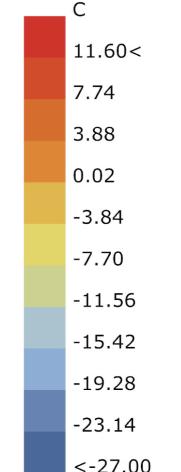
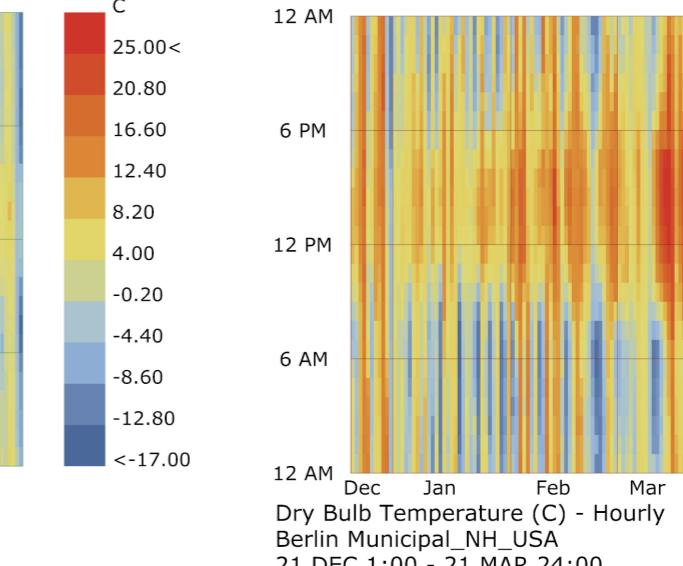
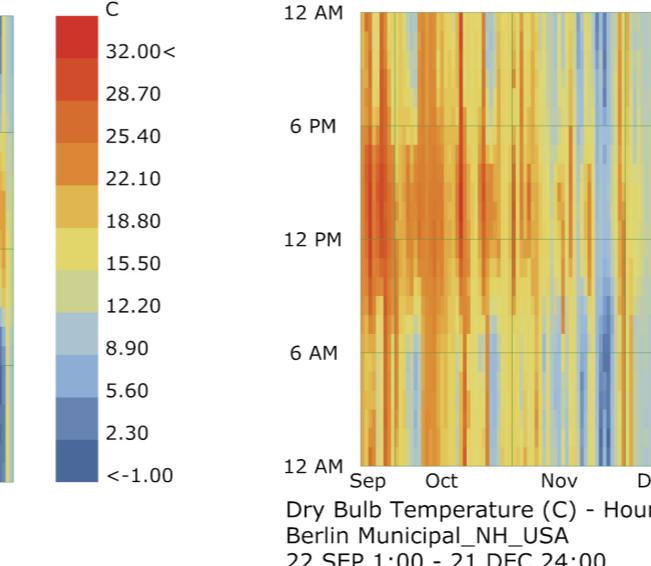
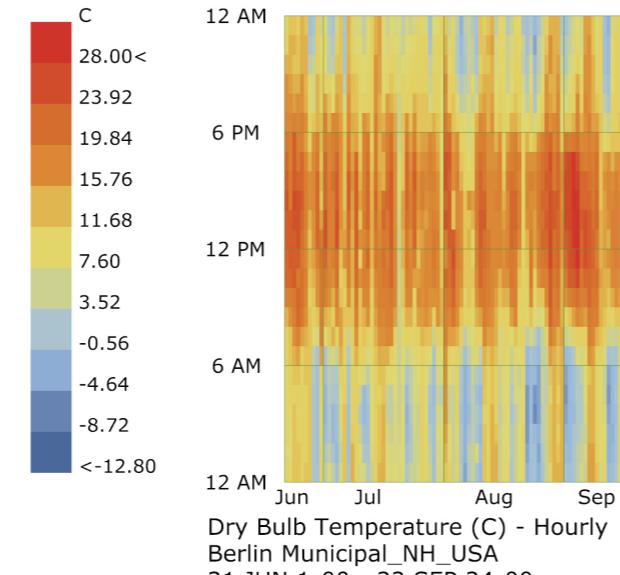
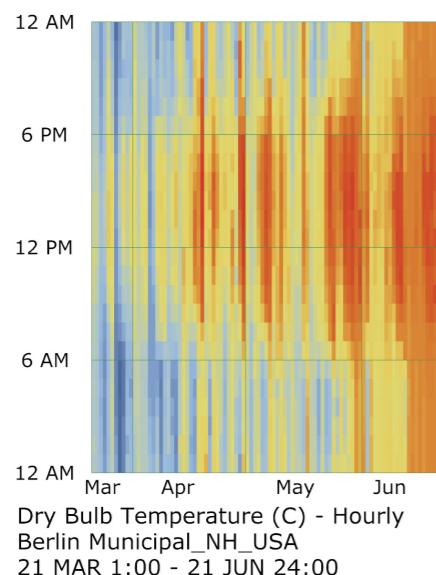
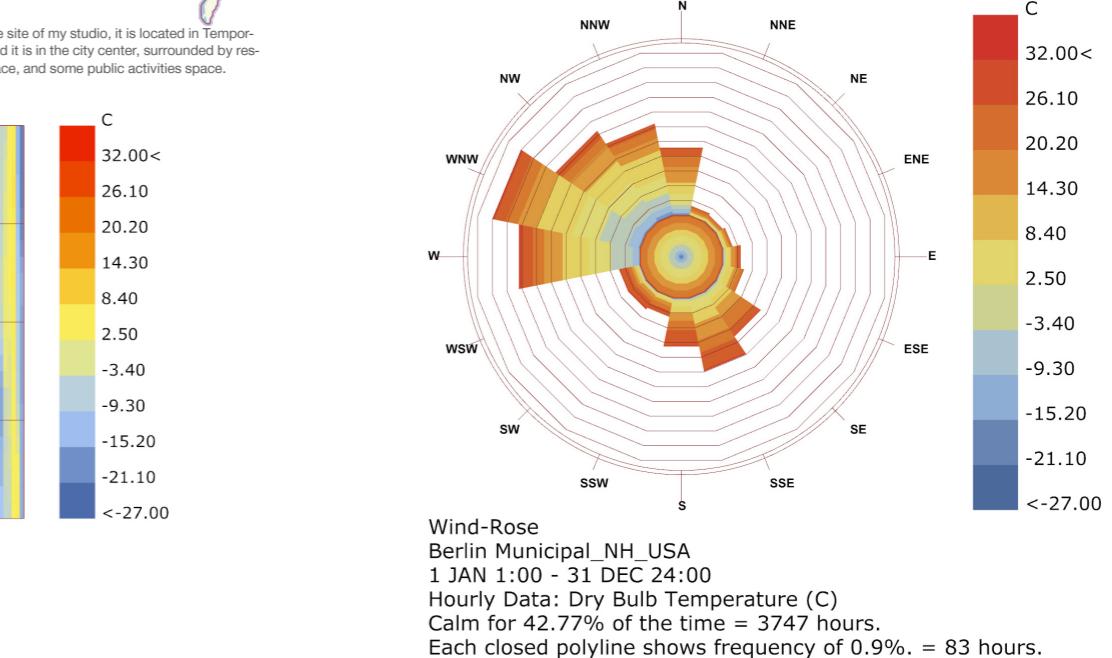
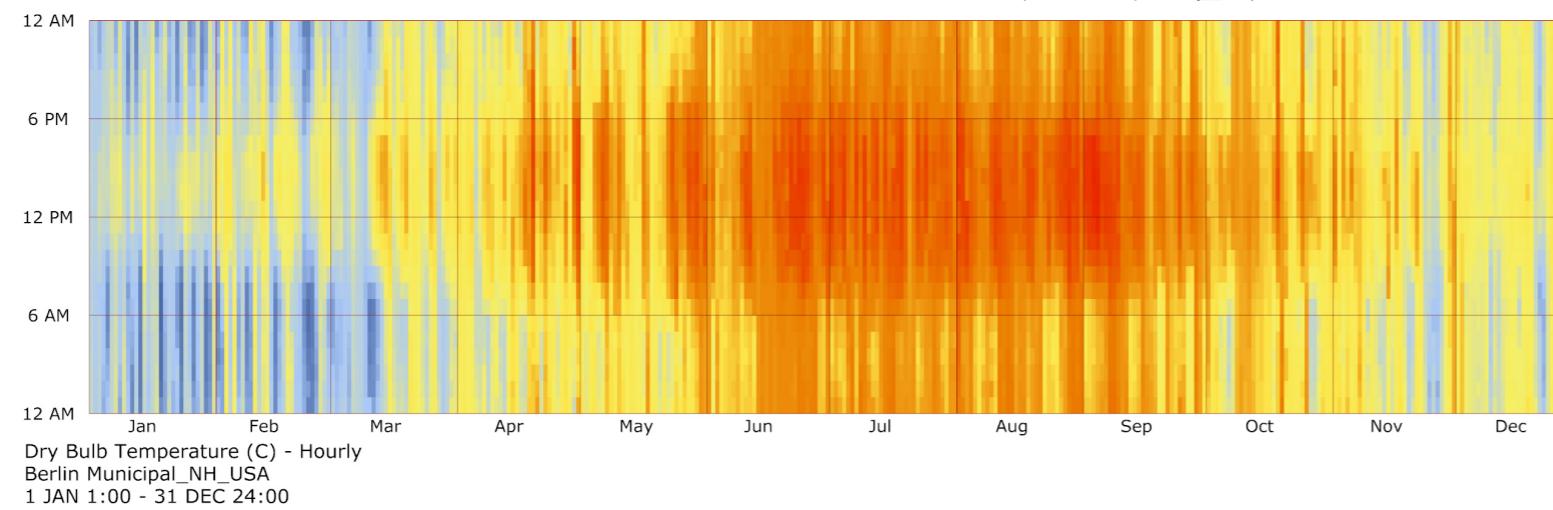


