

# Living in Light – a transformation concept of existing buildings

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## Abstract

The intension of Living in Light is to create additional space behind a more transparent and flexible building envelope in a transformation of existing buildings. The purpose is to make a more demand driven concept for renewal and transformation of existing buildings to the benefit of the users, the owners and the environment. The transparent building envelope adds new qualities to the building. A part from more space it creates a “Summer Garden”, with daylight and better indoor environment, active facades (PV and thermal sun power) and better energy performance. The Living in Light Box tests the concept.

## 1. Introduction / The Valby Project

The Valby project is a private rental property from 1899 located in the district of Valby in the city of Copenhagen. The property is beautifully built with handmade bricks and is a part of the worth preserving built environment of the district. The property contains 20 apartments, including 4 ground floor apartments as commercial leases.

All apartments are two-room and only about 50 m<sup>2</sup> each - the loft apartments being even a bit smaller. The apartments have small toilets situated at the backstairs and shared bathrooms at the basement only. At the same time, the apartments appear outdated regarding living spaces, comfort, and technical installations. The tenants therefore had wishes for the property to be modernised. The need for modernisation was also recognised by the property owner, who wished to raise the value of the building by focusing on added qualities – as well technically, as added living qualities for the tenants.



Figure 1: The Valby Project: Existing building in Copenhagen

## 2. The Process

The process started as an urban renewal project with the support from City of Copenhagen, involving the tenants, the owner and his advisor. Rapidly, questions about how to improve life through living qualities, convenience, and health, rather than technical details on improving the existing building, came to be at the focus of the process.

The tenants dreamt about new living functions such as a nice kitchen and a fine living room, on in-door climate and comfort such as access to daylight through a balcony or direct access to outdoor spaces. A thorough investigation on existing resident behaviour and wishes for the future has emphasized the focus on “living qualities, convenience and health”, rather than on “the building” itself.

Several workshops including with the tenants were held, and the first layout was drawn incorporating thoughts on how to open up the building for more daylight and more space. Little by little, the process has pivoted around key issues regarding daylight and how to design new living functions. Also indoor climate and energy performance were worked with, where principles from the Active House Standard were applied.

## 3. The Concept

The concept for the Valby project has pivoted about how daylight changes during the seasons and the day – and how daylight can be accessed at the right moment in the right amount, creating com-fort, well-being and healthy homes.

Daylight also directly impacts the means to access “natural” and “cultural” qualities in the near environment – “nature” as an access to green outdoor spaces, “the courtyard” and its “close community” - “home” as a private space - and the city, the “vast community”, referring to the “cultural identities” of the city.

The property’s existing building structures create an opaque division between indoor and outdoor qualities, between social, private and cultural spaces. The Valby project therefore seeks to open existing structures of the built environment to new social, private and cultural spaces, i.e. through the means of daylight. New living spaces are created, meaning new means of accessing and under-standing garden spaces, home spaces, and city spaces – for each day of the year.

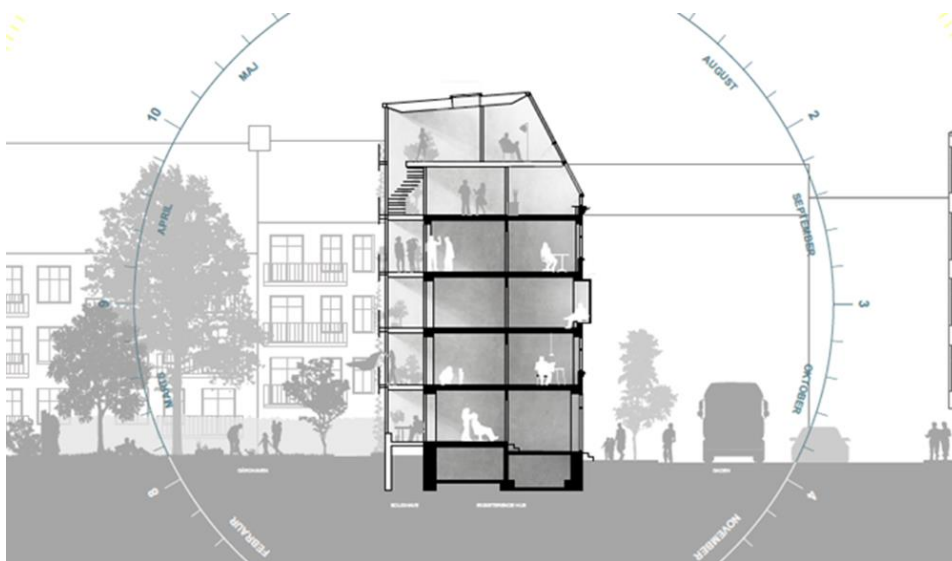


Figure 2: The Valby Project, cross section - Black: Existing structure / Light: Additional and new structure



