Energy Simulation

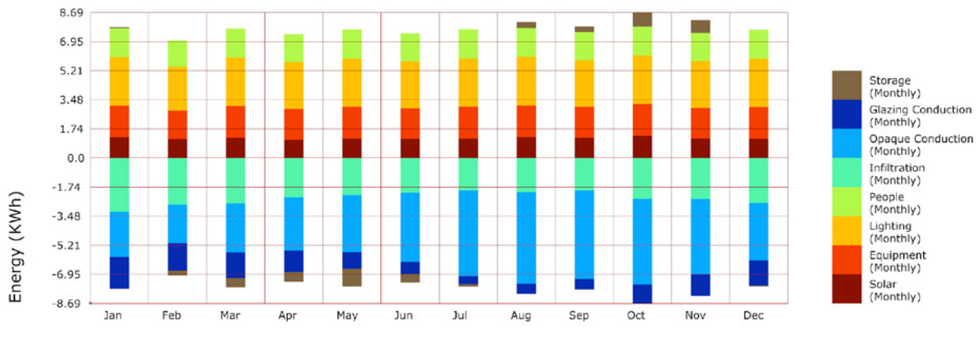
Building Performance Simulation Assignment 8
Yuchi Wang

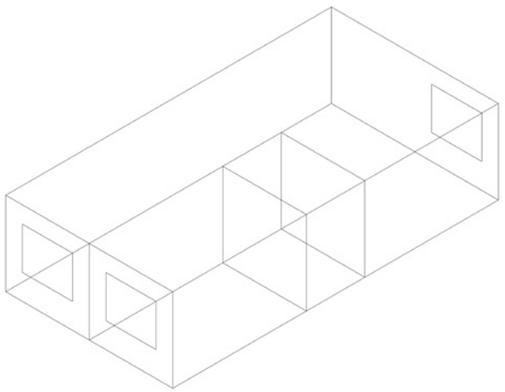
.epw file information :
Location : Philadelphia International Airport
Data Type : TWY 3

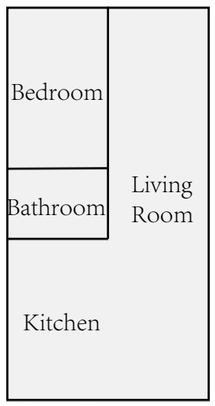
Base Case Analysis

From the base case analysis, we can find that when without AC system, the main problem of the room is overheat during the noon of summer and too cold during the winter. First step is to increse the R value of the wall and roof construction to reduce the heat gain during the summer and heat loss during the winter.

