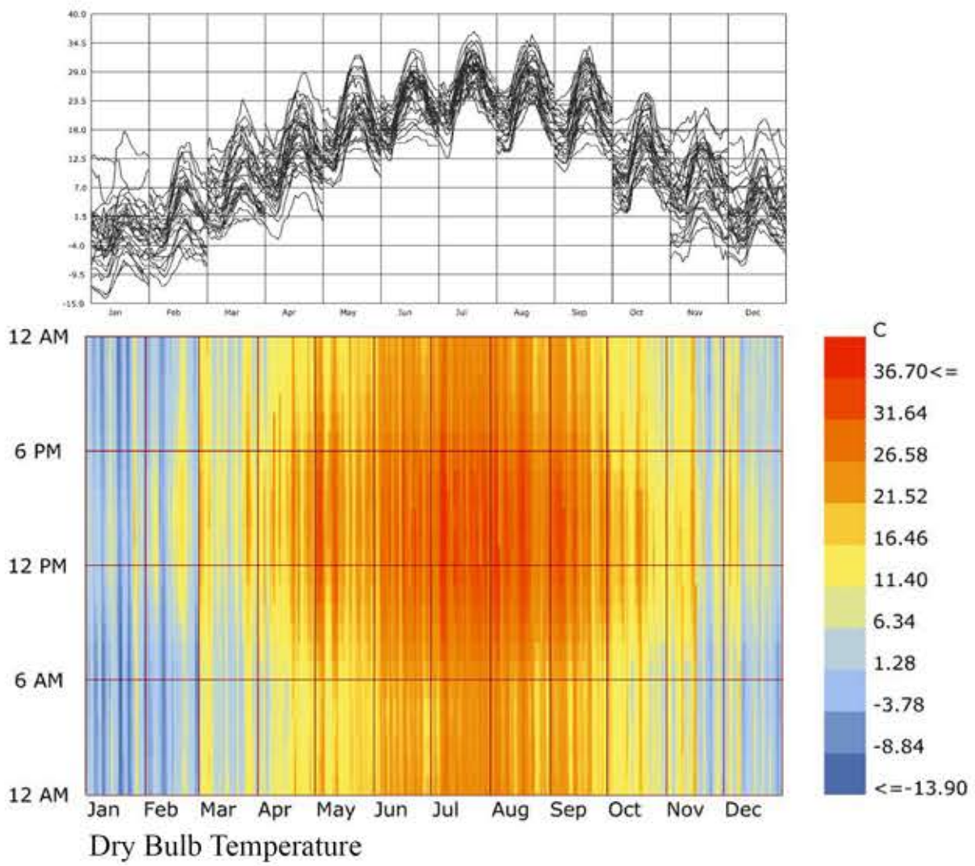
Climate Analysis of Philadelphia, Pennsylvania

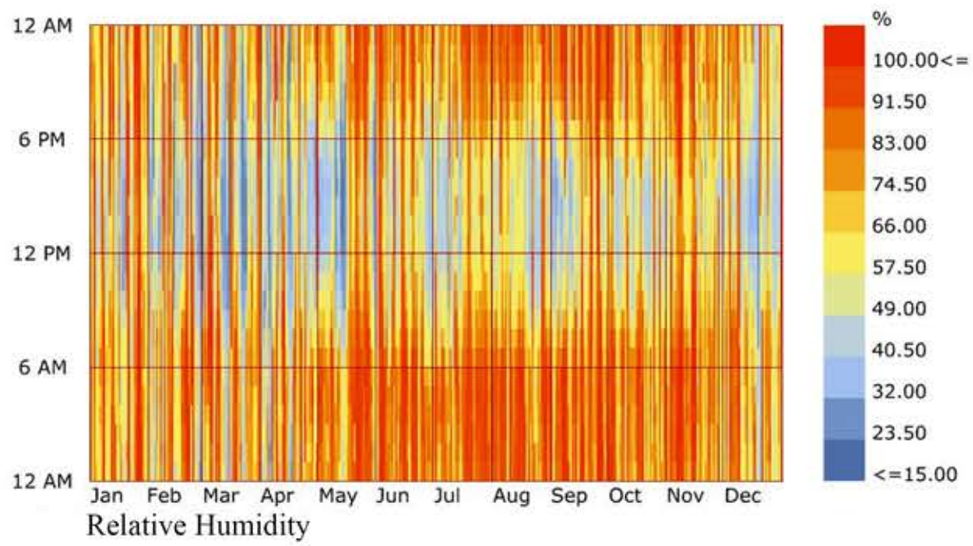
Philadelphia is the largest city in the Pennsylvania and the fifth-most populous in the United States.In general, Philadelphia has a temperate climate. Summers are typically hot and muggy, fall and spring are generally mild, and winter is cold.

