a growing trend that people want to live in unique houses, that the house is built to fulfill one's desires, fantasies and latent needs. Also, there is a growing awareness about sustainability (for our planet) and a need to battle the climate change with every day choices.

A growing number of people have this dream about a sustainable house powered by renewable energy and made from cyclical materials. Unfortunately, that kind of dreams are not very easily achieved. There aren't many companies which build affordable, unique, sustainable houses. The Selficient house is this dream made reality.

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1 Conceptual design

1.1 Conceptual thinking

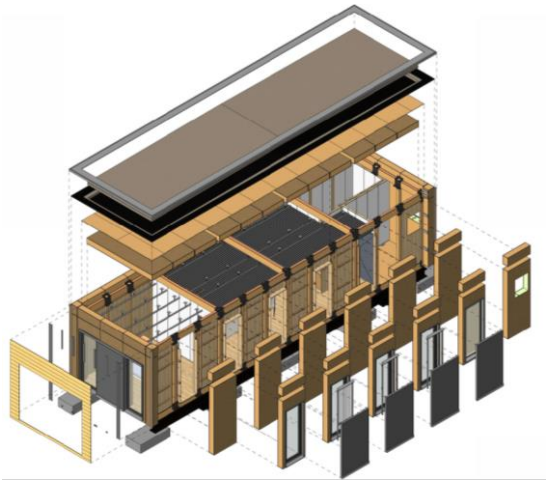
We didn't design just a house, but a building concept. The philosophy that has the base of our concept is modularity and circularity while still being affordable. By designing a building concept instead of a house we were able to change our way of thinking. All the decisions had to made with the concept in mind, which changed our design process radically. Our conceptual thinking allowed us to simplify the design so that could be scaled up pretty easily. By considering our design as a concept instead of just a house we made decisions that will be beneficial on the long run rather than just short term. This means the house will be compliant to the needs of everyone even in a few decades from now.

1.2 Circularity

Our concept is based on the principles of the circular economy. We are aiming towards a building concept that has the lowest environmental footprint as possible. Which means the house is as environmentally friendly as possible, without sacrificing in comfort. We are doing this by creating a building method that is a closed loop in which raw materials are reused without losing their value by focusing on reusing materials.

Since the house is modular, all elements can be easily detached from the house. That way elements won't get damaged by disassembly so they can be reused while keeping their highest value. All material choices have been made with the impact it has on the circularity and modularity in mind.

1.3 Modularity and adaptivity



Everyone wants to change their house to their needs and preferences. Very few houses will deliver that. Most of the time this will cost a vast amount of money or it will be a huge investment of time. Which makes it a large disruption of a persons life. Our concept tackles these problems. Changing the shape of the house? No problem. Adding rooms to the house? Possible. Creating more natural lightning by adding windows? Why not? All of this is possible with a Celcius house. How does it do that you might think. It is made of standardized prefabricated 2D components which are individually attached to a wooden frame. That way it is possible to disassemble small parts of the house easily without the need to take apart the entire house (e.g. adding or removing volumes, windows and façade cladding). With such flexibility we are giving the customer the freedom to design the house to their own preferences. That is why

the building is also achievable for everyone, no matter the situation. For example, if a couple buys this house for the first time with one bedroom, it is usual practice for them to move to a bigger house with the birth of their child. With the Celcius house they won't have to move at all. Because of the modular structure of the house, they can just add one more room to the house and keep living in their own home for the rest of their life. Celcius adapts according to life situations. That is the future of housing.

1.3.1 Less site disturbance

Because of the flexibility and standardized elements of the Celcius house the house can be build up quick without the need for heavy equipment like excavators or wheel loaders. This enables the house to be build in the middle of a busy city without causing inconvenience for the adjacency. The prefabricated elements are much more compact than traditional building elements which means they can be transported to literally anywhere.

