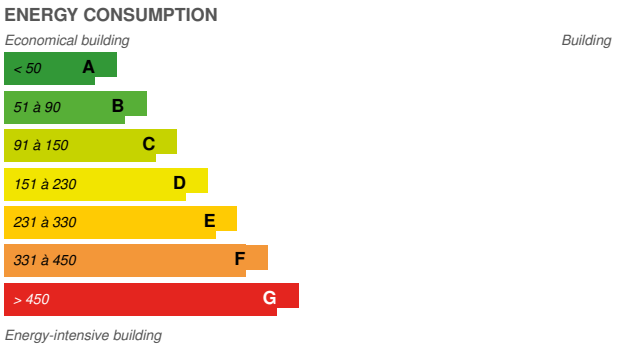
Thermic renovation of a guard house with baked clay

by Taman Mhoumadi / 2023-03-17 00:00:00 / International / 7 / EN

Primary energy need :
kWhpe/m^2.year
(Calculation method :)



Building Type : Other building
Construction Year : 2021
Delivery year : 2022
Address 1 - street : Avenue Félix Éboué x Route des Brasseries BP 737 DAKAR, Other countries
Climate zone : [BSh] Subtropical Dry Semiarid (Steppe)

Net Floor Area : 9 m^2 SHON (fr)
Construction/refurbishment cost : 5 574 €
Cost/m2 : 619.33 €/m^2

General information

We have renovated a guard house located at the entrance of Eiffage Sénégal headquarters.

The project aimed at :

- Providing thermal comfort for users (guardians)
- Demonstrate that locally produced baked clay can impact the thermal confort of buildings built in concrete. Especially since the construction market is booming in Senegal, but buildings are essentially made of concrete. Yet, we know that concrete buildings face overheating therefore leading to extra use of air conditioning, meaning extra greenhouse gas emissions.
- Displaying our first pilot of thermal renovation. That is why we decided to locate the project by the entrance of our headquarters, so that anyone could see it with their own eyes, especially our commercial stakeholders (clients, backers, suppliers...) and decision-makers passing by our headquarters for regular meetings.
- Promoting clay as a "modern" product, while it is commonly perceived in Senegal as a material for the "poor". As we know that it carries a lot of potential in a climate context we need to promote its modernity to lead to its acceptance by users. Therefore it was strategic to set the project by our headquarters.

Technically the project consisted of 3 phases :

We decided to use baked clay because of its ability to slow down the penetration of heat inside a building. Working as a protective layer.

1. We first made a thermal study of the guard house made of concrete and sheet metal, before renovations. It has helped us identify how we should renovate the guard house to enhance thermal comfort
2. We then made architectural plans of the renovation, following the recommandations made by the thermal study

3. After we decided on the architectural designs based on the layouts, we started the renovation works, focusing mainly on adding a baked clay layer outside and inside the existing walls, plus adding a baked clay canopy on the roof

Photo credit

Ibrahim Niang

Stakeholders

Contractor

Name : EIFFAGE SENEGAL
Contact : Taman Mhoumadi - Low carbon innovation manager - taman.mhoumadi@eiffage.com
https://www.eiffage.sn/

Construction Manager

Name : EIC (Entreprise d'Ingénierie et de Construction)
Contact : Moussa Dia - CEO - Dakar - moussadia@sofamac.sn

Stakeholders

Function : Thermal consultancy agency

EMASOL

Ibrahim Niang - Consultant - ibrahimniang@hotmail.com

Study of thermal efficiency of the building before renovation, providing thermal recommendations to guide renovation works

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Function : Others

Architect - CAWD

Adji Woury - Architect & CEO - rywou66@yahoo.fr

http://cawdgroup.com/
Made architecture plan of the renovations, according to thermal recommandations made by EMASOL's thermal study

Contracting method

Other methods

Type of market

Design and implementation

Other type of market

subcontracting

Allocation of works contracts

Separate batches

If you had to do it again?

For the stakeholder in charge of the rehabilitation works, one of the first issues he had to solve was that there was no concrete armoring existing in the original building, and they've discovered it once the rehabilitation works had already started, the moment the previous aluminium roof was taken

while it was necessary so that the baked clay canopy could sit on it.

Besides, the collar surrounding the arch was an issue. Cutter angles had to be set while the canopy is not a perfect circular arc.