As it can be perceived from the barchart and 3Dchart of Dry Bulb Temperature, Philadelphia has varieties of temperatures depending to the specific seasons; from Nov. -Dec. to almost March and even April it is rather cold. It begins to get hotter afterwards and it is mostly in a mild temperature except for noon hours from June to Oct,. So, the most problematic time for philadelphia is from 11 a.m. to 4 P.m. in these month so the cooling purchases should be taken in consideration. If we considere comfort zone from 18-22 C is it moslt-ly bellow this zone. Consequently Heating Considerations in cold monthes can be put into action as well.



Dry Bulb Temperature

With accordance to Relative Humidity Chart, it seems that philadelphia is a city with nearly high amount of humidity with mostly over 50% . It just becomes less during noon hours which is not so helpful-because the temperature in those hours are high so humidity can have a huge role in building designs in Philadelphia.



Relative Humidity

Designing Based on the Level of Humidity

Humidity can be a parameter which is effective in the design process and designers should considere this factor. Ventilation and its design options is a way of reducing humidity in outdoor and indoor spaces which can be purchased through different kinds of designs methodes and device. A design team can provide information based on comfort level in humidity and provide alternative examples to prevent the level of humidity to be out of comfort zone.

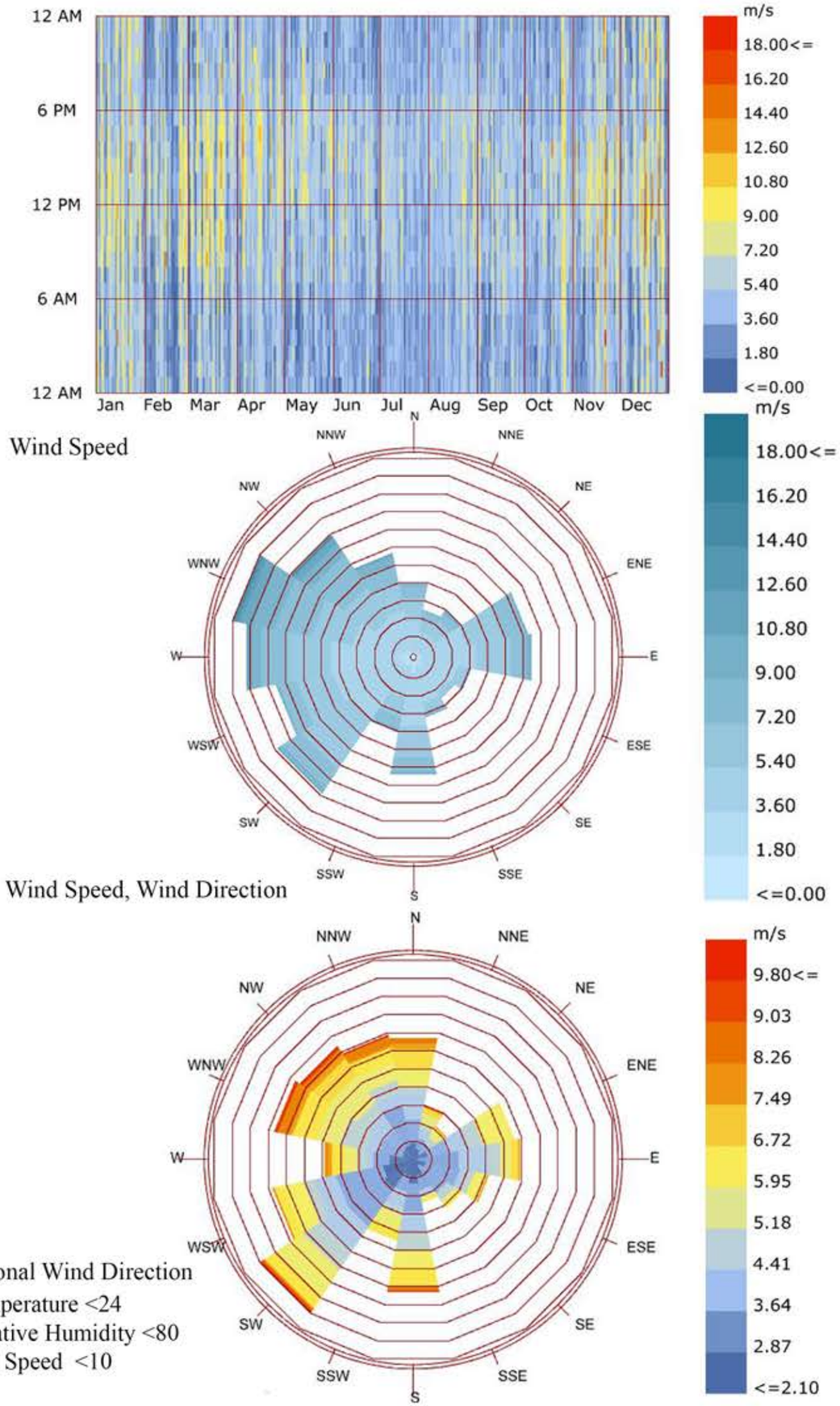
In weather data informations, wind informations can have a huge role in design in humid climates. Using wind datas is the first way in ventilation purposes. As humidity can be problematic in philadelphia buildings with regards to previous graphs, it is important to take wind datas into acount to provide the best ventilation for our spaces.

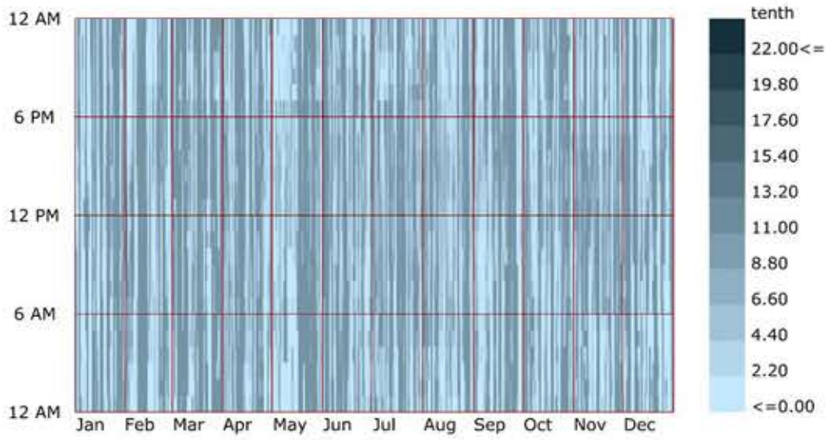
As it is shown in the wind speed chart, wind speed in philadelphia is mostly in the comfort zone bellow 5 and there are rare moments that wind speed will be a problem and needs to be prevented. One approach that can be perceived in this subject is to design a pwerful structural buildings which are resistant to high levels of wind speed.