R Value of Each Surface
Wall : 1.54
Roof : 3.06
Floor : 6.33
Window : 0.44

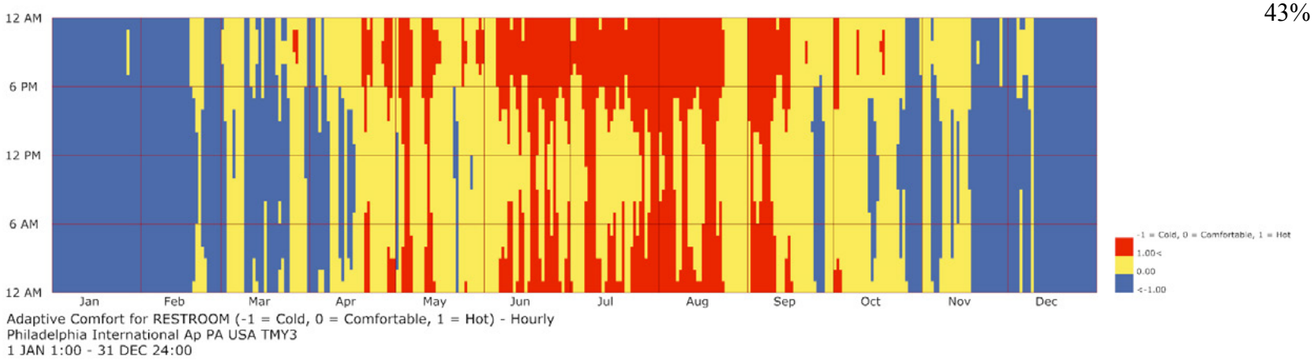






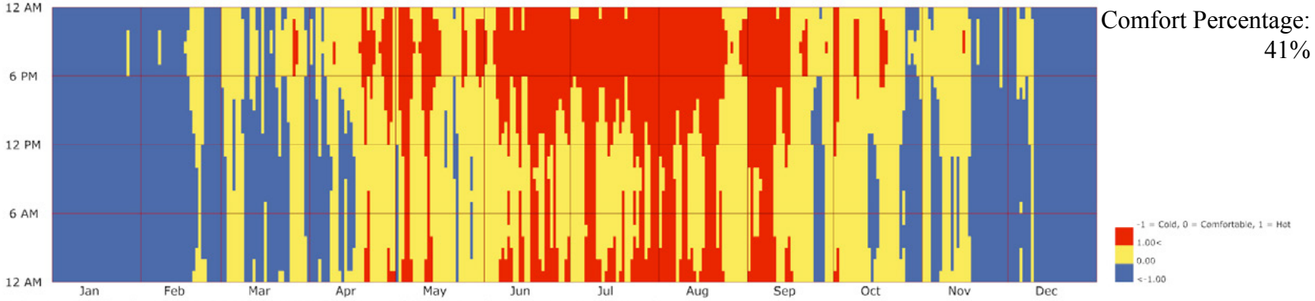
.epw file information :
Location : Philadelphia International Airport
Data Type : TWY 3

Comfort Percentage: 43%



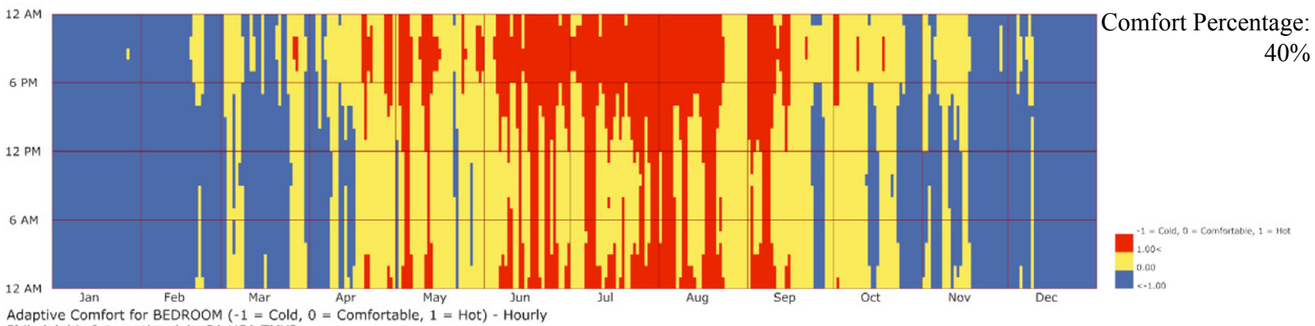
Adaptive Comfort for RESTROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Comfort Percentage: 41%



Adaptive Comfort for LIVING_ROOM_&_KITCHEN (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Comfort Percentage: 40%

