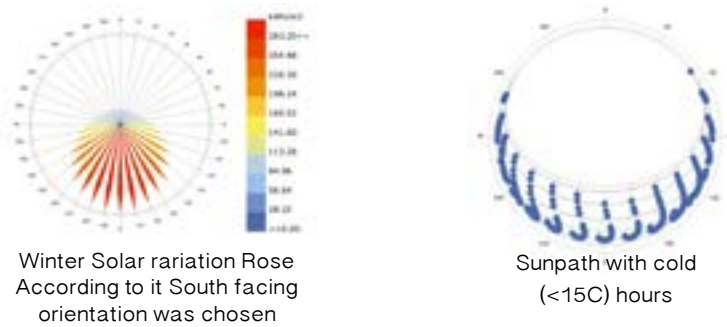
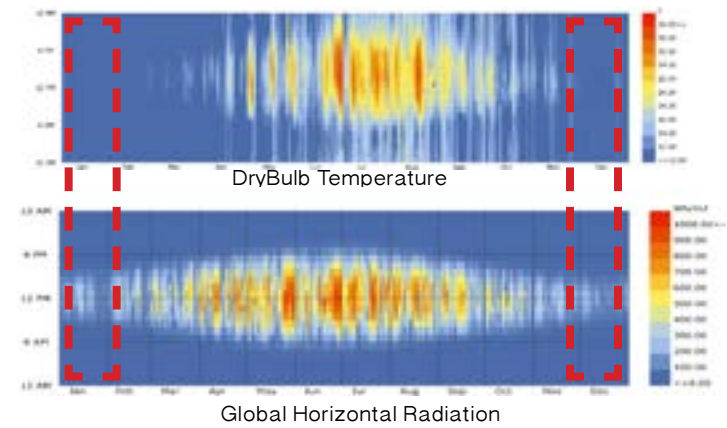


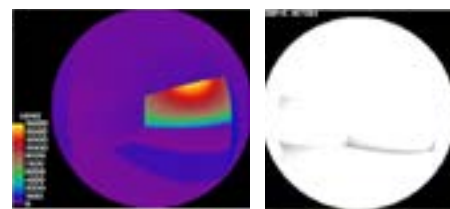
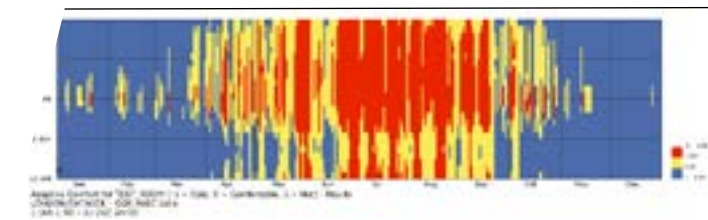
CLIMATE ANALYSIS

Due to low outdoor temperatures in winter (January, December) and lack of the radiation, it is impossible to create thermal comfort inside without systems on these months. However, energy usage for HVAC may be significantly reduced by passive heating and cooling strategies - thermal mass, glazing, shading and ventilation.



BASECASE

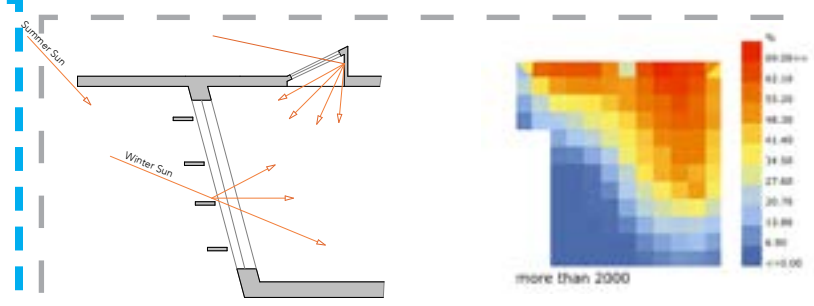
Adaptive comfort without using systems is 25% with prevailing cold hours (51%). DGP on July 9am (which is the most problematic hour for this case is 0.46)