Apparently, wind is mostly flowed form South-West, West and North-West. Also, there is a mild wind flow from East and East-North-East. Based on these wind's speed and their degree, they can help a design team to design in a better way. Winds with temperatures in a comfort zone 18< a <24 can be used to make a natural ventilation for the buildings.

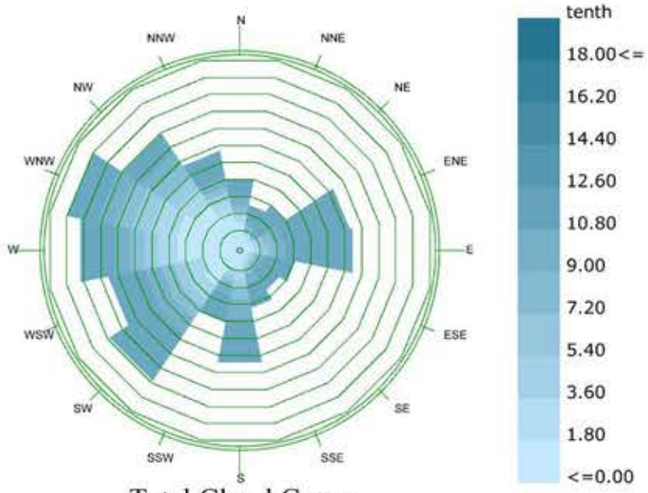
It is depicted that the best wind which is within the comfort zone is coming from South-West. Also North and North-West are other directions through which wind is flowed. So the altimate result is that to have a better ventilation the best way is to direct the buildings towards west oriented to the south to exploit the mild wind in the comfort zone.

V = 5 m/s or 18 km/h onset of discomfort
V = 10 m/s or 36 km/h definitely unpleas
V = 20 m/s or 72 km/h dangerous





