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Transsolar KlimaEngineering

CONNECT IDEAS
MAXIMIZE IMPACT

IMPROVING COMFORT IN MICROBRIGADA BUILDINGS

For my year in Transsolar I chose to focus in buildings which are nor in the centre of the city or beautiful, because I want to have an impact on Cuban lives including my own home

MICROBRIGADA BUILDINGS

Built mainly in the 1970s
In 10 years: 100 000 homes
Inhabitants were in charge of the construction
Government provided plans, technology and materials

Havana_Alamar

Pinar del Río

Isla de la Juventud

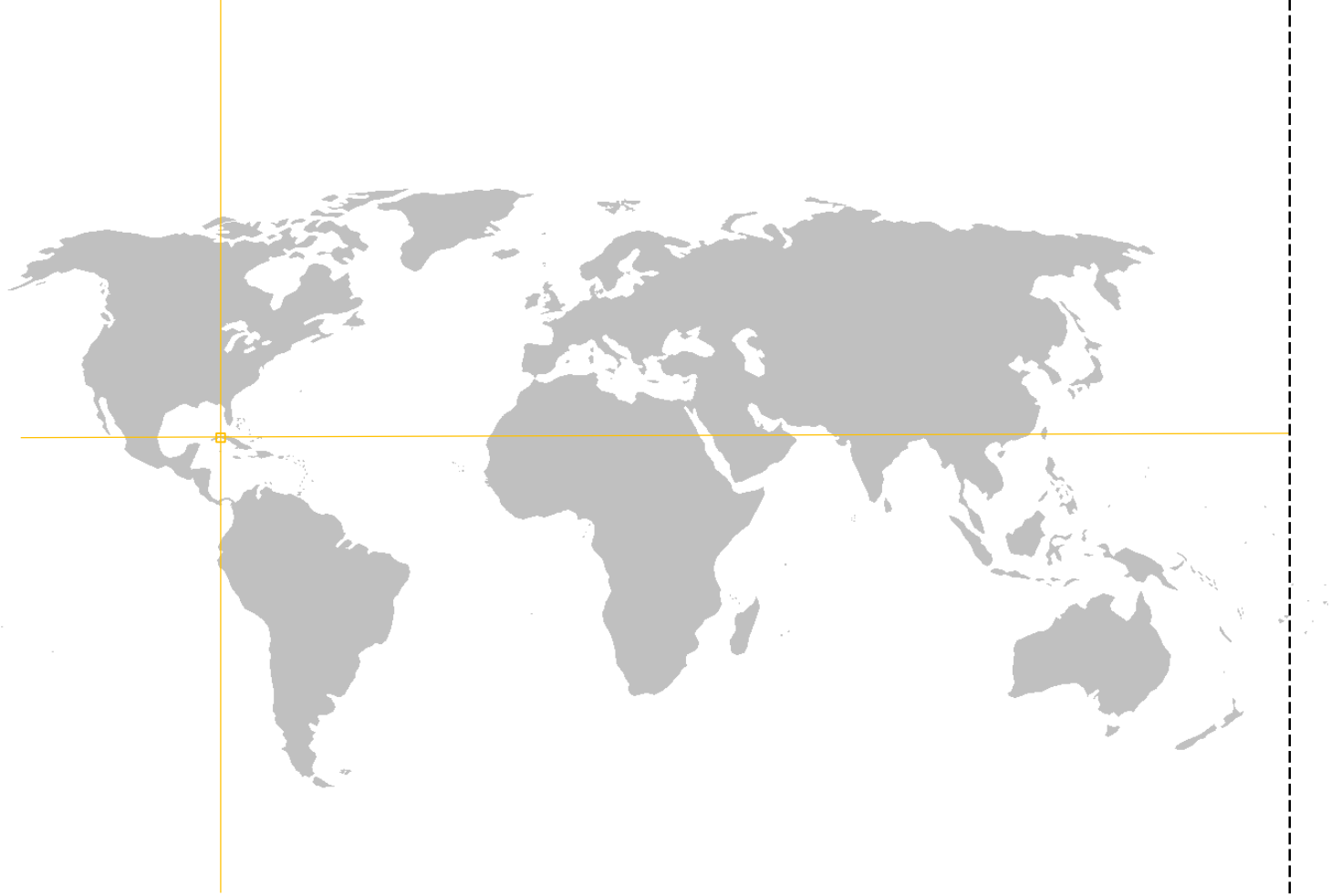
Sancti Spiritus

Holguín

Therefore, what can be better that the type of buildings in which I live, which is a typology that is spread all over Cuba and was originated in the 70s. It is the product of a governmental program with the objective to build as many homes as possible in a short time.