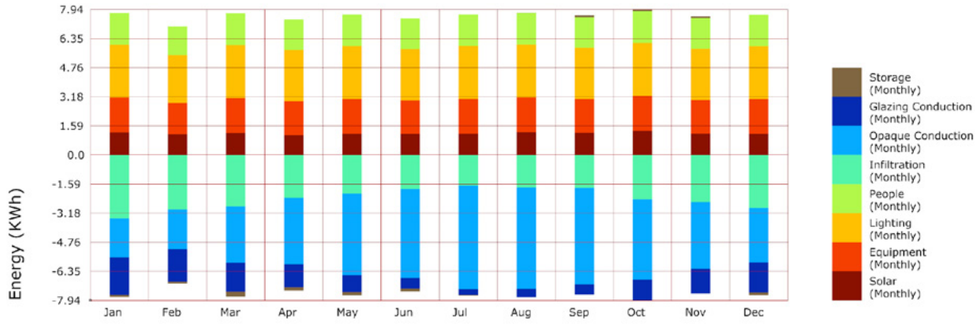


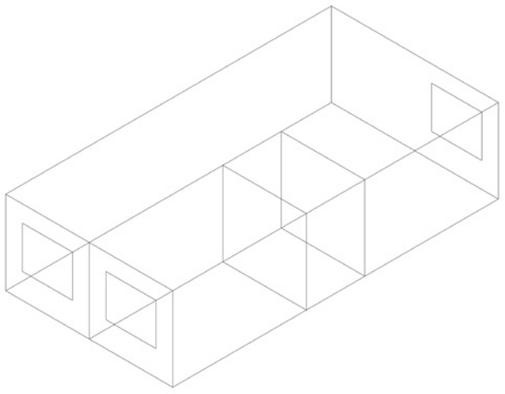
Adaptive Comfort for BEDROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

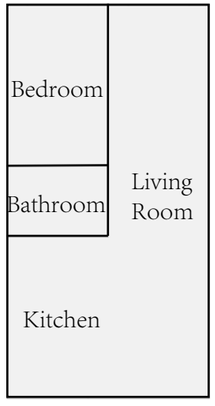
Add R Value of Wall and Roof

After adding R value, the performance of the building reaaly improved! But still, the noon time during the summer is still too hot. Introducing the natural ventilation can improve the situation.

R Value of Each Surface
Wall : 2.60
Roof : 3.53
Floor : 6.33
Window : 0.44

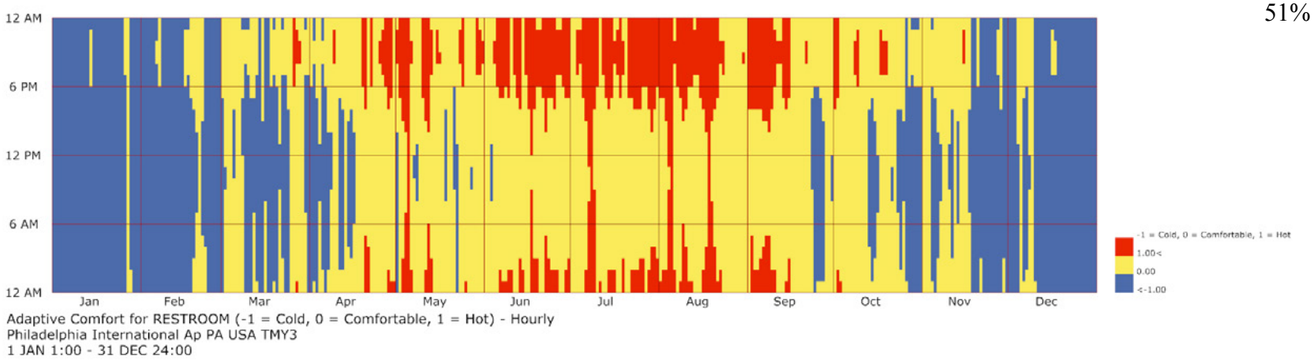






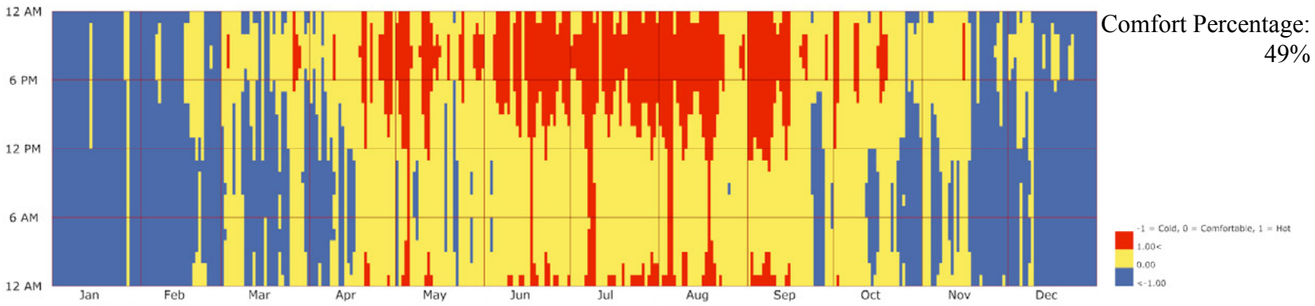
.epw file information :
Location : Philadelphia International Airport
Data Type : TWY 3