Building users opinion

From discussions with 2 guards who have worked within the guard house before and after renovations, they have confirmed that it is cooler inside, and that they are using less ventilation.

Energy

Energy consumption

Breakdown for energy consumption :

Before renovation, the energy consumption was made of a fan and a light build used at night

After renovations, the energy consumption was also made of a fan and a light bulb at night. However, the fan was much less used thanks to the thermal renovations, and likely dropped.

Due to the small surface area of the building, it is hard to isolate the sole consumption of the house guard, and therefore know the exact consumption. However, we carried out a study of the temperature outside and inside the building before and after renovations.

What came out was that the renovations with baked clay have helped us enhance the room temperature of 2 degrees, and through different discussions with guards they've confirmed that they feel cooler inside the room, and use less fan.

Envelope performance

Envelope U-Value : 0,10 $W.m^{-2}.K^{-1}$

More information :
We don't have the information

Indicator :

0

Real final energy consumption

Final Energy : 0,10 $kWhfe/m^2.year$

Renewables & systems

Systems

Heating system :

- No heating system

Hot water system :

- No domestic hot water system

Cooling system :

- No cooling system

Ventilation system :

- Natural ventilation
- Free-cooling

Renewable systems :

- No renewable energy systems

Environment

Urban environment

The building is located near a small yawn, and nearby a street where bus stops for passengers, and next to a small parking

Land plot area : 9,68 m^2

Built-up area : 98,00 %

Products

Product

Baked Clay

SOFAMAC

antagueye@sofamac.sn; moisedia@yahoo.fr

http://www.test.sofamac.sn/

Product category : Structural work / Structure - Masonry - Facade

Baked clay produced in Senegal for construction and renovations

Construction in clay is an ancestral method and is known for its reliability. However, it is socially associated to being poor. On the contrary, building in concrete is seen as "modern". Mindsets are slowly changing and we see more and more constructions with clay, that's why it was important for us to set our project under the spotlight, by the entrance of our headquarters

https://www.construction21.org/data/sources/users/50992/20230316175443-photos-realisations-sofamac.docx

Costs

Construction and exploitation costs

Cost of studies : 3 648 €

Total cost of the building : 5 574 €

Circular Economy

Circular economy strategy

Phase in which reuse has been integrated : Programming

Type of circular economy strategy implemented :

- Targeting a few diversified products for testing
- Targeting of areas
- Maximization of the mass of waste avoided

Type of circular economy strategy implemented : From the programming phase, the aim was to renovate the guard house while preserving a maximum of the material already in place. That's why the foundations, and the four walls made of concrete have not been altered by the renovation

Quantified targets for reuse? :

About 80% of the original house remained after construction

Integration of reuse into the written contract documents : Integration of the approach in the general clauses

Validation protocol for reused materials : No

Deposit validation form : No

Reuse : same function or different function

Batches concerned by reuse :

- Structural works
- Structural framework
- Facades
- Electricity

For each batch : Reused Materials / Products / Equipments :

Facades, structural works, Electricity and the structural framework of the house have remained, or been "reused" after the renovation phase. Thanks to the thermal study conducted during the first stages of the project, we managed not to modify most of the initial guard house

Reused materials rate :

About 80% of the original building material has remained after renovations

Logistics

Rehabilitation and reconditioning operations (if project concerned by a cleaning/demolition stage) : Yes

Please specify the stakeholder that carried out these operations : EIC

Storage of materials for reuse in situ (if project concerned by a cleaning/demolition stage) :

- On an external platform, without specific reconditioning operations

Storage of materials from external supply :
- On site, on a dedicated area not covered

Insurance

Consultation of the technical controller : No

Insurance broker on the project : No

Consultation of the broker : No

Consultation insurer : No

Environmental assessment

Impacts avoided : water, waste, CO2 :

We have not made an calculation of the impacts avoided.

To be completely honest, we don't believe that the project in itself managed to prevent CO2 emissions because the building did not use air-conditioner, and therefore, before renovations, the amount of electricity used for ventilation was rather smal and it still is. However it was not the primary focus of the project, even if it is part of our low carbon strategy.

Indeed, we still believe that it is an interesting project from a low carbon perspective. Why ? Because we managed to prove that using baked clay reduced the room temperature of a building made of concrete.