STRUCTURE

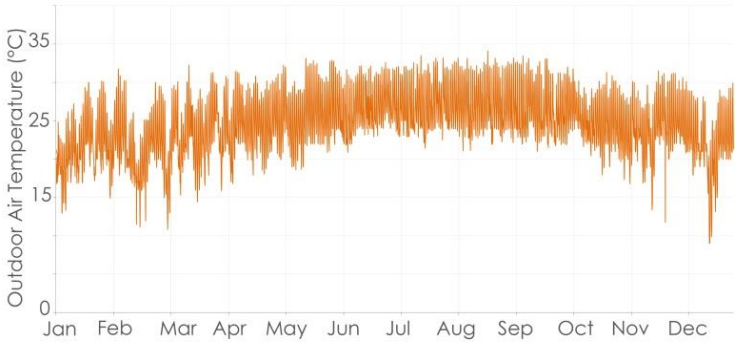
In order to fulfil the objective of improving comfort, the followed structure was first, to identify the problems , later to envision the strategies to tackle the problems . Then, to evaluate them and finally to make a proposal.



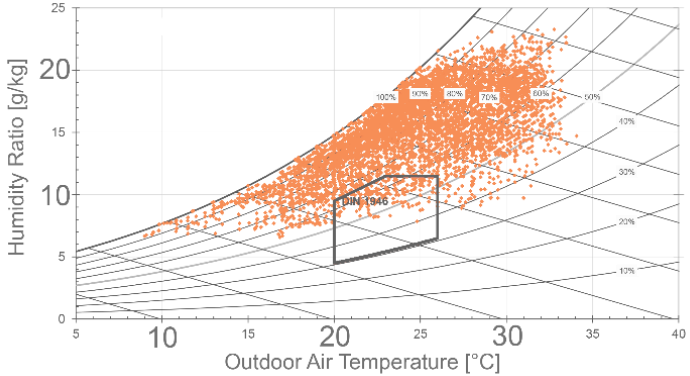
problems

In the search for the main problems to solve. It is needed to start from the location. So, Cuba is a tropical country…

Havana



Havana



problems

Temperatures, humidity and sun angles are high all year long. Therefore, the goal for comfort is to try to keep spaces cool

problems

As important as the climate it is to understand the social context. It is needed to say that for economic and social reasons most of the people who live in these apartments cannot afford to rent or buy a different home, they own their apartments and are attached to them. The government doesn't invest in its retrofit, therefore, these growing families depend on their own economies and the black market.

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problems

On the other hand, these are very vibrant neighboorhoods, stairs and

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problems

Balconies are spaces to socialize.

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problems

The streets are very active, therefore inhabitants feel the need to put borders to try to keep their privacy.

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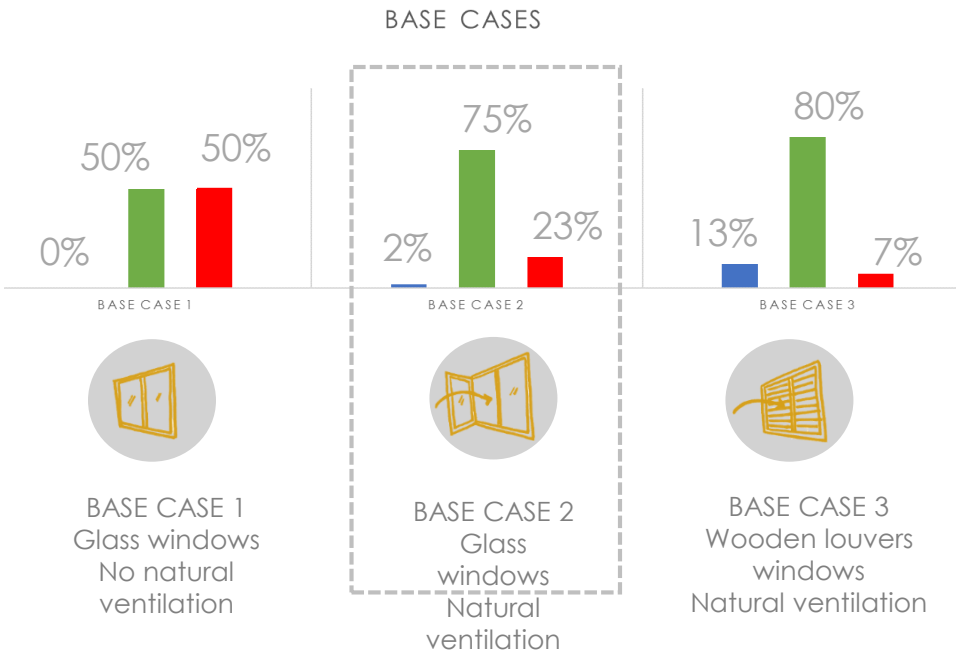
problems