1.3.2 Prefabrication improves the building process

Because of the standardized elements, the production process can be automated. An automated production process will decrease the number or errors greatly, making for a cheaper construction process. Also the amount of material wasted will be less because of the reduced number of errors, reducing the demand for raw materials needed and minimizing the amount of energy expended to create a house that is adaptable to varying needs. Less errors also mean faster and more efficient production processes.

Wall panels during production proces

1.3.3 Flexibility enables reuse

The flexibility of our standardized prefabricated elements makes It possible to swap elements between different houses. This means that when a elder couple shrinks the volume of their house, the elements that would have otherwise been thrown away can now be used to expend the house of another Celcius resident. This will decrease the strain of the environment and also be cheaper for the customer.

1.3.4 Plug and play

One of the greatest benefits of standardized prefabricated building elements is that they are ready to be assembled at the building site. Thanks to the plug and play connections which are already build into the elements, there are only two operations needed to secure an element in place: lifting it in place and bolting it against the structural frame. Due to this elements can be easily swapped in place or dismantled all together.

1.3.5 Faster construction time

Because all the connection are plug and play, the construction time is vastly decreased. Allowing to built a Celcius house in just a few weeks, unforeseen weather won't have as big an impact as it would with traditional houses. Faster construction time also allows for faster modifications or rearrangements, adding a new floor or room to the house, change the shape or orientation of the house or disassemble a room to make it more cosy with less cleaning surface. All of that is possible in a jiffy.

1.3.6 Lower costs

Manufacturers of prefabricated modular houses are usually able to built new house plans more affordably than custom builders, for the same reasons that automobile manufacturers can build a new car for far less than a mechanic could build the same car in his garage. This is thanks to the standardization of the building elements. This will allow for mass production cutting down the production cost by a lot.
It also comes with lower labor costs since the production process can be mostly automated factory workers are less needed. It also reduces the need for highly skilled carpenters, plumbers and electricians because all elements are plug and play.

2 Circular economy

"A circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times. The concept distinguishes between technical and biological cycles." (EllenMacArthur).

In a circular economy, the focus is more towards reusing materials and elements instead of using raw materials to build houses (or anything for that matter). A great example of this is using wood instead of concrete to build our house. Traditional houses in the Netherlands are build using concrete floors and masonry walls. Building that way has a huge environmental impact. The Dutch regulations are changing which pushes the building industry towards a more environmental friendly way of building. Our government has set the ambitious goal of being a fully circular economy by 2050. To reach this goal, a lot of innovations are needed The Celcius house is one of these much needed innovations. With our house we show the building industry in the Netherlands that it is possible to build a house which minimizes the environmental impact while maximizing livability and comfortability.

A circular economy is underpinned by a transition to renewable energy sources, the circular model builds economic natural and social capital. It is based on three principals:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

(EllenMacArthurFoundation)

By changing our way of thinking towards a conceptual way of thinking we were able to incorporate the fundamental principles of a circular economy into our house. By standardizing and automating the production process the amount of waste an pollution will be vastly reduced.
All of our elements have been designed to be as lightweight as possible, that way the house can be built with very little have machinery. The only thing that has to be used is an electric crane. This crane runs on renewable energy, reducing the need for fossil fuels even more.
Standardizing the building elements comes with another great benefit. All of the elements are interchangeable with each other keeping them at their highest utility and value at all times.

Another way the circular economy is reflected into our concept is by the insulation material that will be used in further innovations. This material is based biobased and doesn't require any energy during the production process. Our house would've been the first building in the world

that would have been insulated using this material. The insulation material is made using organic waste. The organic waste is grinded after which a bacteria will be added to solidify the material into a water and fireproof insulation material. This material will have the same thermal performance as traditional insulation materials while reducing the environmental impact greatly. It uses a lot less raw materials since it is made out of organic waste and emits zero green house gases.

Due to the novelty of the material is didn't work out the way we planned. Unfortunately the materials did solidify completely making it a struggle to incorporate it into our building elements. However, we will be a part of the development of this material in the coming years. Making it a great addition to our concept. Using this material will help us meet our circular ambitions even more, while having a breakthrough in the building industry.