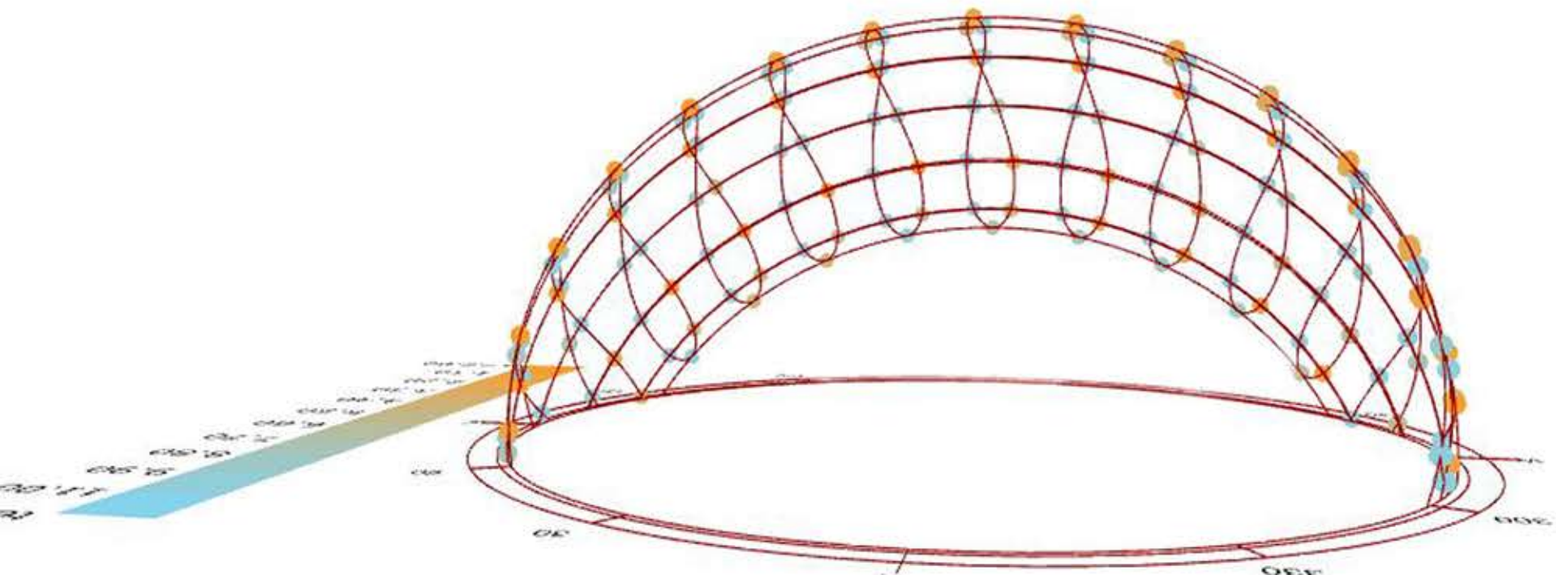
Total Cloud Cover Bar Chart

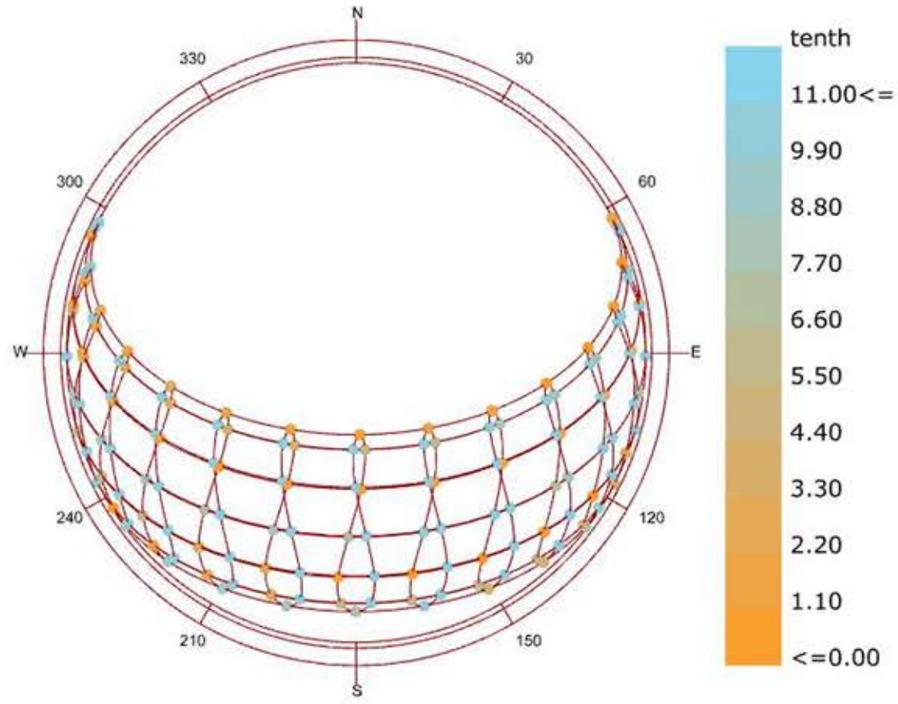


Total Cloud Cover

With regards to what can be perceived form the sunpath and total cloudiness cover diagrams, those sun radiations which make problems for inner and outer spaces can be specified. It seems that during summer times and also in midday we have the most issues with sunlight, other than that sky would be mostly cloudy. So thermal comfort considerations should be out into action for these times.

Providing different kinds of shading in summers and middays would prevent the direct sunlight to inter inner spaces and omit them in other times would let the inner space to use the most of the sun and light. It is shown that philadelphia is mostly cloudy half of the year. As a result, designers should consider this and try to find ways to get the most sunligh during the day.