Of course, there are different ways in which the people face this issue to keep noise and views out of their apartments. That is why it was interesting to see how different types of windows and ways of operation impact on comfort. It was taken the old wooden original windows, the new glass windows open and closed for privacy.



problems

This study was useful to see the influence of the natural ventilation and solar protection, and therefore, it was a hint of the possible strategies. From these 3 base cases the number 2 is the most likely to happen because wood is no longer available in Cuba. And therefore this is the situation to improve.

THERMAL COMFORT

air movement

lack of privacy

noise

THERMAL DISCOMFORT

lack of air movement

privacy

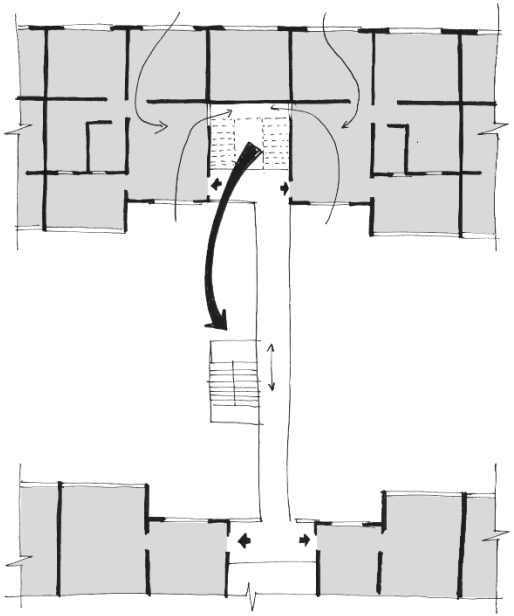
quietness

PROPOSAL

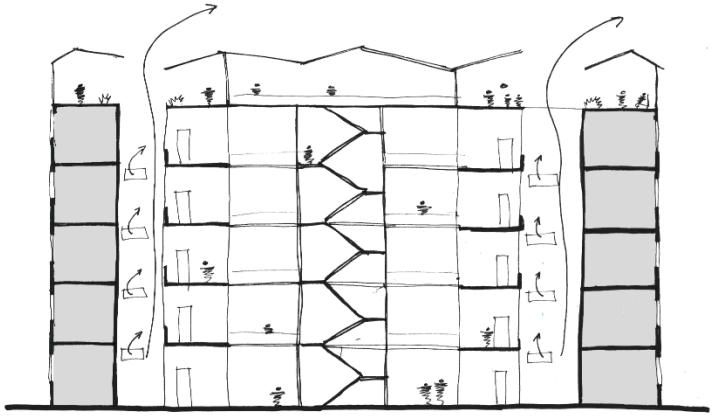
With the previous analysis , it can be concluded that now the users have to choose between having thermal comfort by letting air in but be annoyed by the noise and the people looking, or be quiet and private but hot. My proposal must solve this conflict.