# ENERGY SIMULATION

## YUNLONG ZHANG

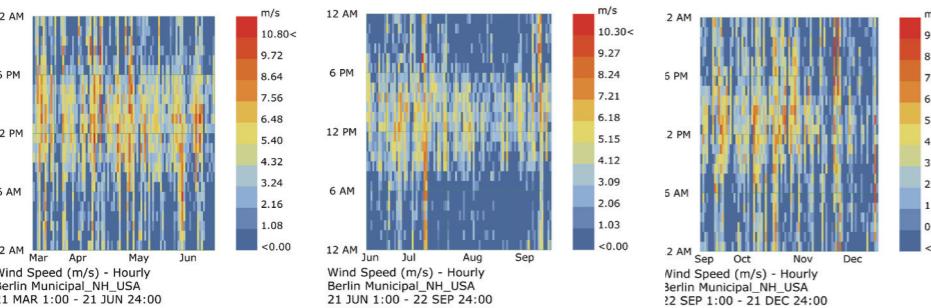
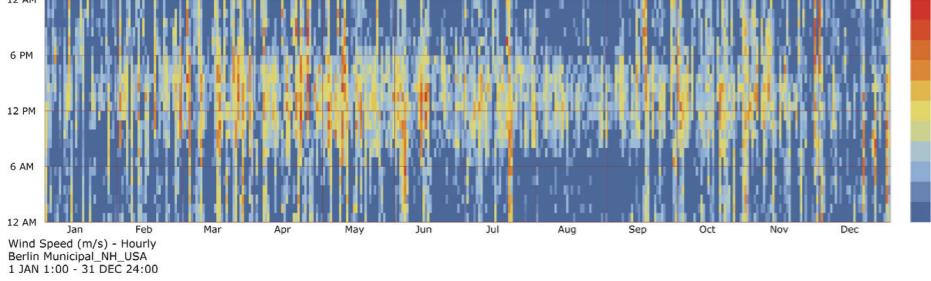


From these images , the most warm month of Berlin is in July and August, the average temperature is 18.6 °C. The most cold month of Berlin is in January, with an average temperature of -0.9 °C.

From May, Berlin began to warm up, and the temperature began to fall in September. The annual average temperature of 9.4 °C.

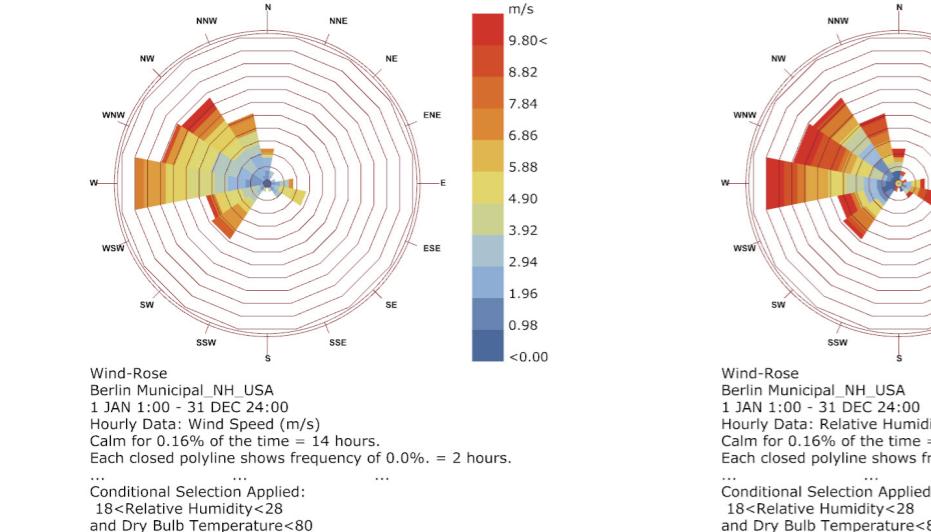
# ENERGY SIMULATION

## YUNLONG ZHANG



The wind speed in the region is appropriate, the northwest wind may have an impact on people's living. And the average wind speed in spring is 2.6m/s, in summer is 1.6m/s, in autumn is 1.9m/s, in winter is 1.8m/s.

The wind speed is not bad in Berlin. We should only think about wind speed in spring.

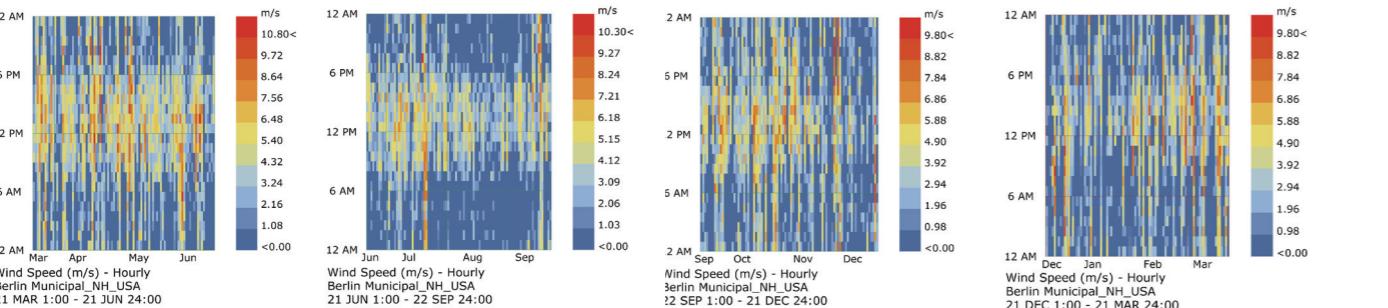
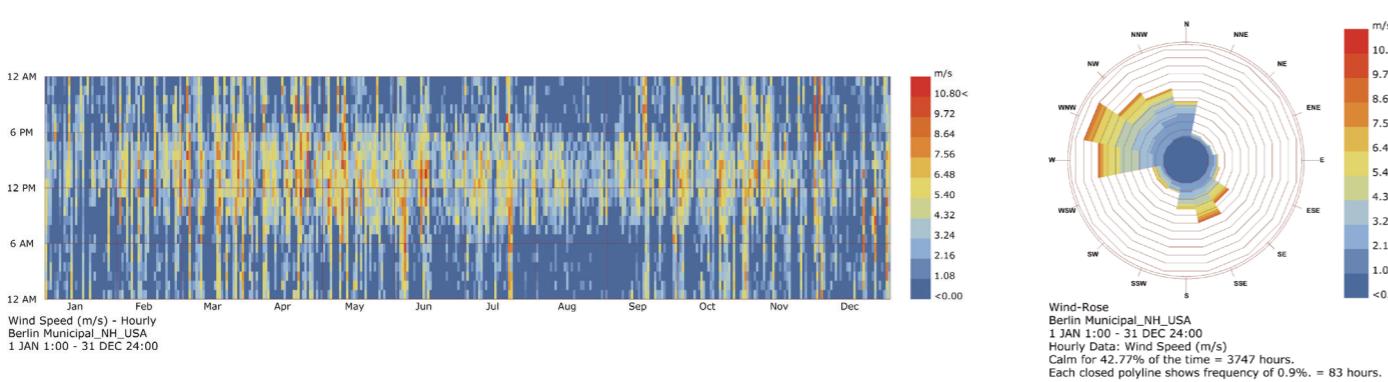


If we control all the conditions in a comfortable range.

For example: temperature is during 18°C -28°C, humidity is less than 80%, wind speed less than 2 m/s.