Comfort Percentage: 51%



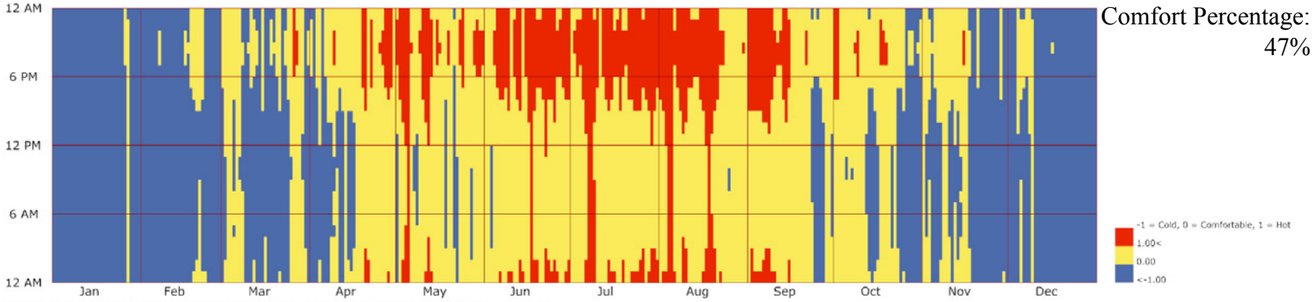
Adaptive Comfort for RESTROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Comfort Percentage: 49%



Adaptive Comfort for LIVING_ROOM_&_KITCHEN (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Comfort Percentage: 47%

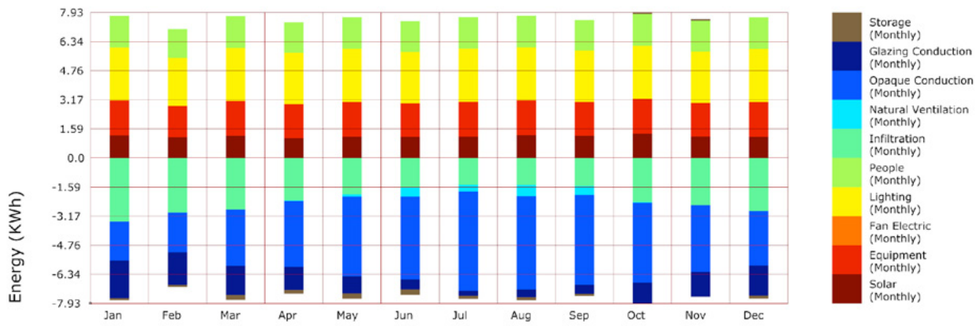


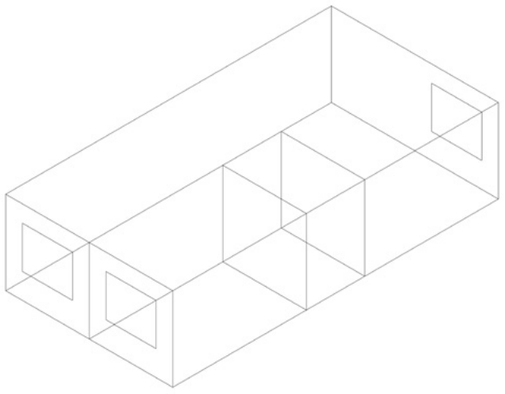
Adaptive Comfort for BEDROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

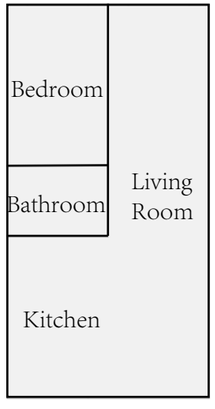
Add Natural Ventilation

After the natural ventilation, the comfort percentage increased a little bit. But now the main problem becomes how to decrease the heat loss during the winter because from the comfort chart, the winter time is always cold. So the next step is to decrease the heat exchange during winter.