GLOBAL SCHEME

Strategy 1. Stairs out + Atrium



Strategy 2. Shading of the roof

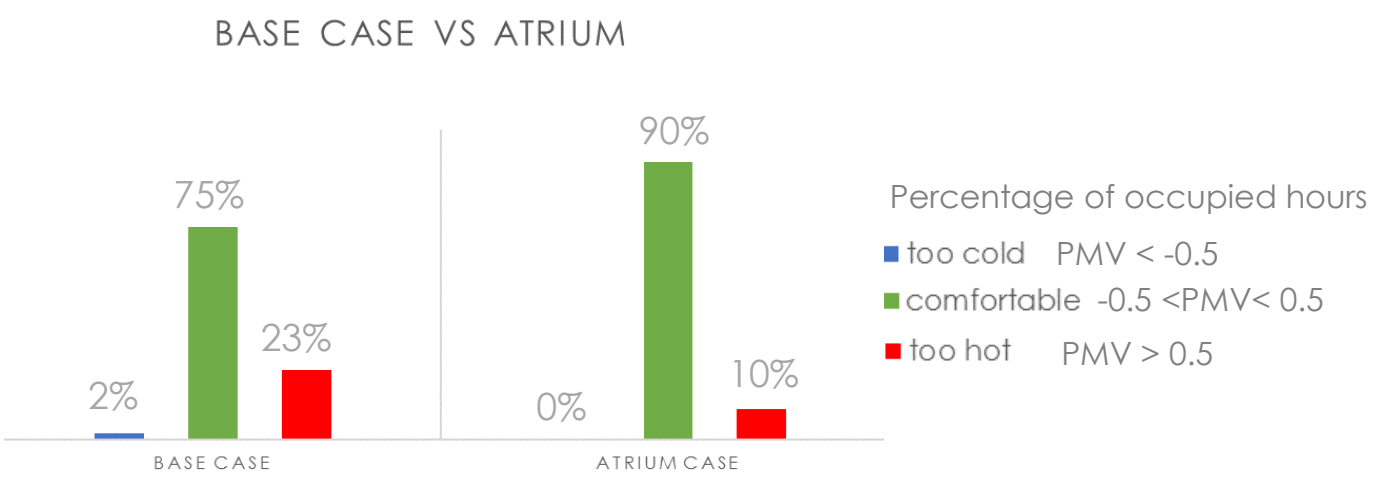


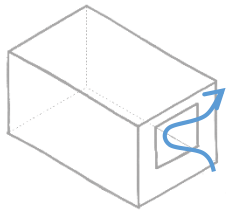
strategies

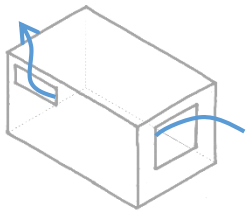
To achieve this objective, it was envisioned a two level program. The first level will be a global scheme in which the first strategy is to take the stairs out from the centre of the building and make this space a sort of atrium, that helps with the cross ventilation of the apartments. The second strategy is to shade the roof to improve the conditions in the apartments less benefited by the atrium.

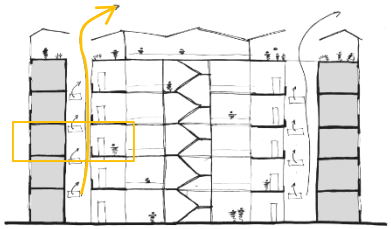
GLOBAL SCHEME

Strategy 1. Stairs out + Atrium









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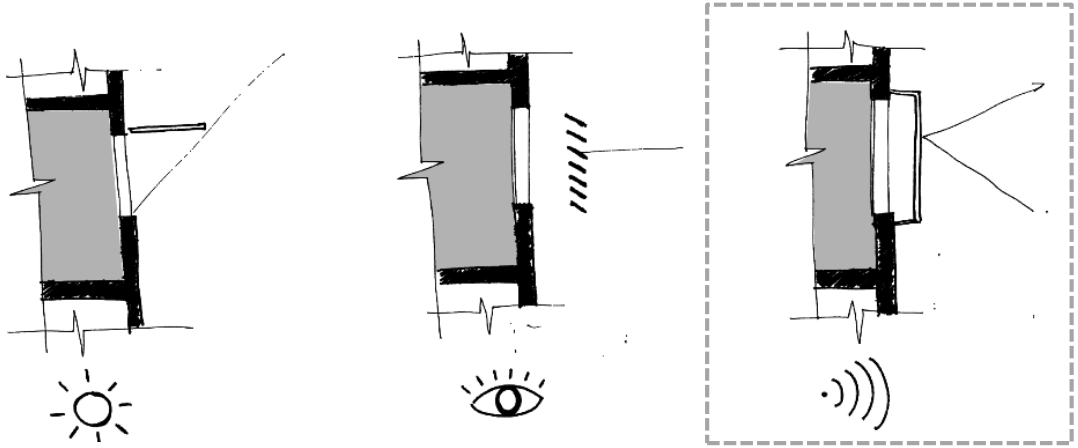
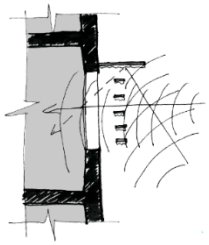
evaluation

In the evaluation it was observed for this apartment a considerable improvement in comfort hours by using the atrium for natural cross ventilation.