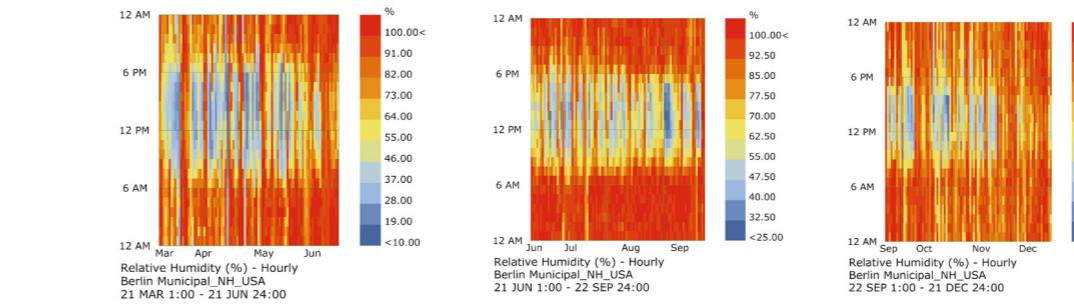
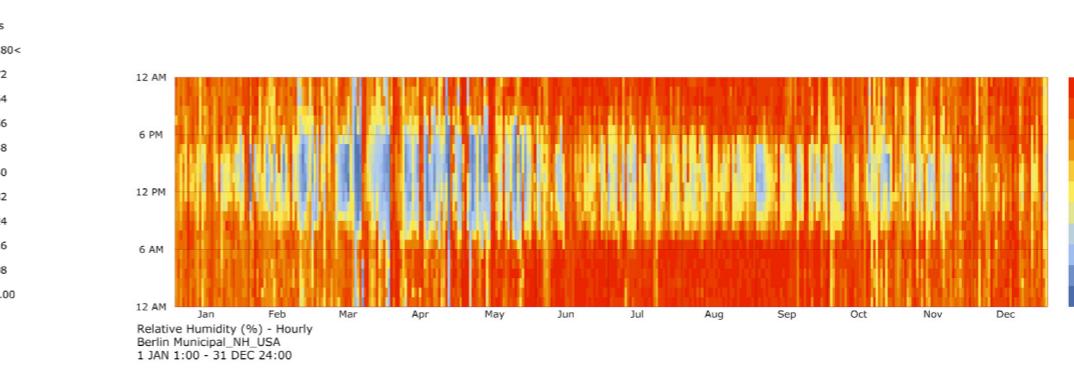
We can see that there are less conditions meet the criteria.

So if we design the residential in Berlin, We need to think about how to protect temperature , reduce humidity and limit the wind speed .



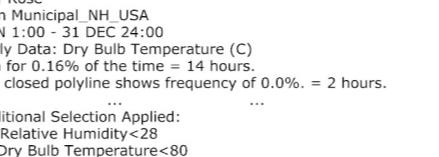
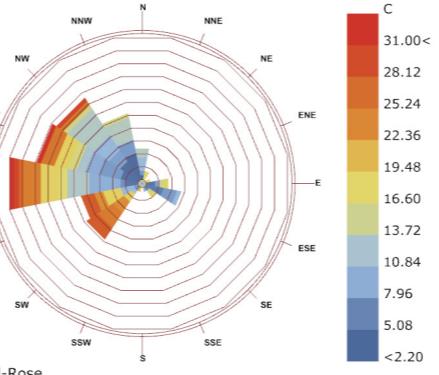
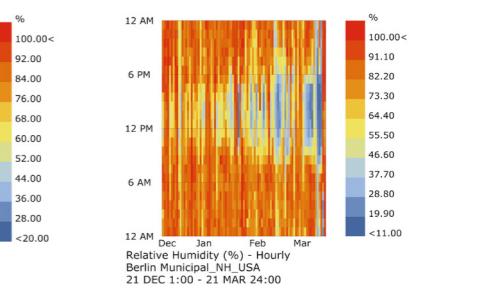
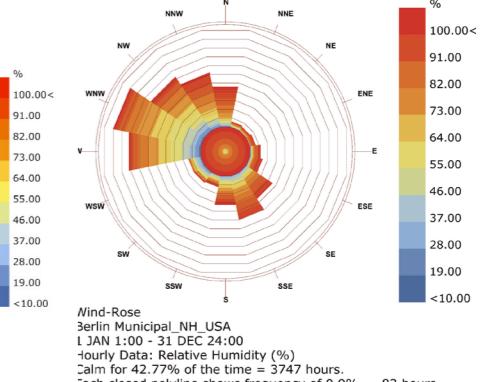
Winter in Berlin is cold, and the annual rainfall is 580 mm, the rainfall is more uniform in a year, but slightly more summer rain. Winter have more snow, snowfall about the total annual precipitation of 1/4 to 1/5. The average annual snow cover is 50 days.

Because of this, the huimidity of Berlin is high, and the data not change too much in a year. The residential in Berlin must think about how to reduce the huimidity.



Winter in Berlin is cold, and the annual rainfall is 580 mm, the rainfall is more uniform in a year, but slightly more summer rain. Winter have more snow, snowfall about the total annual precipitation of 1/4 to 1/5. The average annual snow cover is 50 days.

Because of this, the huimidity of Berlin is high, and the data not change too much in a year. The residential in Berlin must think about how to reduce the huimidity.



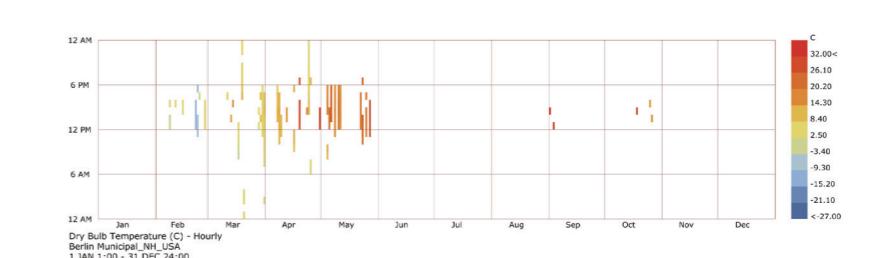
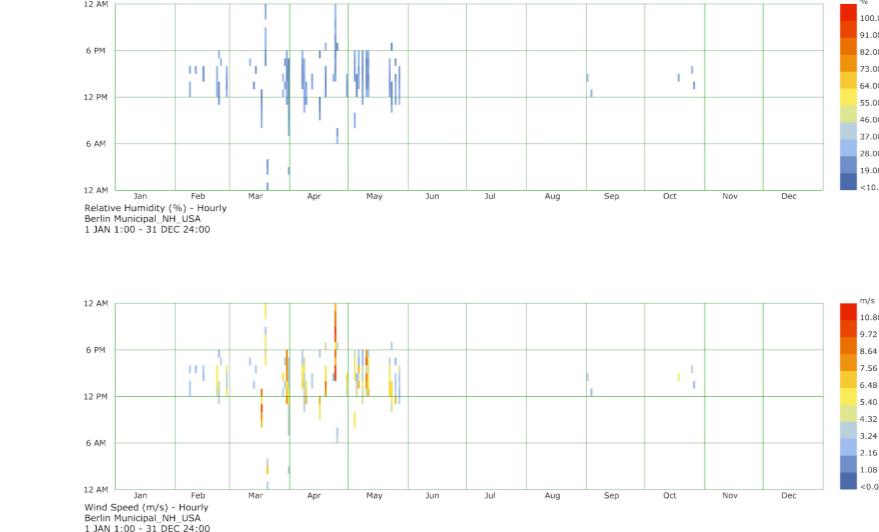
...  
Conditional Selection Applied:

18<Relative Humidity<28

and Dry Bulb Temperature<80

and Dry Bulb Temperature>2

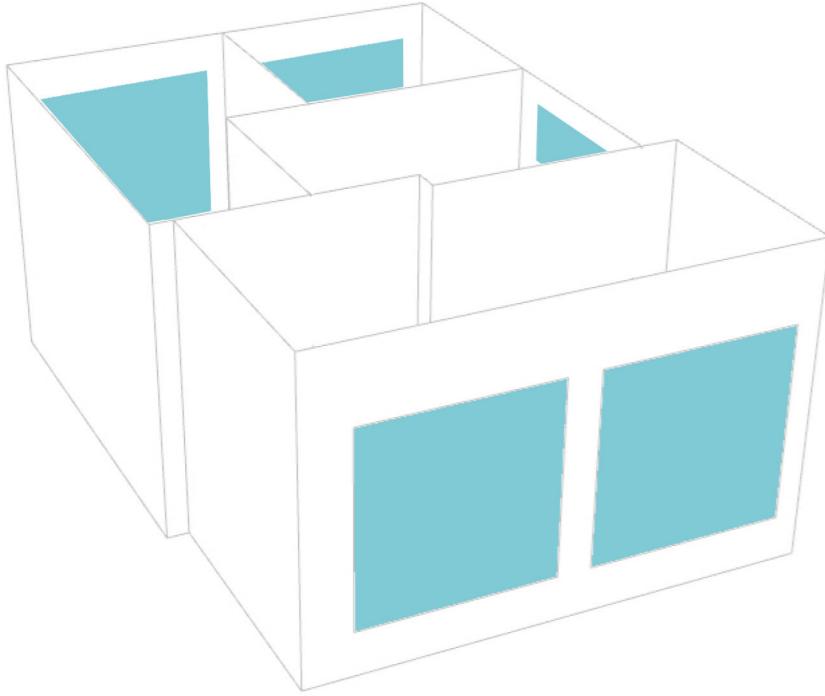
158.0 hours of total 8760.0 hours (1.80%).