Figure 3: The Valby Project, illustration of the Summer Garden (Domus Architects)

## 4. The Demonstration

There is a lot of different technologies that are applied in the Valby project. Therefore there have been a need for a small-scale demonstration of some of the technical solution before applying them to the Valby project. This small demonstrations have been build and tested in the demonstration project “Living in Light Box”. Here we will present two of the technical solutions; the Summer Garden and the active façade.

### 4.1 The Summer Garden

“Summer Garden” concept is a new development of the traditional winter garden. Here is utilised the much improved quality of window systems.

The idea with the “Summer Garden” is that in the summertime, part of the living room along the facade will be utilised as an exterior area. This is secured by help of two different window façades, which is used in summer periods and in winter periods.

The winter façade is the glass façade which is the exterior. This has a u-value of  $0.9 \text{ W/m}^2\text{C}$ . The summer façade is the inner glass façade and has a higher u-value.

In the summer, the exterior glass façade will be opened and the inner glass façade will function as an active facade. By help of this, the “Summer Garden” is introduced as a covered exterior outdoor space, where the cover also function as a horizontal solar shading system.

During winter, the outer façade is closed and the inner glass facade is opened. In this way, the whole space is useful as heated space area.

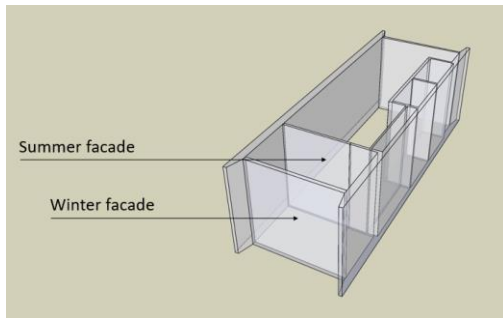


Figure 4: The Concept

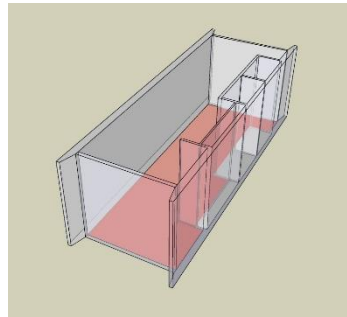


Figure 5: Wintertime

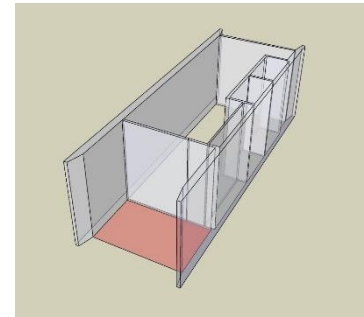


Figure 6: Summertime

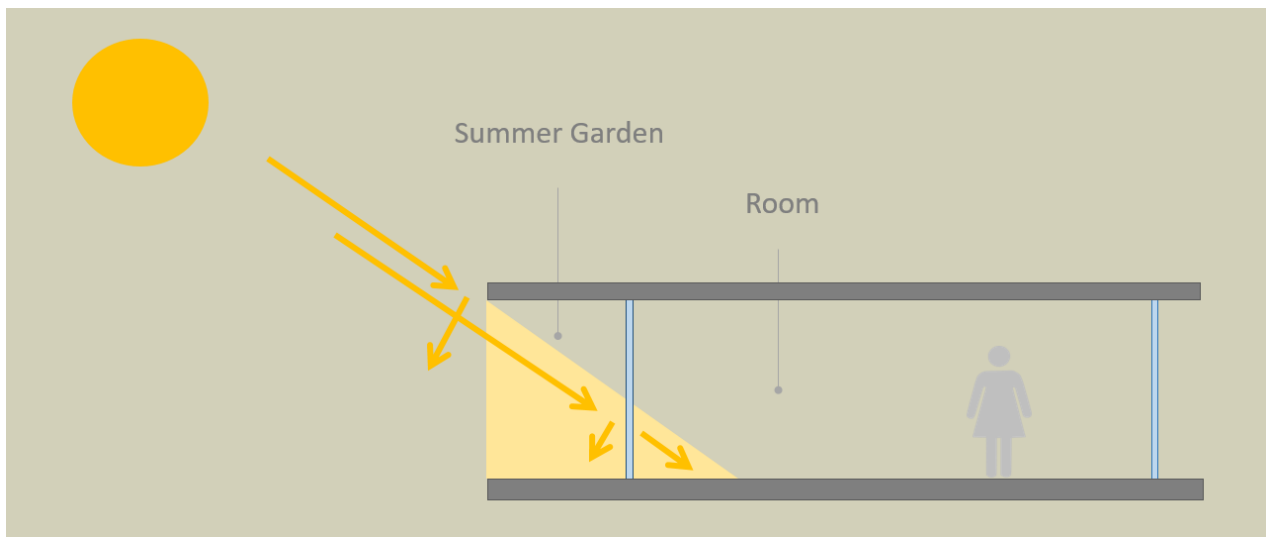


Figure 7: Horizontal solar shading system