Therefore we validated the assumption that it is of high potential to renovate with baked clay the existing senegalese housing stock made of concrete and using air-conditioner. Especially in a context of climate change linked with a pressing need to reduce greenhouse gas emissions.

As we know that buildings built with concrete lead to high consumption of air-conditioner, and that air conditioner consume lots of greenhouse gas emissions, our project aimed at impacting the minds of programmers, and all in all aimed at paving the way for low carbon solutions adapted to senegalese economic and housing stock context.

Everyone suffer from heat inside concrete buildings, and air conditioner is very expensive. So we are hoping to open up new ways of thinking.

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More details on the avoided impacts :

Senegal has taken commitments regarding climate change to reduce its greenhous gas emissions (GHG) by 7 to 30% before 2030, according to the paris agreement.

However, oil & gas is about to start being operated. Therefore we need to find other potential gist of GHG reductions within the country. Air-conditioner-related GHG could be one of them, by carrying out well-thought renovations.

Economic assessment

Reuse quantified in the companies' offers? : N.C.

Purchasing process for reused materials :
- Others

Purchasing process for reused materials :

The reuse process happened on site as we didn't alterate the existing walls of the original building.

New business model and financial balance :

From an economic point of view, we need to lead potential future clients to think long term, and see the extra cost of renovation as an investment for future air-conditionner-related savings. And savings from a climate-related point of view.

Communication

Communication on the process : Yes

If so, please specify :

We have written the project into our first notebook on "low carbone innovation by Eiffage Senegal".

Besides, we have interviewed the CEO of the company which conducted the renovation works, and will add it into our next video about climate change, displayed on our social networks.

Also, we wrote a note about our low carbon strategy and the variety of low carbon projects implemented by Eiffage Senegal. This note is added in our call to tenders so that clients and lenders can now about our climate strategy.

Project visit : Yes

Circular design

Responsible consumption :

The core of the project takes responsible consumption at heart. That is why we have decided to focused on baked clay, locally produced in Senegal by a SME.

Besides, we have decided from the beginning to keep as much material as possible. That is why we decided to focus on renovation rather that demolition/construction.

Also, our main goal is to impact the Senegalese building market by proving that it is possible to renovate building to enhance their energy efficiency in order to prevent greenhouse gas emissions linked with air conditioning consumption

Sustainable supply :

The baked clay used is a geo-material, locally produced.

Recycling :

The recycling aspect lies at the heart of the project, as we kept as much material as posssible from the original building block.

Additional information (PDF documents)

Health and comfort

Comfort

Temperature level :

The project enabled to reduce the temperature level by 2 degrees (see the study)

Humidity control :

Baked clay help to enhance humidy control

Visual comfort :

Clay material is known for enhancing the well-being of users

Quality of life and services

The project also aimed at enhancing the quality of life of guards, as the point is to get a cooler room temperature so that they could handle better the high temperature that can be experienced in Senegal.

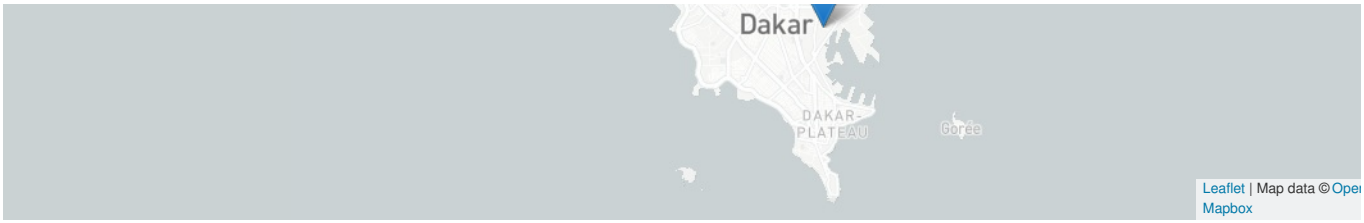
Contest

Reasons for participating in the competition(s)

Our building have a lot of assets regarding our contest category, from its conception to its realisation.

Indeed, it is a renovation project focused on promoting green renovation by experimenting first on a small building.

It is green renovation in its scope by aiming at reducing air conditionner-related greenhouse gas emissions. But it is also green renovation because of the materials used : baked clay, which is a geomaterial.



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