# ENERGY SIMULATION

## YUNLONG ZHANG

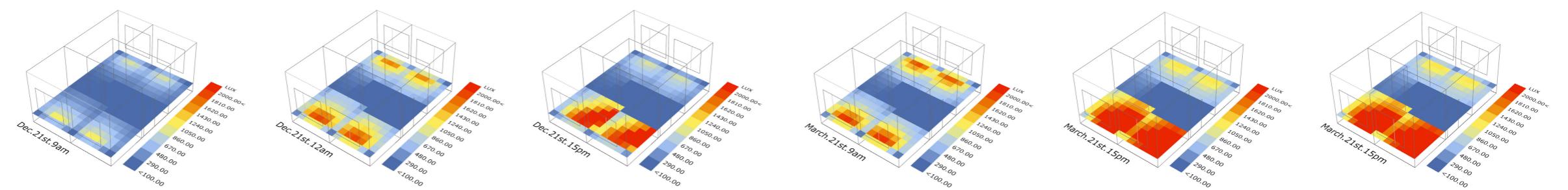
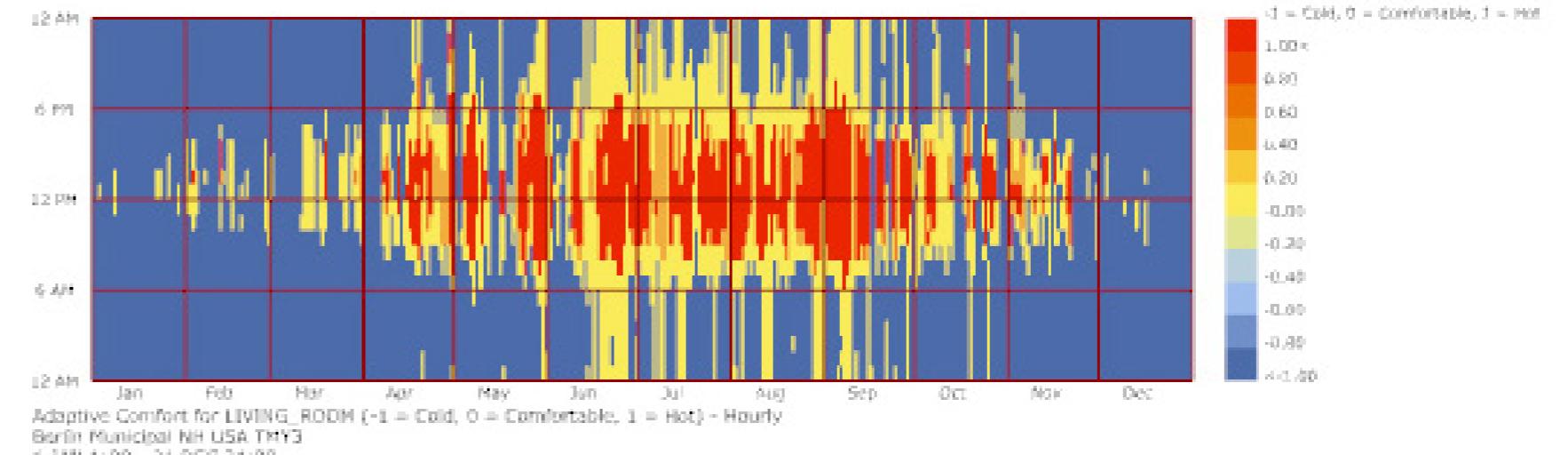
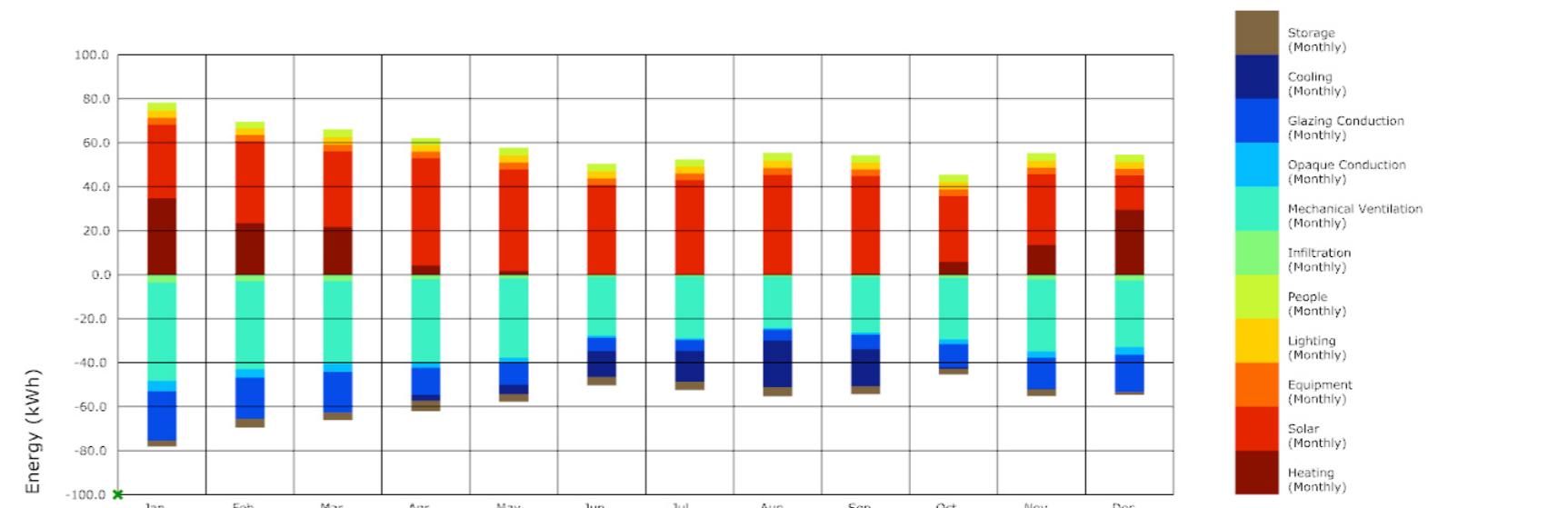
### 2.0 Zone Analysis



Comfortable : 27.82

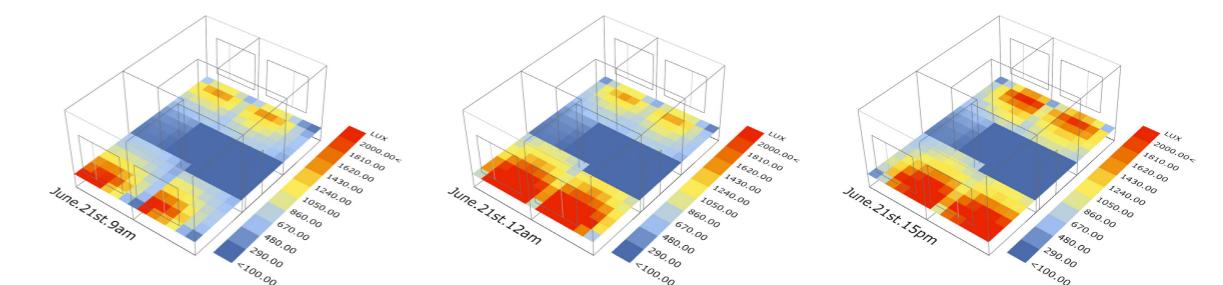
hot : 16.33

cold : 55.85



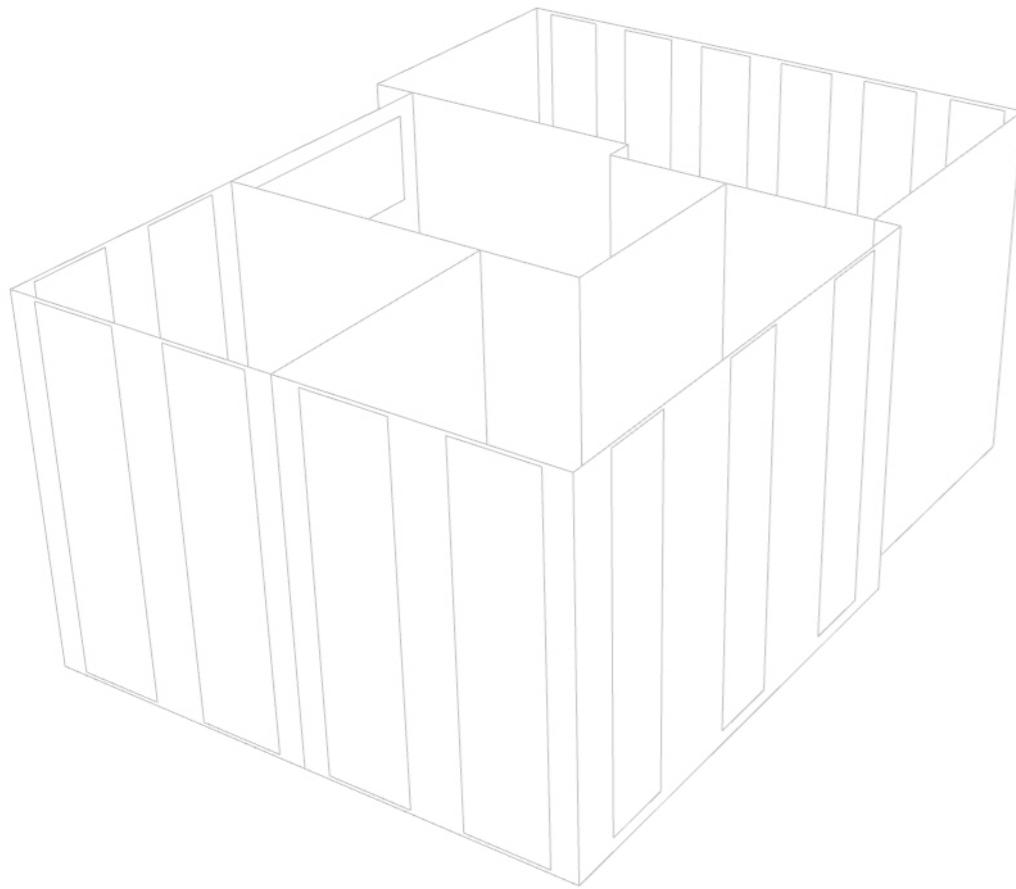
Too much hours are on the low temperature level.

