WHY FACADE RETROFIT?

- Nearly 50% of the global energy use is accounted to residential and commercial buildings.
- A building constructed before 1945 uses almost twice as much energy in comparison to a building constructed after 2006.
- Currently buildings use most energy for heating and cooling, followed by materials, hot water, electricity, process energy and lighting.
- The facade has the highest potential when optimizing energetically a building; the best way to reduce the energy consumption for heating and cooling is to improve the performance of its facade.
- Today the main energy issue in buildings is the facade (operating energy); in the future the main energy issue will be the amount and the type of building materials used (embodied energy).
- Facades have a significantly lower life expectancy in comparison to the structure of buildings.

PROJECT GOALS:

- Question what is the value of facade retrofit - relationship between performance, weight (embodied energy), assembly effort, cost and savings - data chart.
- Design a facade system where high performance, weight, embodied energy and recyclability are critically evaluated.
- Design a facade system that can respond to transformable interior spaces, i.e. to be adaptive to interior conditions.
- Reestablish the relationship between the building inhabitants and the building skin.

PROJECT STRATEGY:

- 4 different facade systems are analyzed and compared in the context of an existing building.
- One of the systems is installed on the existing building and has been recently retrofitted, while the other three are design proposals.
- System_01 follows a rather conventional approach, where performance and daylight conditions are improved by the introduction of systems and materials that are currently available.
- System_02 is mainly focused on minimizing the structure that is necessary in order to achieve maximized transparency and minimal weight.
- System_03 is the design solution that focuses beyond the conventional performance parameters on assembly method, exchangeability, adaptability, both to the exterior and the interior of the building, recyclability and on the relationship between the inhabitant and the skin of a building.
This facade system serves two main goals: First, to achieve a significantly higher performance value than the existing facade and second, to bring the sun back into the central unit through use of natural light. The system is comprised of several components that are connected using a hidden structural support system. The facade consists of high-performance glass panels, 18% triple glazed windows and external shading as well as internal shading.

Architecturally, the solution follows the existing facade design, as it maximizes the position of transparent glass elements and the overall module of a 4’ x 4’. Additional elements are introduced through the translucent materials that allow light to pass through the entire length of the facade at varying angles. Simultaneously, the facade serves as a level of privacy required for residential use.
The facade system consists of modular panels with different functions. These panels are user-friendly, scalable, easy to disassemble and assemble and they can be exchanged with minimum effort. In this way the facade becomes a_border between interior and exterior, where the individual functions of the skin of the building and the user are being exchangeable.

The panels are customised both to the exterior and the interior of the building and thus are able to respond to changing conditions outside of the building, which could allow for efficient use of space where the overall dimension of an apartment cell is increased. The architectural concept allows the reconfiguration of functions and their repositioning so that spaces and areas of the building can be occupied, especially in the core of a building.

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**Adaptive Skin - Transformable Space**

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**System 3:**

- Adaptive glass film: temperature-controlled
- Smartframe window: opening and closing
- Illuminating sunshade: power-driven
- PCM: phase-change material
- Green wall: bio-dynamic, self-cleaning
- Connection between panels: magnetic, easy to install

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**Details:**

- **Material:** Composite panels with integrated sensors and actuators
- **Function:** Adaptive shading, controlled ventilation, energy-efficient design
- **Design:** Modular, scalable, easy to maintain

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**Images:**

- Exterior view of the facade system with adaptive panels
- Interior view of the adaptive panels in different states
- Close-up of the integration of adaptive elements

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**Notes:**

- The adaptive system is designed to respond to various environmental conditions.
- The smartframe window allows for versatile use of the space.
- The integrated sensors and actuators ensure efficient energy consumption.

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**Credits:**

- Architectural design: Studio A
- Engineering: Renewable Systems
- Construction: Smart Structures

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**References:**