R Value of Each Surface
Wall : 2.60
Roof : 3.53
Floor : 6.33
Window : 0.44

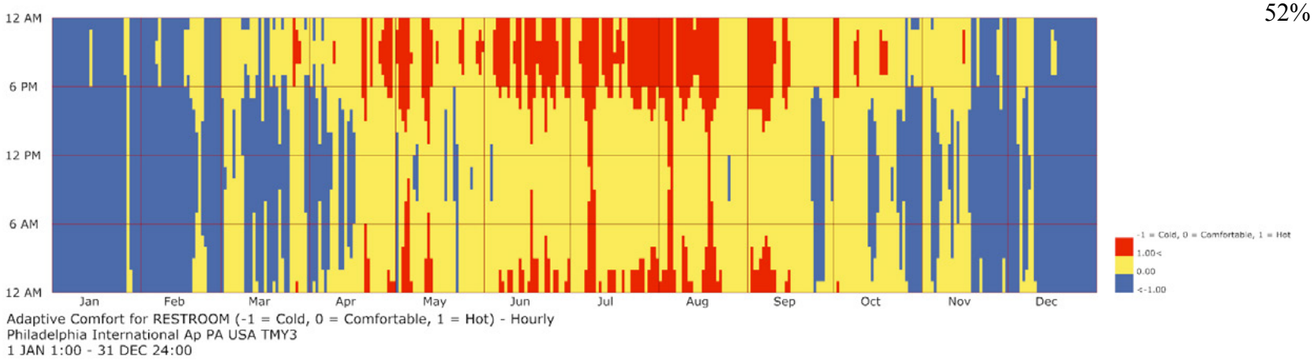




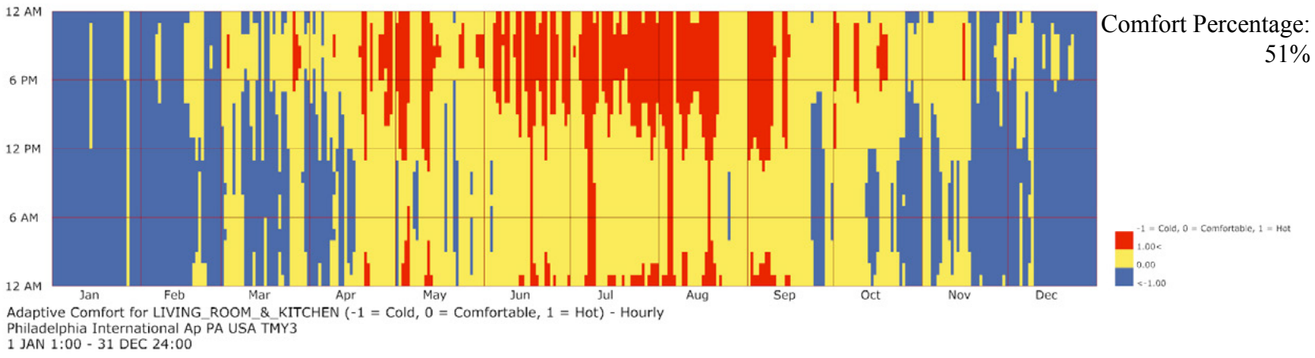


.epw file information :
Location : Philadelphia International Airport
Data Type : TWY 3