Next sept should try to increase to ratio of opening in order to reduce the radiation.

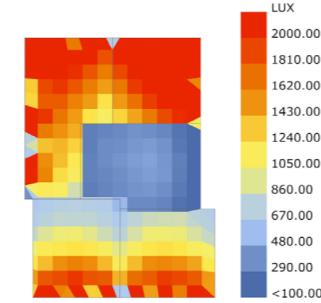


# ENERGY SIMULATION

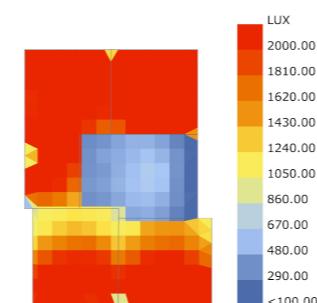
## YUNLONG ZHANG



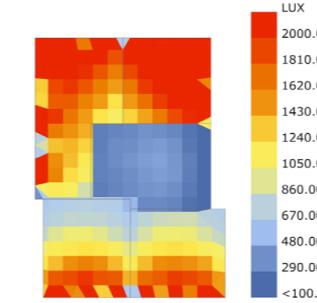
Comfortable : 42.11  
hot : 31.38  
cold : 26.51



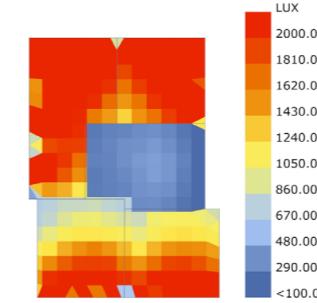
Mar. 21st \_ 9:00



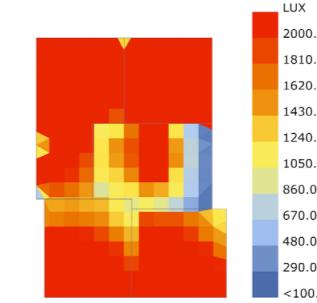
Mar. 21st \_ 12:00



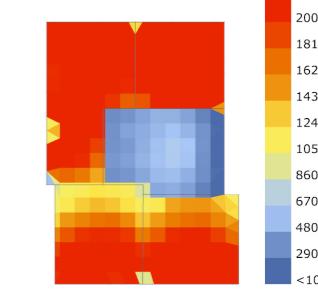
Mar. 21st \_ 15:00



Jun. 21st \_ 9:00



Jun. 21st \_ 12:00

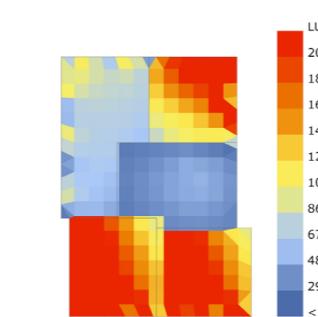
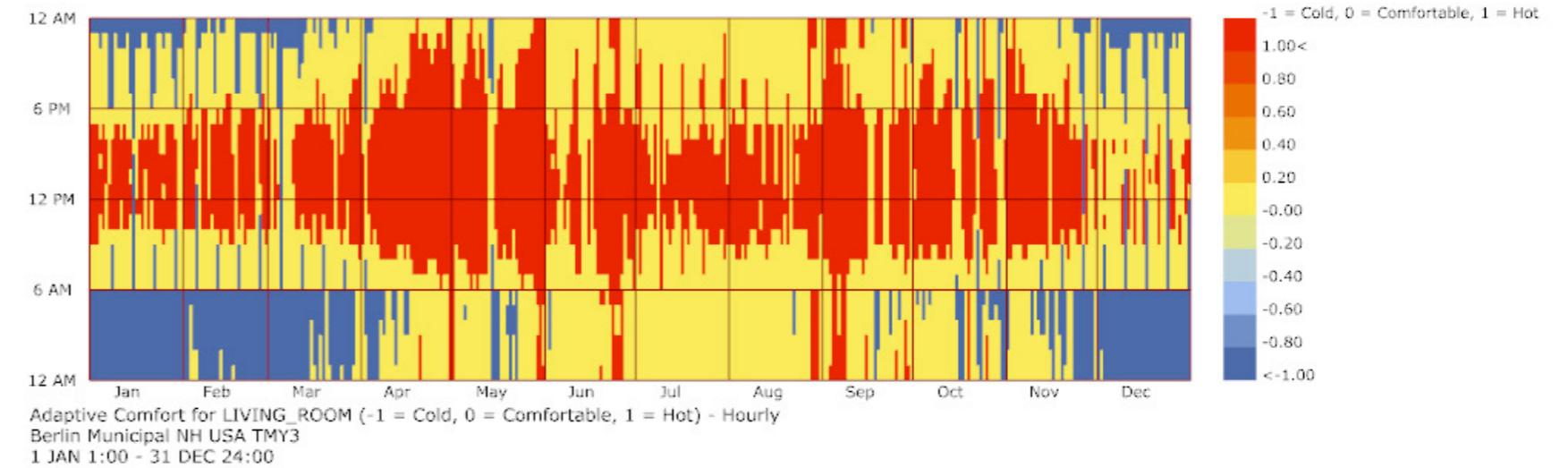
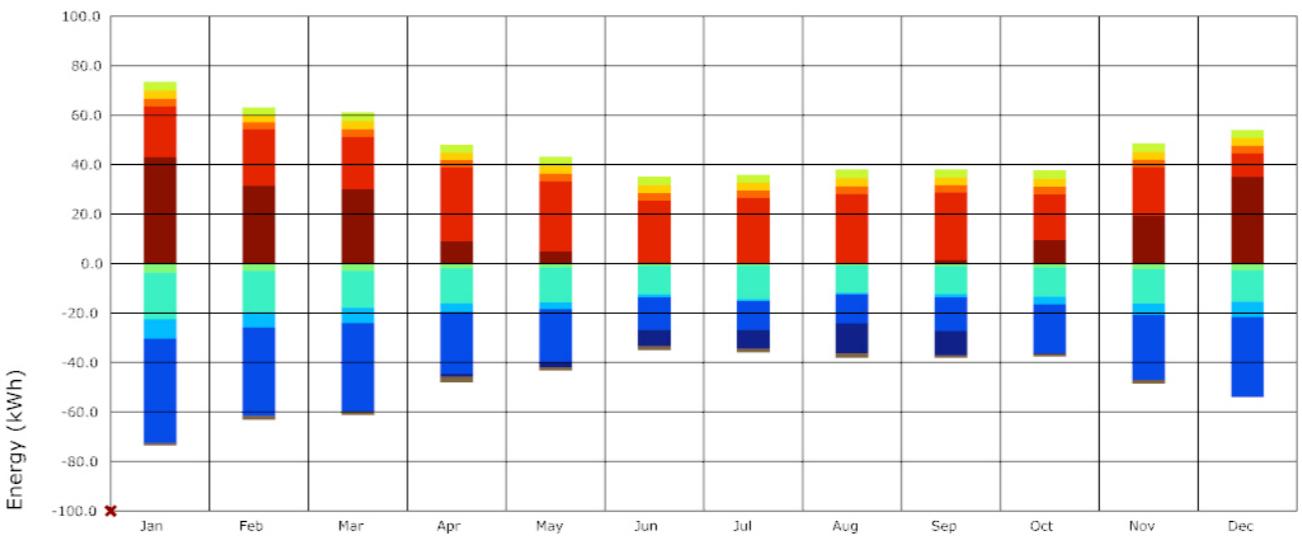


Jun. 21st \_ 15:00

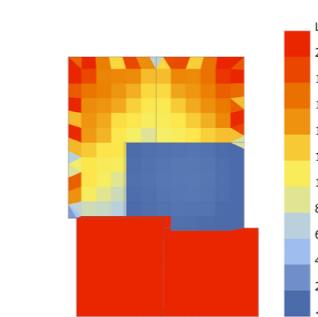
Too much hours are on the hight temperature level .

Next sept

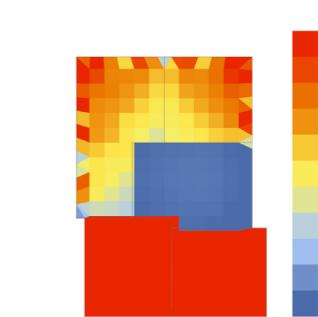
- 1.should try to add the windows on east and west facades in order to increase the infiltration.
- 2.should try to redesign the openings on facades in order to obtain the solar radiation in afternoon which will keep the room warm in night.
- 3.should try to add natural ventilation to this room. Also, try to change the construction options of the envelop.