Sun Path Diagram- Total Cloud Cover

Analysis of Philadelphia Weather Data
Building Performance Simulation
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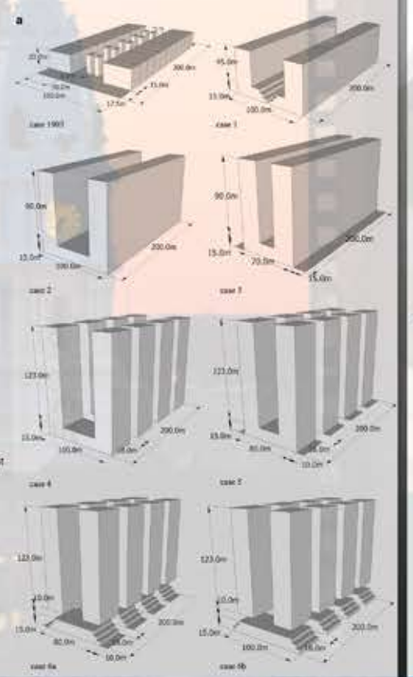
Three Passive Design Strategies

1. Natural Ventilation By Corridors and Vacant Spaces

As we understood from the graphs, wind has a huge capacity in philadelphia for being used as natural ventilation. So we can substitude it with mechanical devices in our designs. A designer can mange openings and corridors in a way that natural ventilation can be provided.

Also the direction of these open spaces should be twoards south-west and west according to weather data.