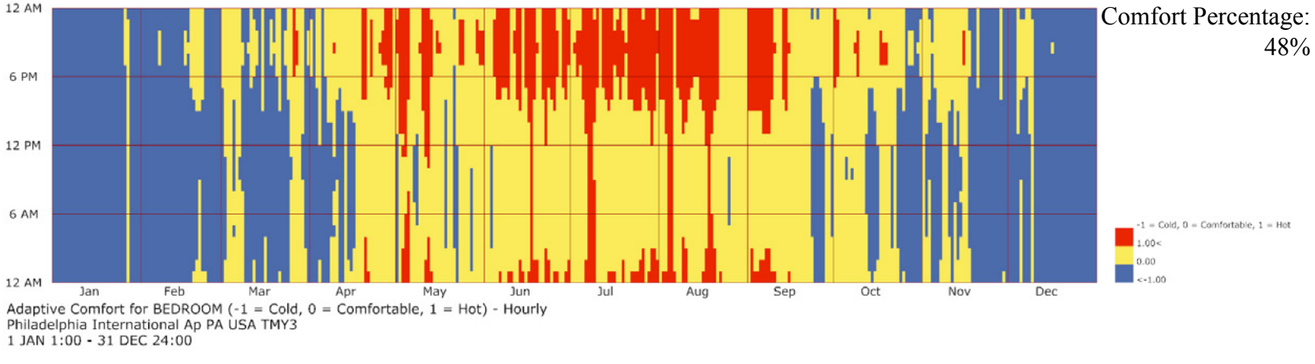
Comfort Percentage: 52%



Comfort Percentage: 51%



Comfort Percentage: 48%



Combining Daylighting and Energy Simulation

Now, the daylighting simulation was added to the energy model. The daylight simulation can give us the lighting schedule according to the daylight situation across the year. From the energy balance chart, we can find that the usage of electric light are reduced due to the modified lighting schedule.

R Value of Each Surface
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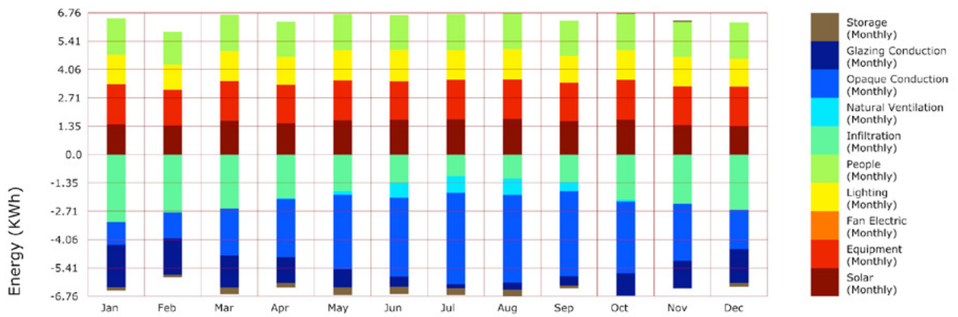
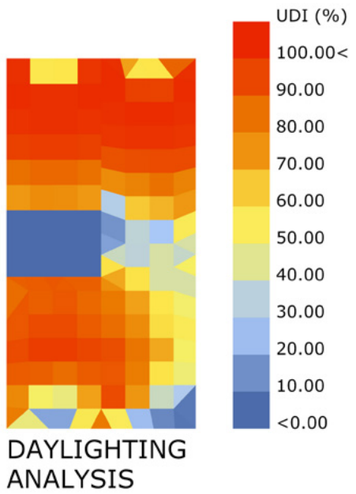
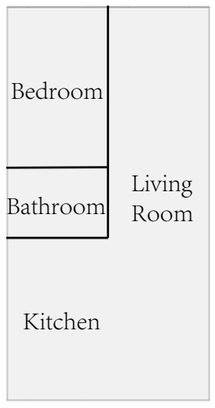
Roof : 3.53
Floor : 6.33
Window : 0.44