Dec. 21st \_ 9:00



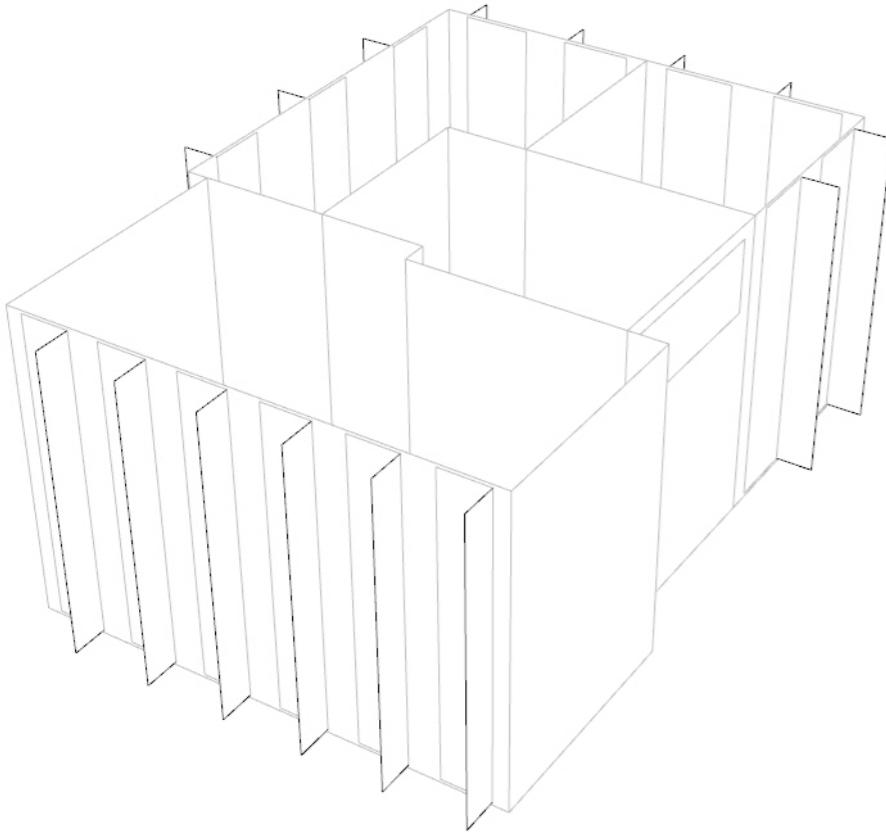
Dec. 21st \_ 12:00



Dec. 21st \_ 15:00

# ENERGY SIMULATION

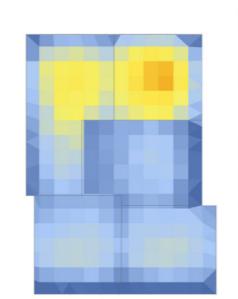
## YUNLONG ZHANG



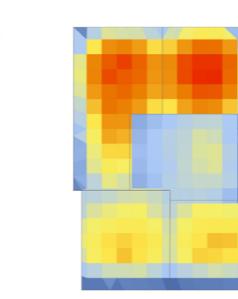
Comfortable : 53.88

hot : 23.08

cold : 23.04



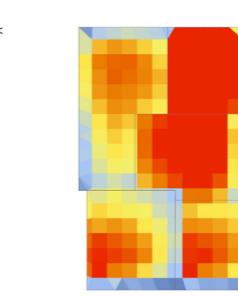
Mar. 21st \_ 9:00



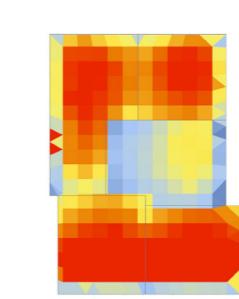
Mar. 21st \_ 12:00



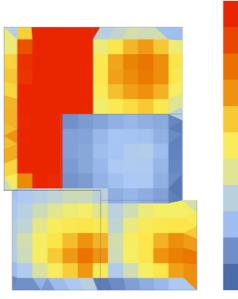
Mar. 21st \_ 15:00



Jun. 21st \_ 9:00



Jun. 21st \_ 12:00



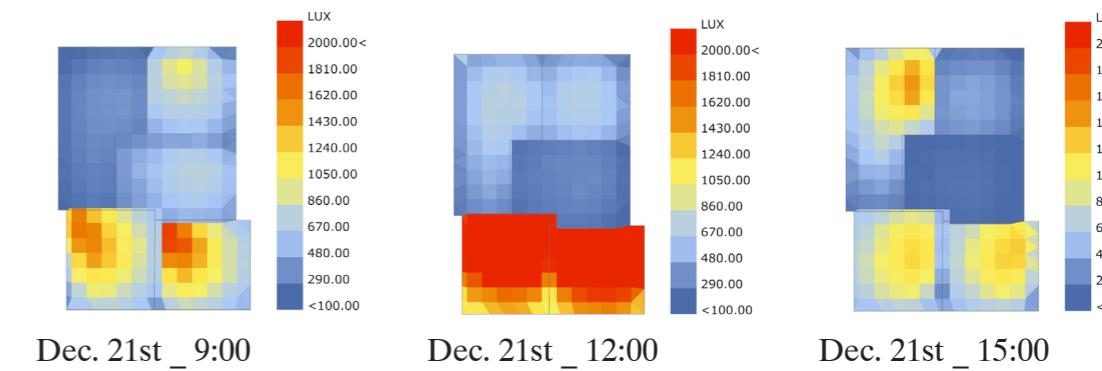
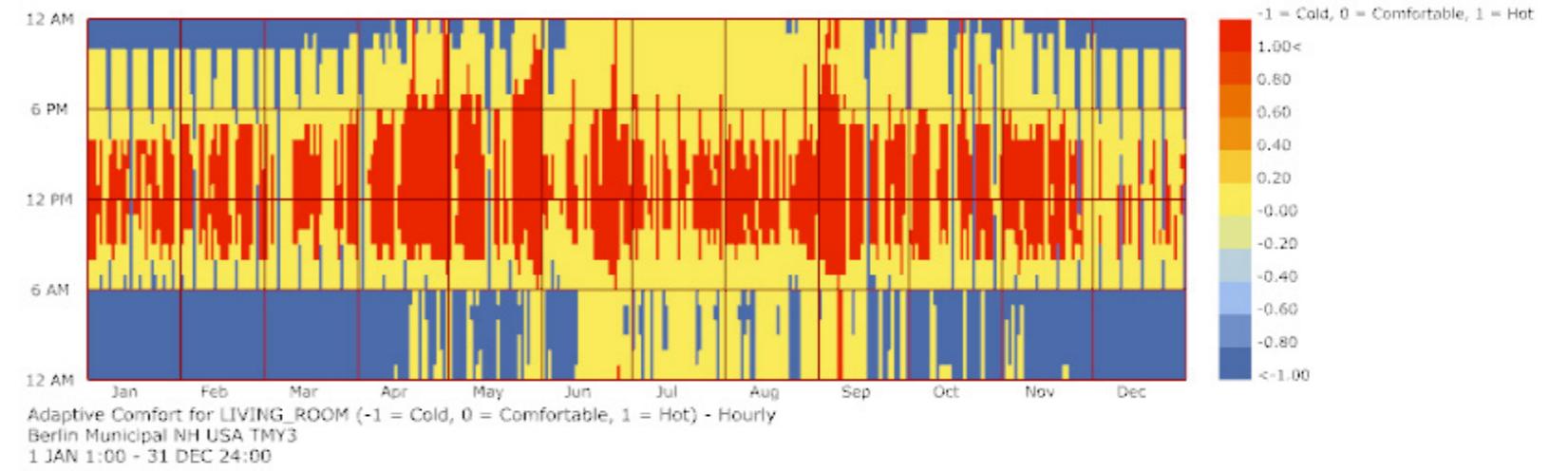
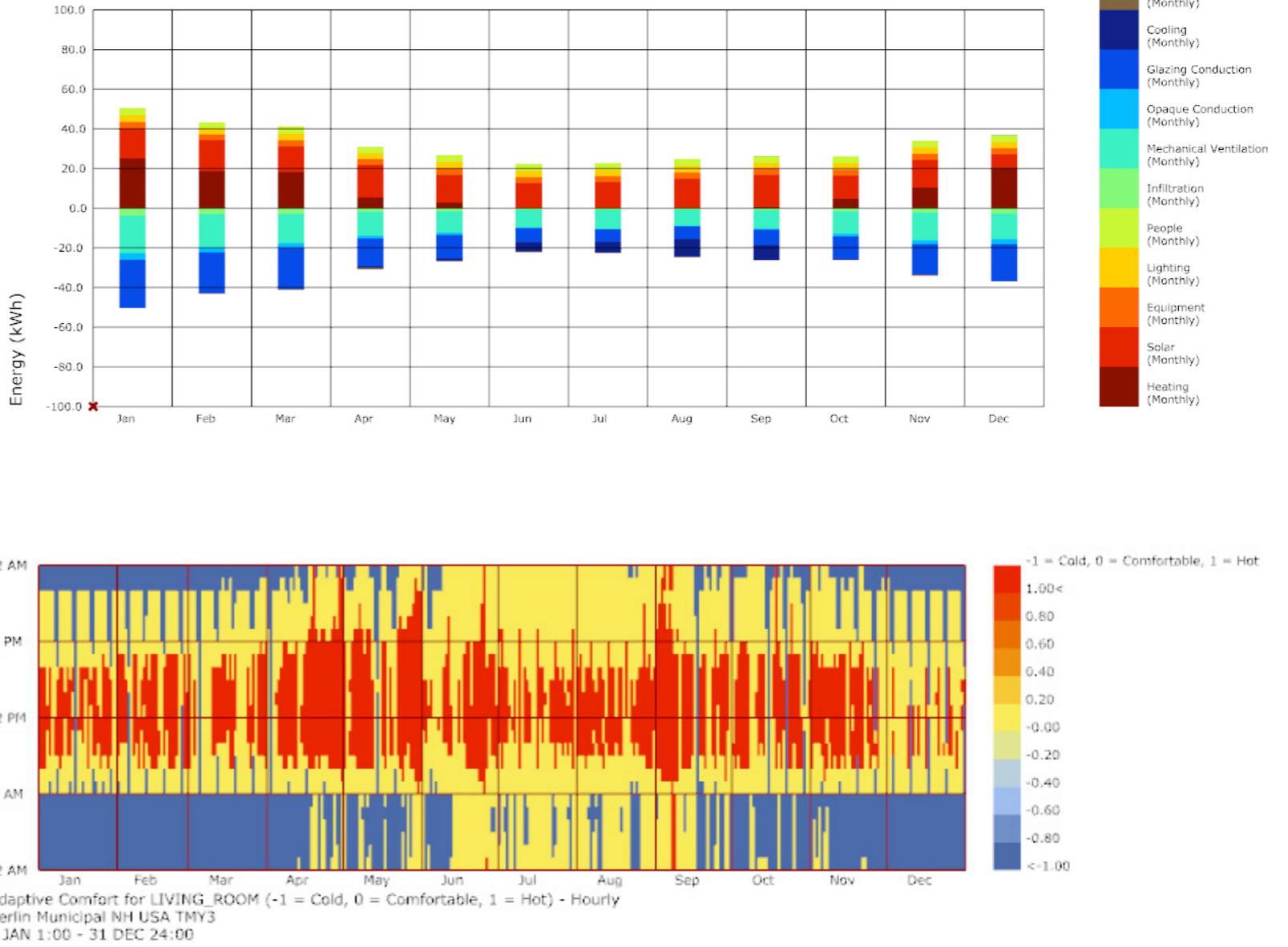
Jun. 21st \_ 15:00