LOCAL SCHEME
DIY device

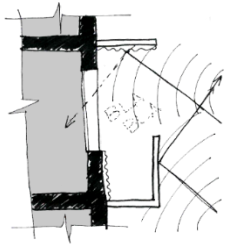


FINS, LINTELS, SCREENS



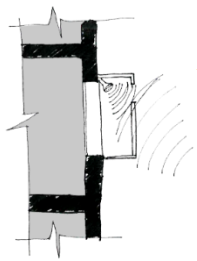
SECTION

BALCONIES



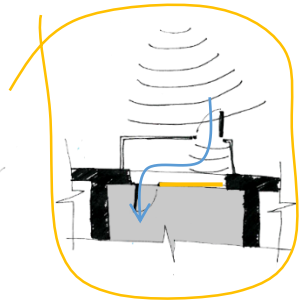
SECTION

ACTIVE NOISE CONTROL



SECTION

PLENUM WINDOWS



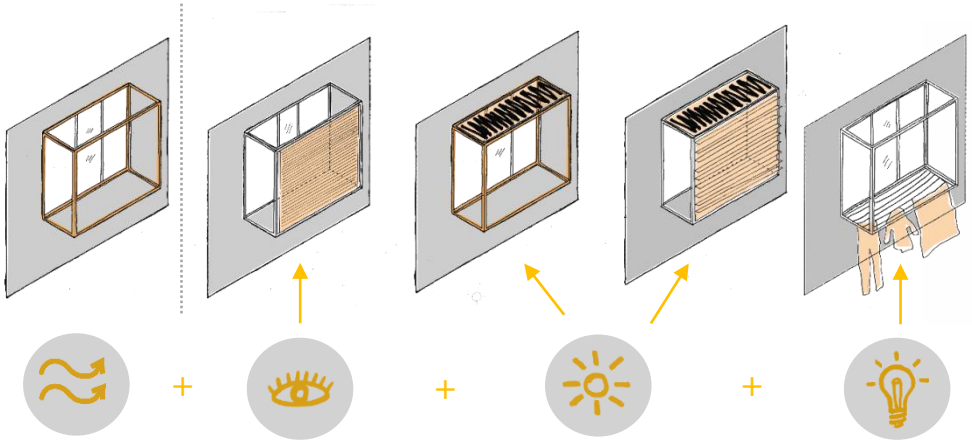
PLAN

strategies

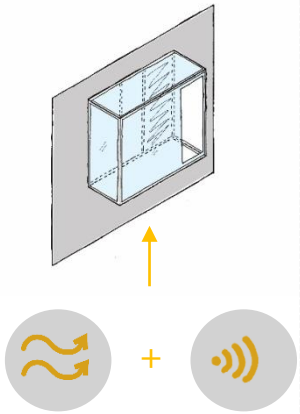
However, a most local and affordable program was necessary to give the families the tools to pursue their comfort independently. The idea for this scheme was to have a flexible and simple “Do It Yourself” system that could provide solar protection, privacy and noise protection. However, BY getting into the acoustics world it was evident that the only effective way to protect the spaces from different frequencies noises coming from all possible directions was to have a box in front of the window with two openings located in opposite positions. Solution that is too complex to be integrated into this system.

strategies

DIY DEVICE 1



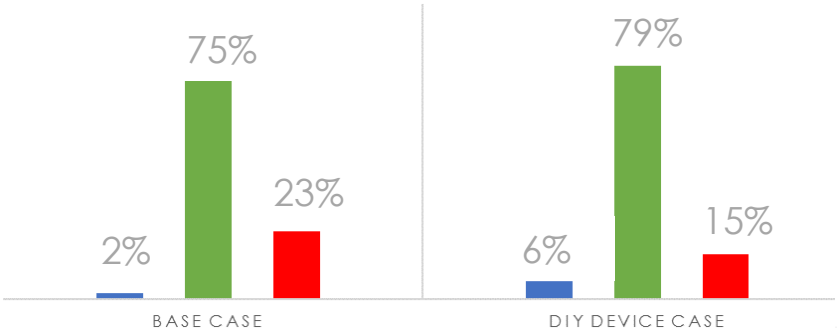
DIY DEVICE 2



Therefore, two devices or systems are proposed. The acoustics one needs to be fix. However, the other functions are integrated into a simple metal frame, that can receive elements like curtains, overhangs, etc, all allowing natural ventilation.