## 4.2 Active facade

The Living in Light box has one active façade that is facing towards the South. The active façade includes a combination of solar collectors and photovoltaics both building integrated, so that the façade is having one uniformed look. The solar collectors cover an area of 12 m<sup>2</sup> and is dimensioned to cover 68% of the heating demand for the “Living in Light Box” the rest 32 % is covered by electricity that comes from the rest of the active façade area, the roof and the electricity grid.

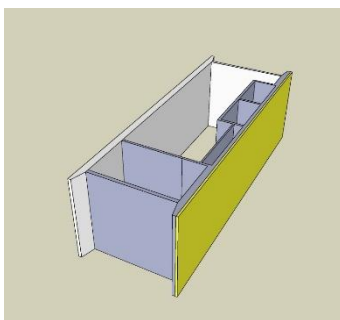


Figure 8: Active façade



Figure 9: The active façade on the “Living in Light Box”

## 5. Evaluation of the technical solutions with Active House

Both the Living in Light Box and the Valby project will be evaluated by the active house specifications. For each project there will be made a radar that shows the calculated and simulated indoor climate and energy production and consumption. Afterward there will be made a radar that shows the performs and these two radars will be compared.

Active House is a vision of how to create sustainable buildings anywhere in the world. It really comes to life and becomes a viable proposition in the second generation of Active House specifications. There are now three steps:

The first is The Principles, providing an overview of the vision, thinking and principles behind an Active House.

The second step is The Specification, gaining the insight and knowledge needed to draw up the requisite technical specifications and design concept for an Active House. They include the important issues to consider when creating an Active House. These issues are often processoriented, some provide guidance on how to achieve the performance levels described in the technical specifications, and some describe the holistic approach of the design (biodiversity, local culture and location).

The third step is The Guidelines, addressing the process of planning the construction of an Active House.

These specifications for building an Active House seek to provide an answer for the three main challenges facing the building industry today: comfort, energy and environment.



Figure 10: Active House Radar

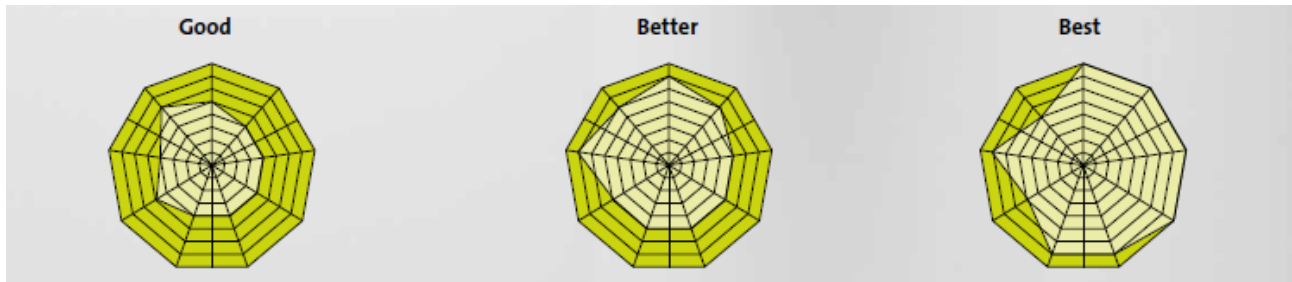


Figure 11: The evaluation of the active house radar