Too much hours are on the hight temperature level .

Next sept

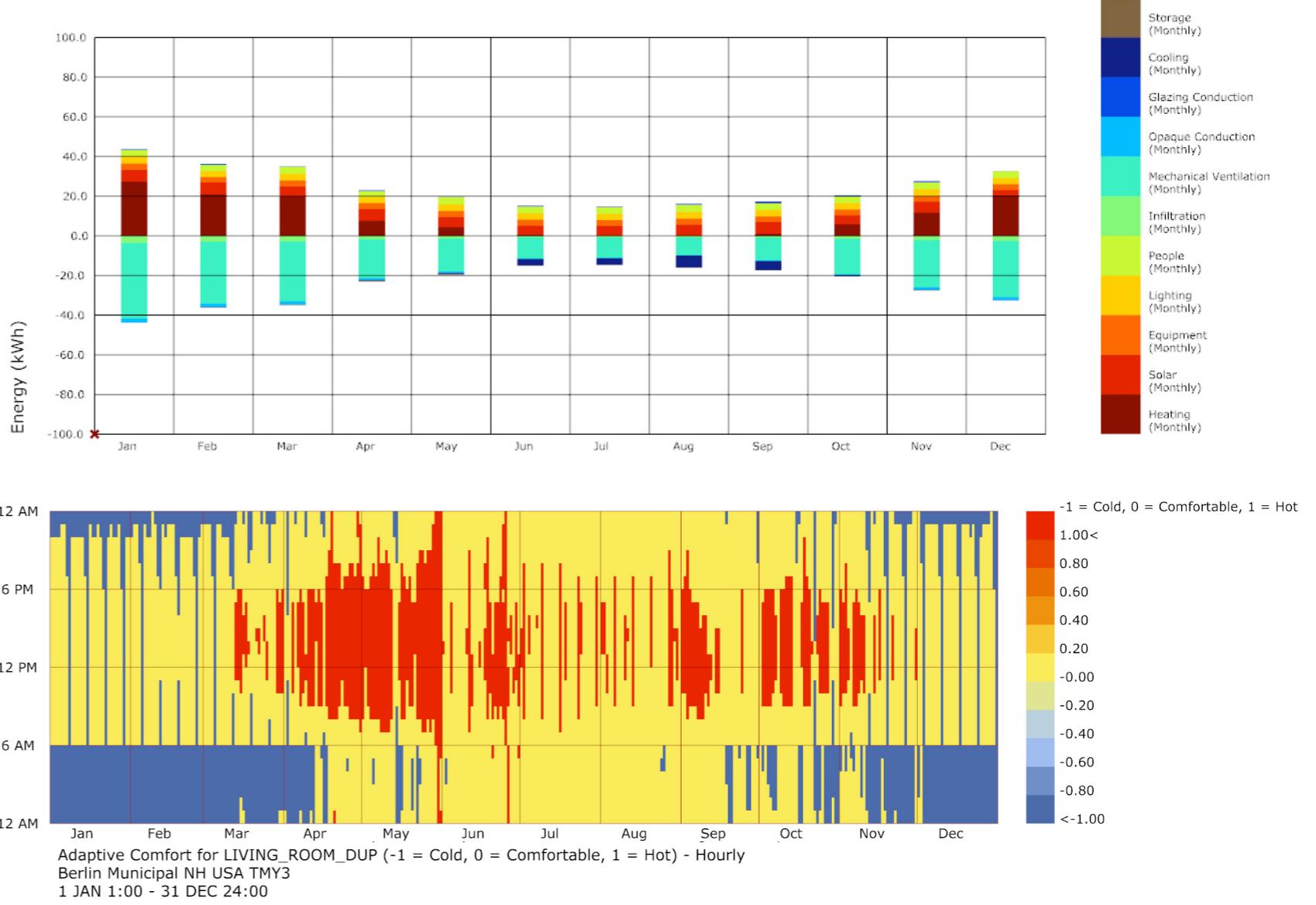
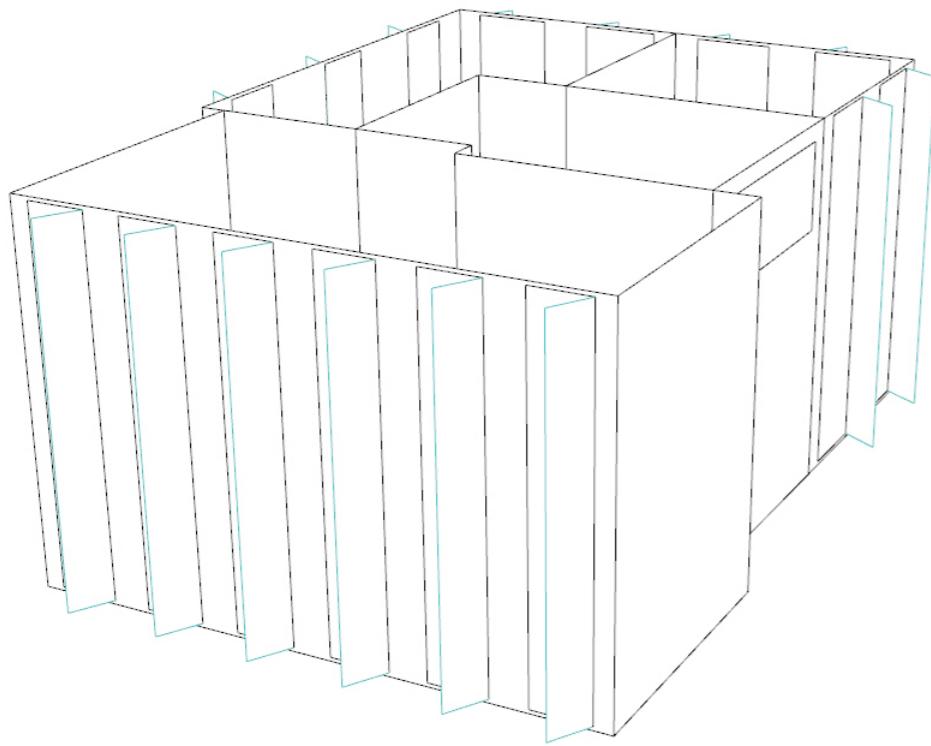
By using a shading and using lights, equipment and occupants in the room can increase the percent of comfort efficiently.

I will try different angles of blinds and different infiltration options to reduce to hot% time.