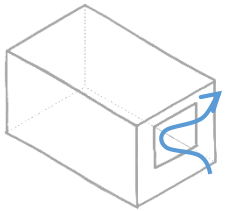
evaluation

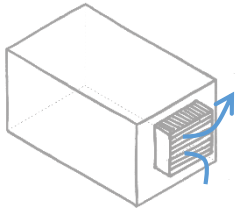
BASE CASE VS DIY DEVICE 1

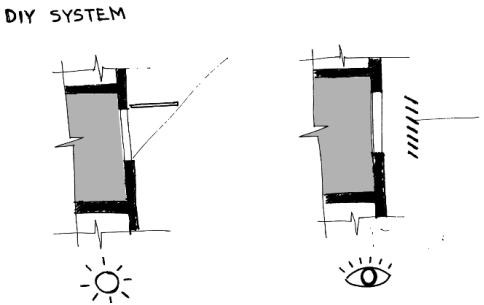


Percentage of occupied hours

- too cold PMV < -0.5
- comfortable -0.5 <PMV< 0.5
- too hot PMV > 0.5

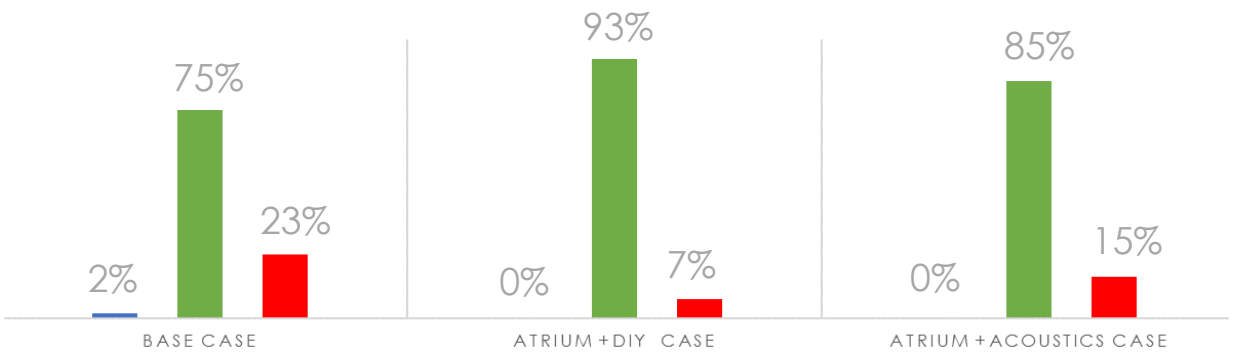


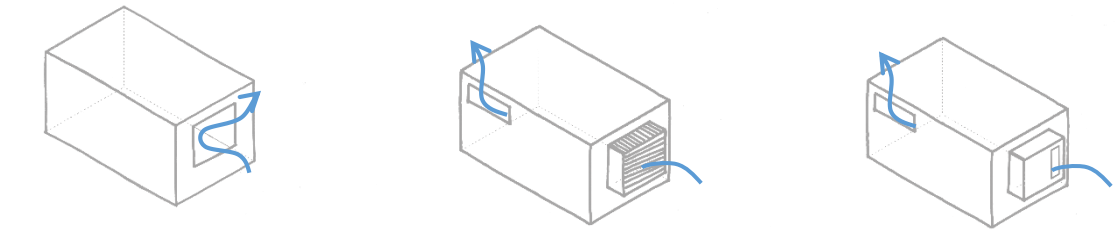




The impact of this device on comfort was evaluated and the hot hours were reduced.

BASE CASE VS GLOBAL & LOCAL SCHEME





Percentage of occupied hours

- too cold PMV < -0.5
- comfortable -0.5 <PMV< 0.5
- too hot PMV > 0.5

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evaluation

And if it is combined with the global scheme the hours of comfort are increased substantially. Therefore the final proposal includes both schemes.

proposal

Thanks