.epw file information :
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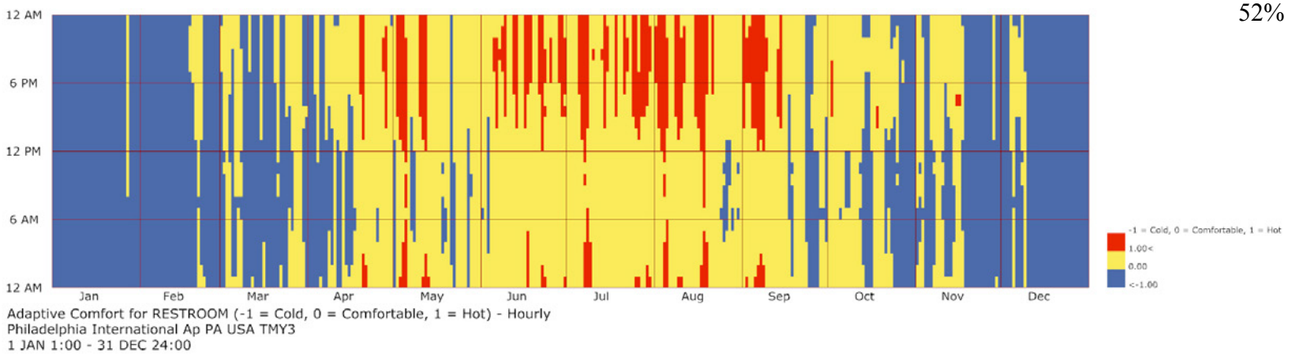
Data Type : TWY 3

Comfort Percentage:
52%



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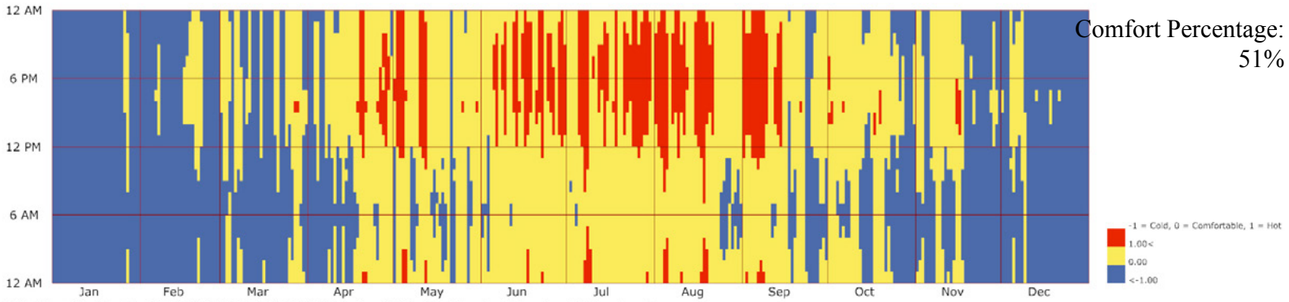
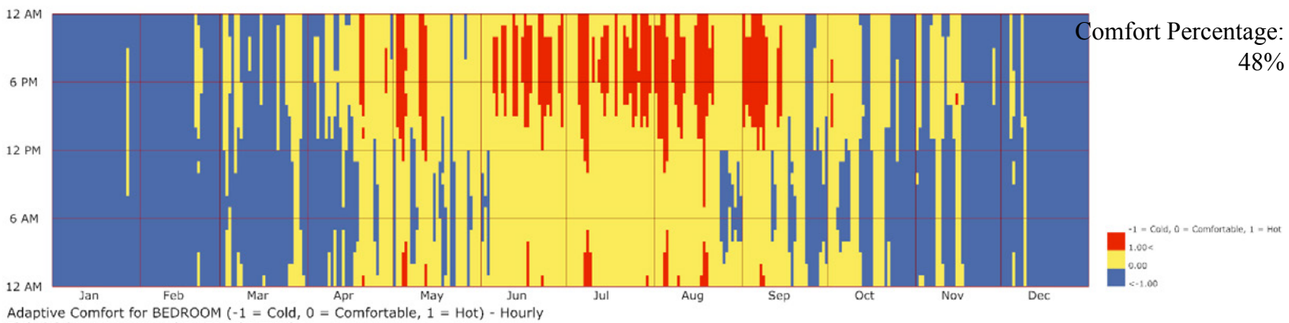
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Comfort Percentage:
51%



Adaptive Comfort for LIVING_ROOM_&_KITCHEN (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Comfort Percentage:
48%



Adaptive Comfort for BEDROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
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