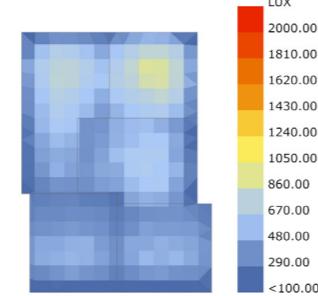


# ENERGY SIMULATION

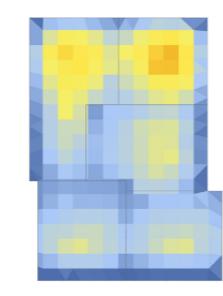
## YUNLONG ZHANG



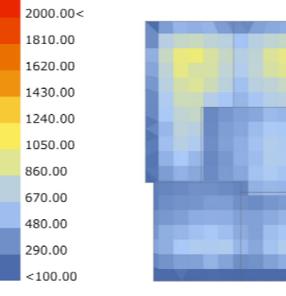
Comfortable : 59.6  
hot : 19.98  
cold : 21.42



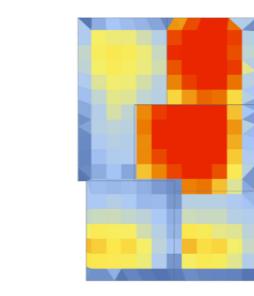
Mar. 21st \_ 9:00



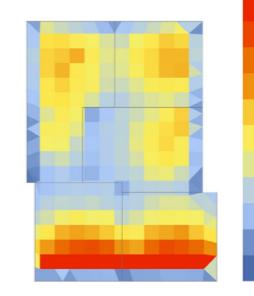
Mar. 21st \_ 12:00



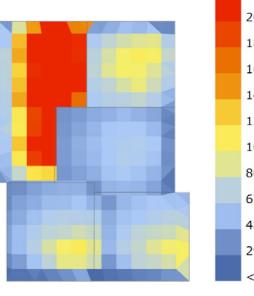
Mar. 21st \_ 15:00



Jun. 21st \_ 9:00



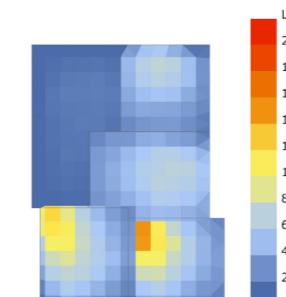
Jun. 21st \_ 12:00



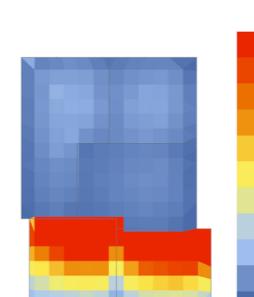
Jun. 21st \_ 15:00

### MATERIALS & CONSTRUCTION

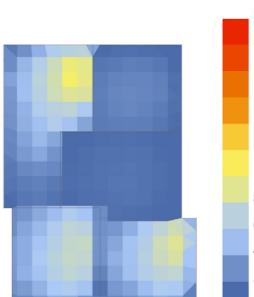
Change the materials to increase insulation values:  
Exterior Wall R-Value 20  
Exterior Window U-Value 0.2 & SHGC 0.9  
Exterior Roof -Value 40  
Air Change Rate 2.0



Dec. 21st \_ 9:00



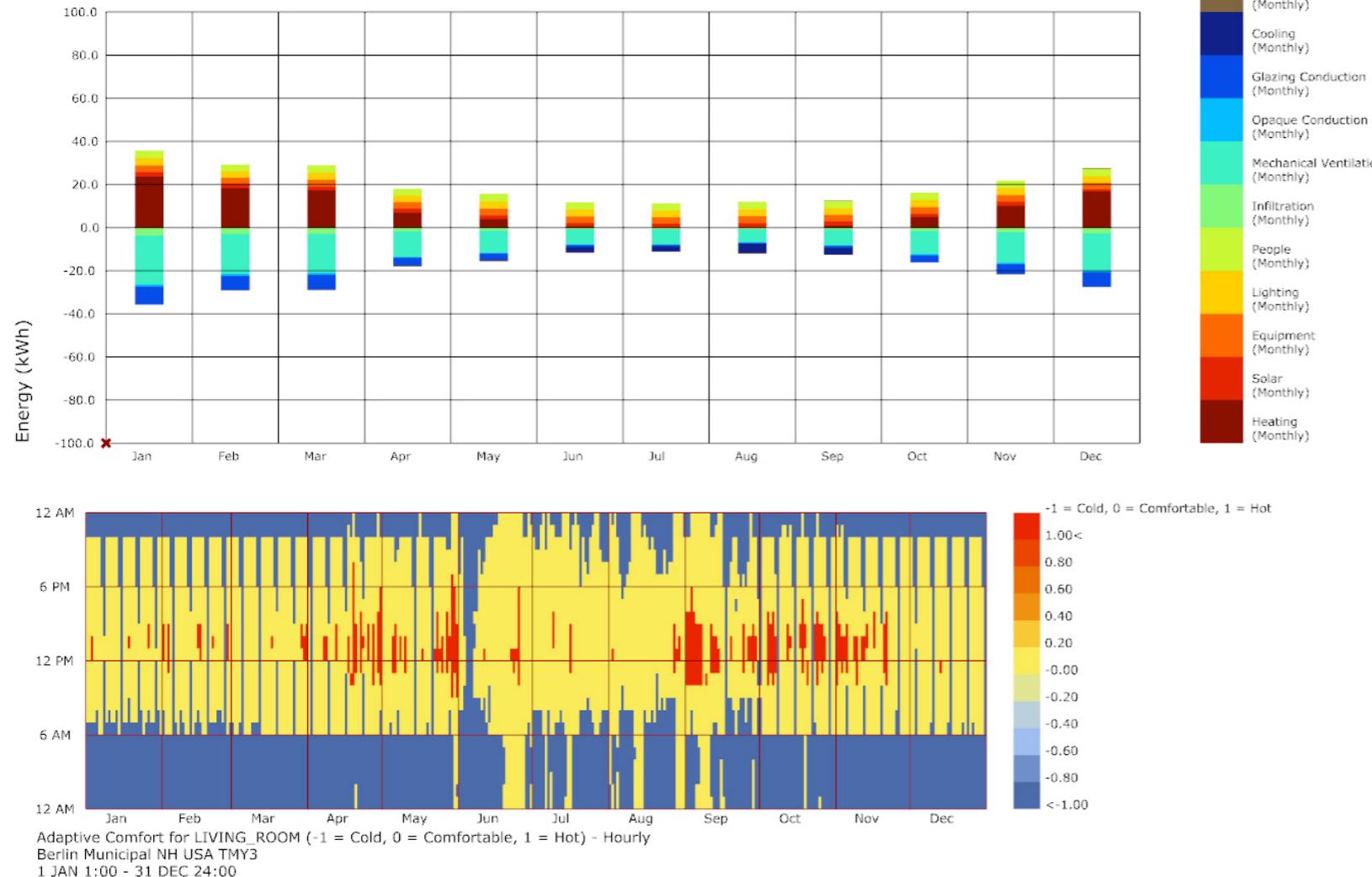
Dec. 21st \_ 12:00



Dec. 21st \_ 15:00

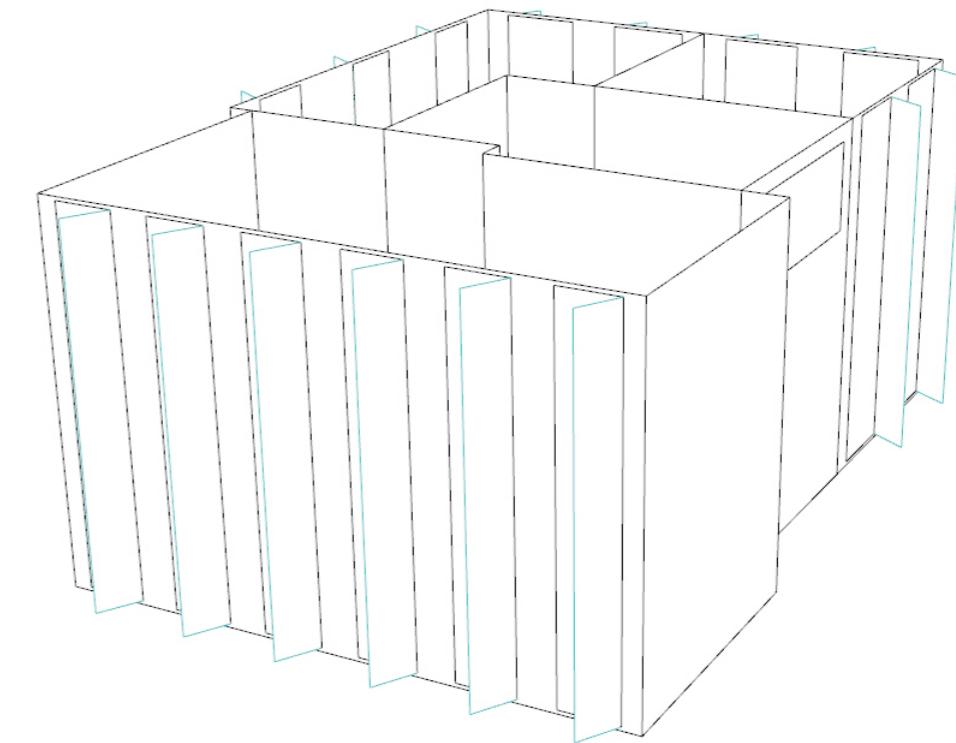
# ENERGY SIMULATION

## YUNLONG ZHANG



**MATERIALS & CONSTRUCTION**  
 Change the materials to increase insulation values:  
 Exterior Wall R-Value 48.1  
 Exterior Window U-Value 0.2 & SHGC 0.28  
 Exterior Roof -Value 34.4  
 Air Change Rate 1.0

The highest percentage of comfort achieved by converting materials is 61.03%, and a visor that changes over time can be designed if you want a very stable level of control comfort. As well as the internal air-conditioning system.



Comfortable :61.03  
 hot : 3.19  
 cold : 35.88