3 Architectural design

3.1 Multiple “layers”

Our house based upon a structural frame made by Suteki Woodsystems. This frame consists of PEFC-labeled, laminated and pre-cut timber beams and columns. This allowed us to design the house in multiple layers. The wall, floor and roof panels make for the building envelope, working as the so-called thermal layer. These are standardized without any customization. As for the finishes, indoor as well as outside, it is a completely different story. Changing the finish won’t affect the structural integrity or thermal insulation of our house at all. This allows the user to go all out in designing their house. Everything is possible, as long as it is within technical reach.

3.2 Spatial performance

The Celcius house has four rooms, the bedroom, bathroom, mechanical room and the large living area. This living area makes up for more than half of the total house. This living area has a comfy lounge area for watching tv or laying back after a long day at work. Behind the lounge is the dining table close to the kitchen. This living area has all you could need to have a comfortable house. Even though the house is small, the living area is large enough to live as a couple and even have friends over. The windows are facing north and south giving a great view of the surroundings. Most windows are facing south which reduces the demand on the heating system since the sun will warm up the house.

3.3 Connected indoor and outdoor

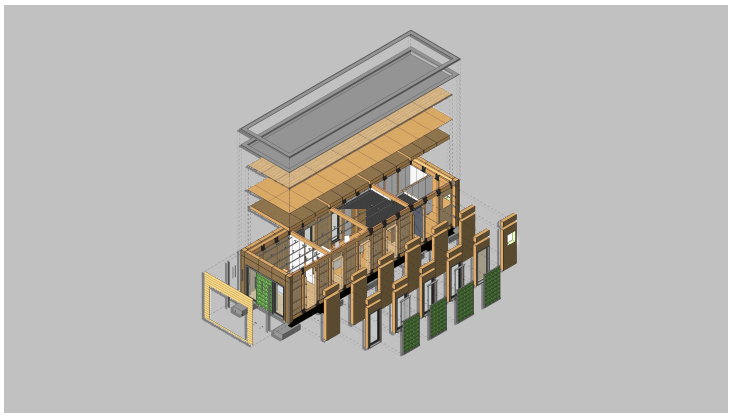
Since the house has a lot of windows the view of the surrounding area’s is great. All of the windows run along the entire height of the living area letting in a lot of natural lighting. It also provides a great connection between the indoor and outdoor. In the Netherlands most people love to live outside during summer time. Our house adapts to this habit by making that connection. Most of the windows can be opened all the way almost working like a door. This will allow the user to really open up the house to fresh air and walking outside when ever they feel like it, improving the quality of life.

3.4 Inspiration

The first reaction of people when they talk about sustainability is the cost and discomfort it comes with. We believe that that doesn't have to be the case. In fact, sustainability should increase the comfort and livability instead of the other way around. Our house is an inspiration for everyone having second thoughts about making their live more sustainable. It shows that sustainability and circularity comes without compromises to comfort and livability. In fact it does improve living without extra costs.

3.5 Community

The fourth core value of Celcius is Community. We want to create a community of people that share the same ideas about sustainability and think the same way as we do. The connected indoor and outdoor helps with building a community. People are living secluded from the rest of the world. By making this connection people will be more connected to their neighbors more.

Since the house is modular building elements can be easily swapped out for different parts. The swapped out parts won't be thrown away as spare parts. They can be shared within a community of people living in Celcius houses. This will greatly improve the circularity of living by reducing the amount of waste.

People will be living in a community when buying a Celcius house. Those people will be producing waste together. This waste will then be collected at a central point. The organic waste will be separated from the rest of the waste. That way the organic waste can be used to produce more insulation material. The people living in a Celcius house will not only enjoy the comfort of sustainable living, they will also be a part of the production process of building elements. That way everyone will be working together on improving the building industry. That is the future of living!