Daylight Autonomy

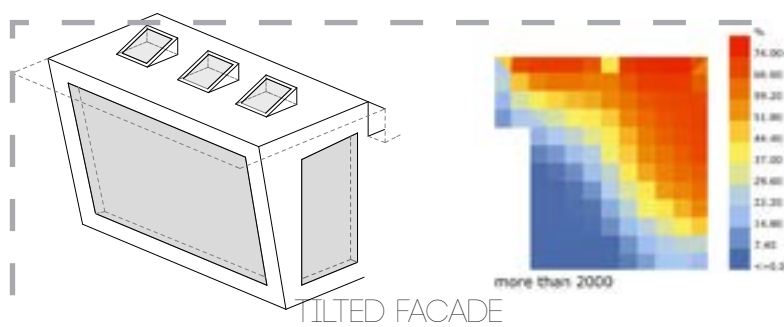
WORKFLOW

1. Let as much solar radiation inside as possible. Glazing facade aims to reduce cold uncomfortable hours.
 2. Since glazing facade leads to overheating and glare, design shading
- The main focus of the project was to find a balance between thermal and light comfort, since increase in one leads to reduction in the other.



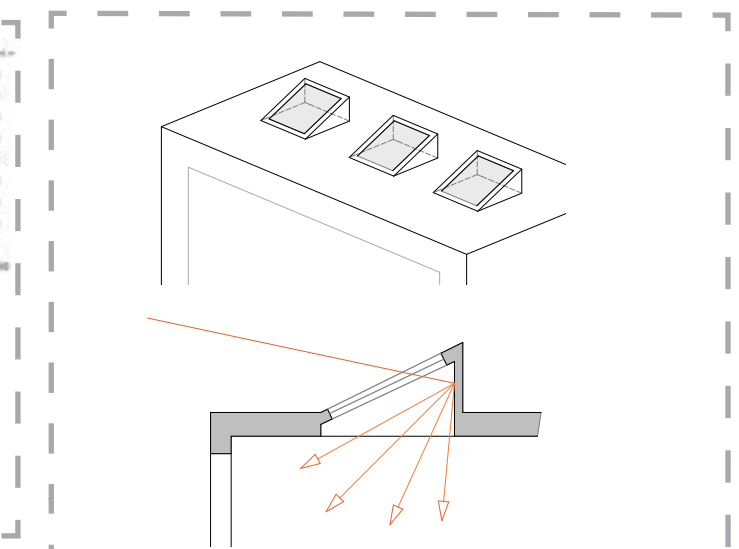
LOUVERS & OVERHANGING ROOF

To prevent overheated and over lighted spaces as well as to keep glare on acceptable level roof overhang were designed. Horizontal louvres diffuse sunlight and prevent glare. Have been tried different depth of louvers .



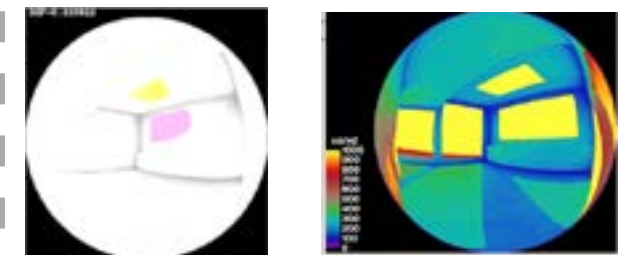
TILTED FACADE

Tilted facade by itself prevent high summer sun rays to overheat and overlight the room without additional shading. the angle is chosen by sensitive method. However space is still overlighted. DGP is 0.45