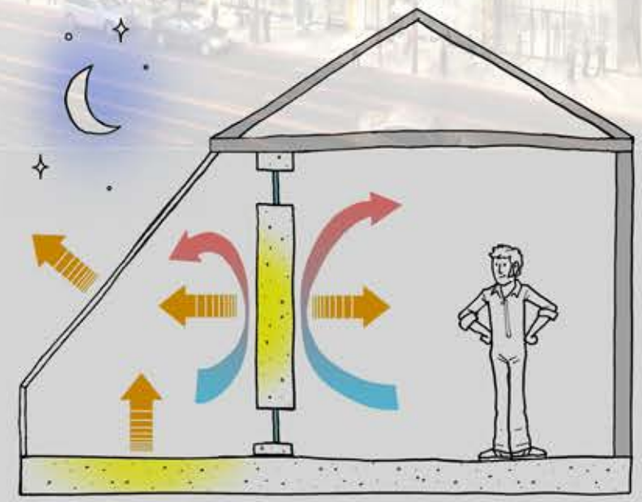


2. Providing automatic vertical and horizontal shadings to manipulate sunlight

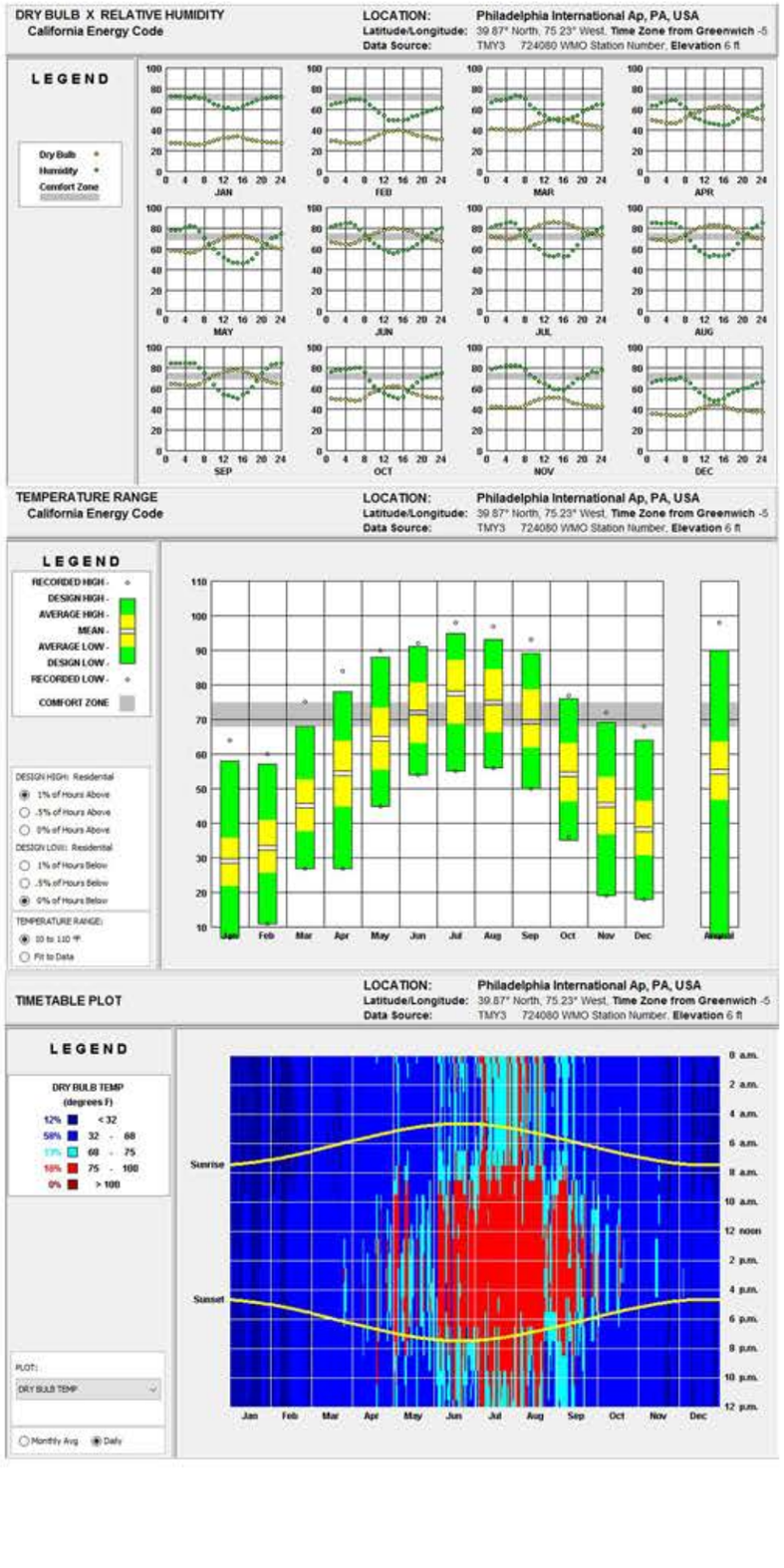
This strategy will allow building to get the sunlight whenever it needs it and prevent it whenever it is bothering. This way using sunlight as a natural resource for providing comfort will be a responsive method of design because it is more efficient. As it was shown in the sunpath graphs, during noon are the times that we need shading in summer and during winter or early morning we need more sunlight.

3. Night-Flushing in cloudy times to make the best use of sun.

Night-flushing is a way in which sunlight is obsorbed during the day and the heat which is saved wil return to the sapce. This can be acheived with absorbing sunlight devices. This method of passive design can be purchased through Fall and Winter times according to the weather data analysis that the amount of sunlightis low and it should be used as much as possible.



Present weather data analysis



What about Climate Change?

The graphs in this page are to make a comparison between present situation of weather data and the projection of weather data for 2050. The projection data is achieved by CCWorld Climate Generator Website and downloaded through some excel proceedures.

In terms of Relative Humidity, there are some fluctuations. It seems that humidity will be more problematic as time goes by. With regards to the graph it is predicted that level of humidity will be a bit further from comfort zone. So in the design strategy, ventilation strategies should be kept and even the emphasis should be more on this issue.

In terms of temperature, it seems that the weather will be much hotter and also the hours and the range of the times which weather is hot will also be larger. It is predicted that in general, 26% 75_100 degree F will be acheived, whereas this percent is 16% for recent condition. So in our design strategy shadings will be much more effective. Also, Cooling Systems should also be taken into account.

Eventually, designers should put a lot more concentration on human comfort as it will be less and less with time passing by.

2050 Projection of weather data Analysis