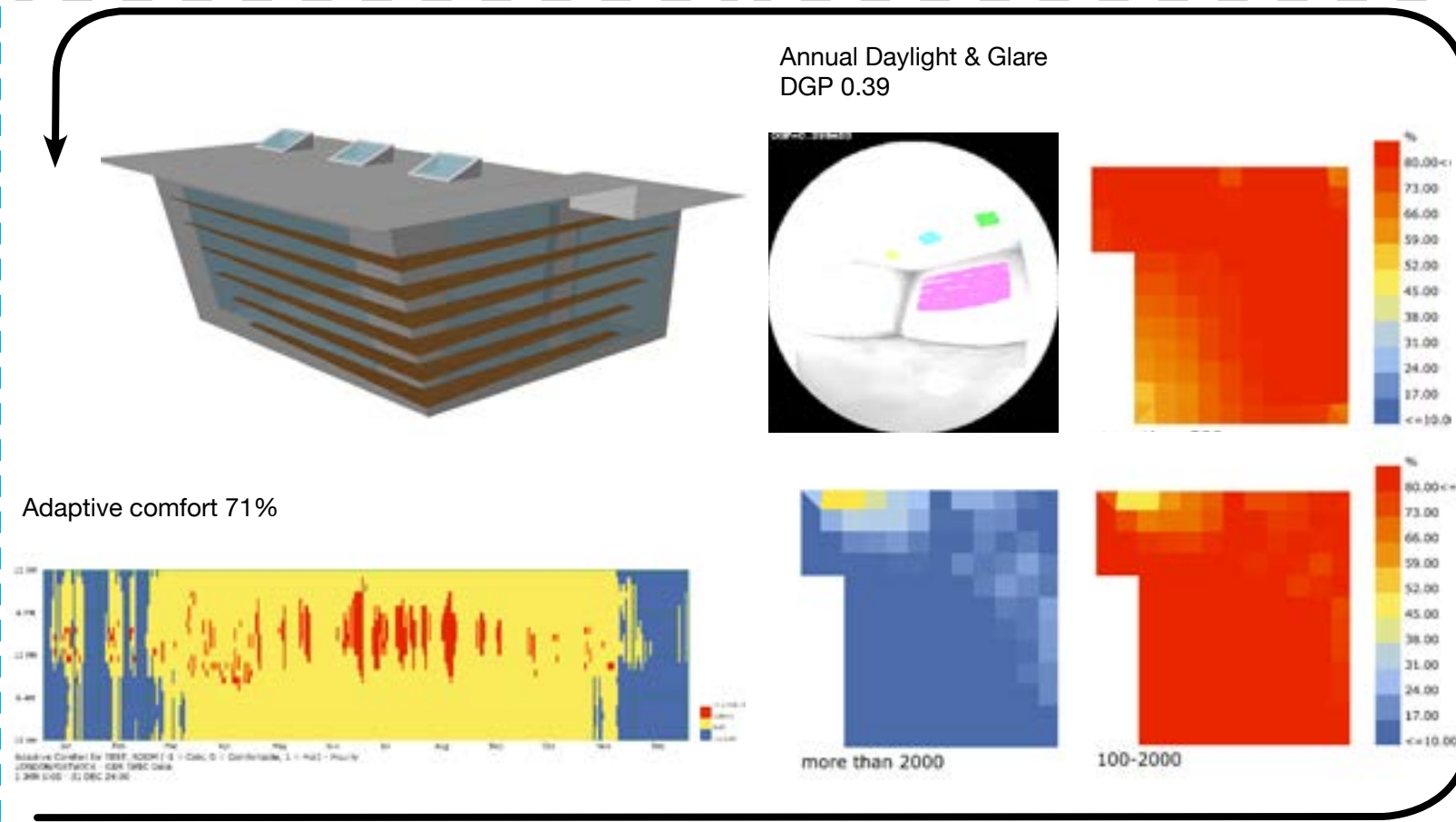


SKYLIGHTS

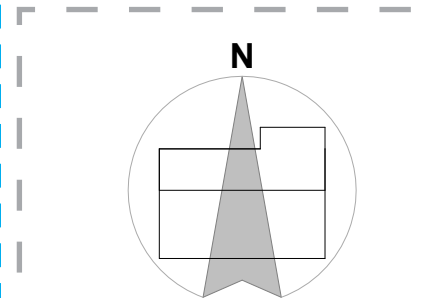
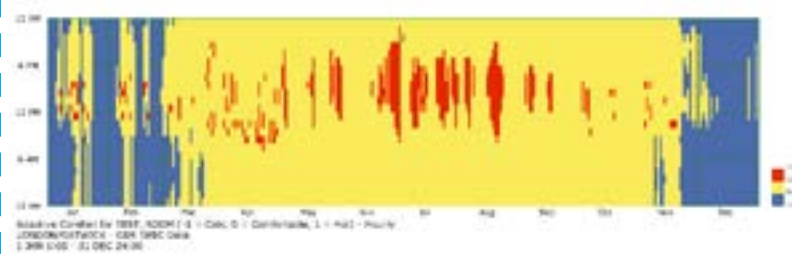
Windows on flat roof let even more solar heat. Final design is chosen to diffuse light all over the room and let more winter sun rays, while blocking summer ones



Simple flat skylight : DGP = 0.82

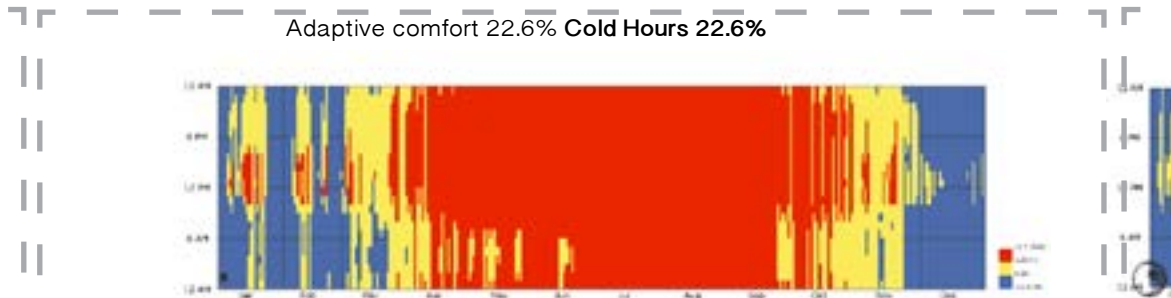


Adaptive comfort 71%



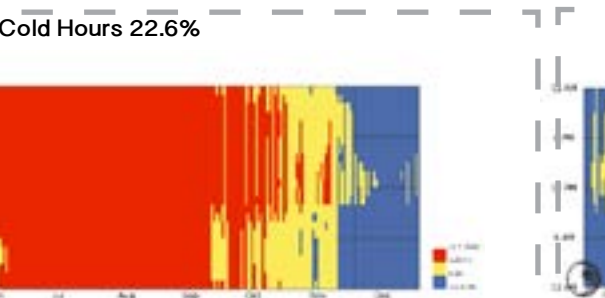
ORIENTATION

Due to the direction of the prevalent solar irradiation the orientation has been chosen. Main facade is facing south



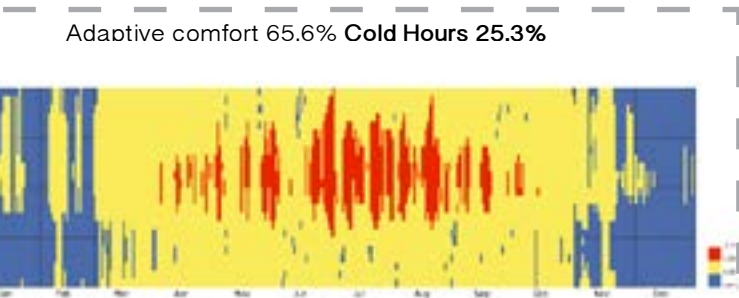
THERMAL MASS & GLAZING

Increasing glazing area (80% south, 70% east, 40% skylights) to let solar heat in and adding thermal mass (by changing materials) to absorb it and to deal with temperature swings



INSULATION

While south and north - facing facades as well as roof designed to have a high thermal mass, west-east facades have a layer of insulation, due to cold wind from the east and possible overheating by evening west sun



NATURAL VENTILATION

Large windows area creates more comfortable hours in cold weather but to prevent overheating in during warm outside temperature natural ventilation is designed. Comfort increased to 65.6. However, even though comfort increased, with such big glazing glare and DLA are not acceptable.