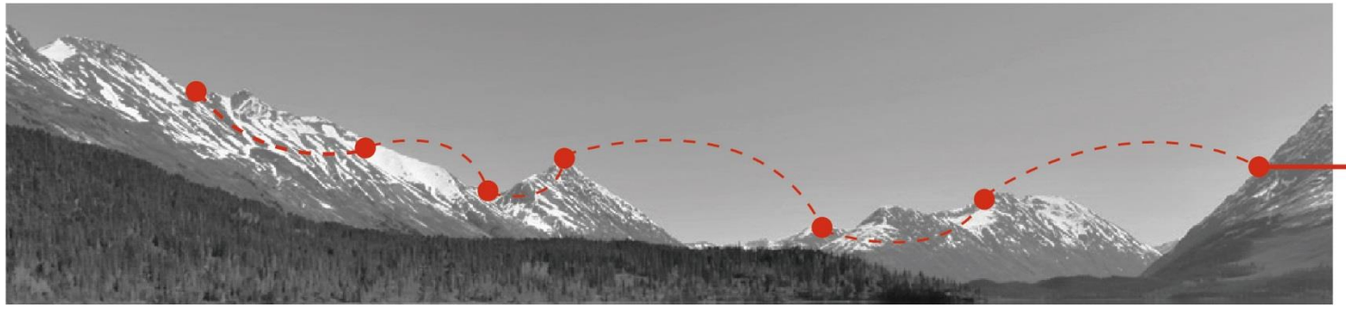
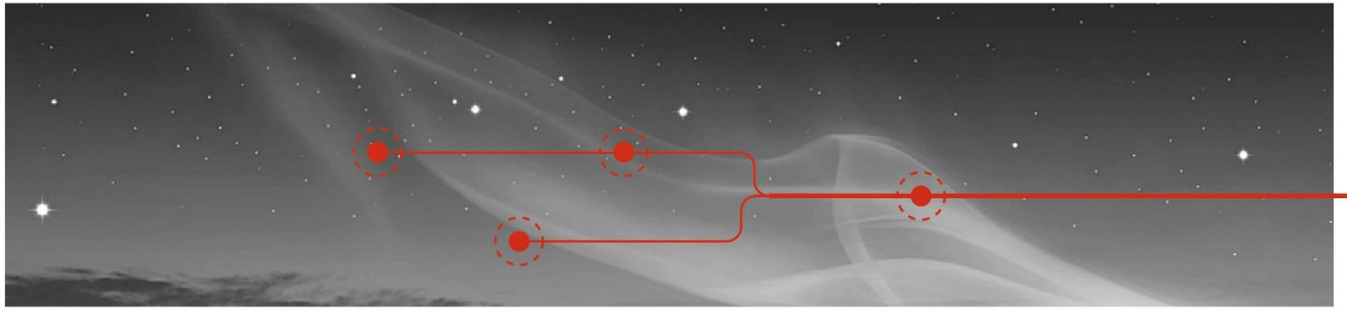
CLIMATE ANALYSIS OF ANCHORAGE

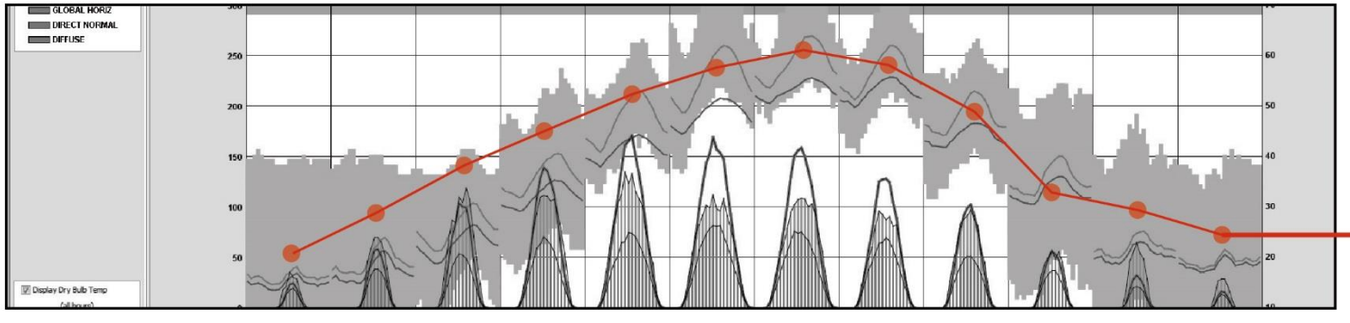
ARCH 753 BUILDING PEFORMANCE SIMULATION

YUNTIAN WAN, MEBD

INSTRUCTOR: MOSTAPHA SADEGHIPOUR







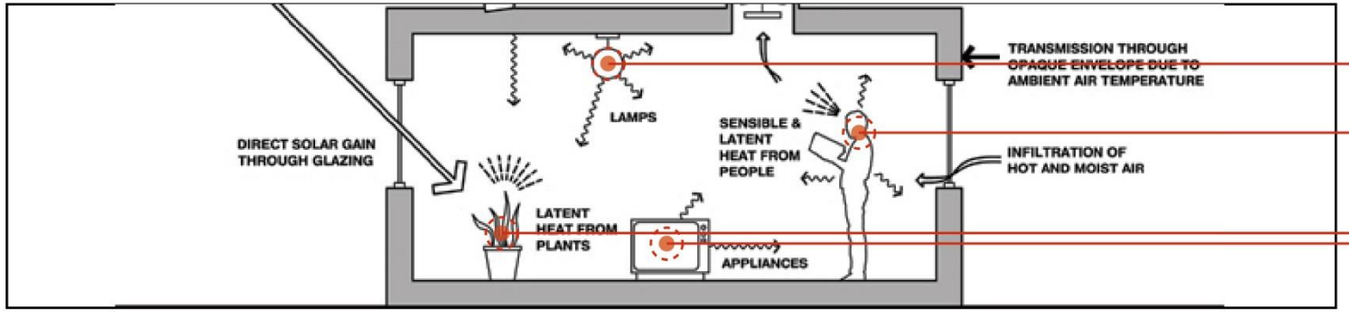
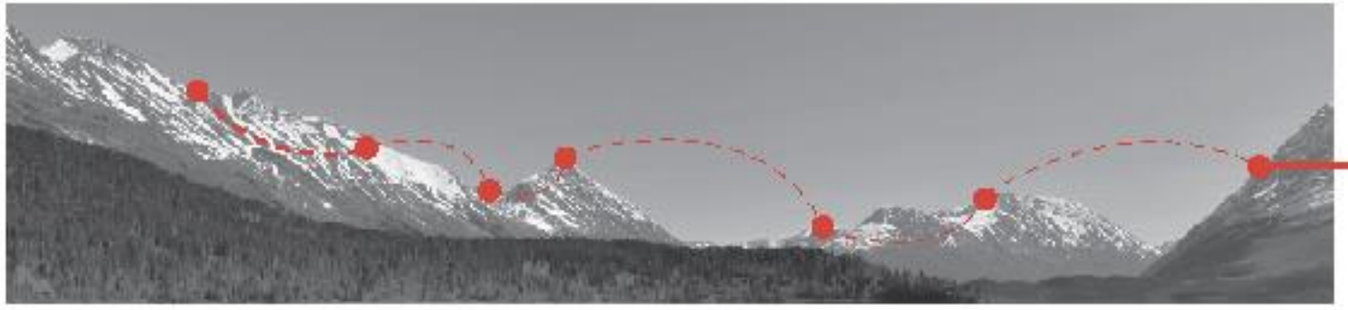
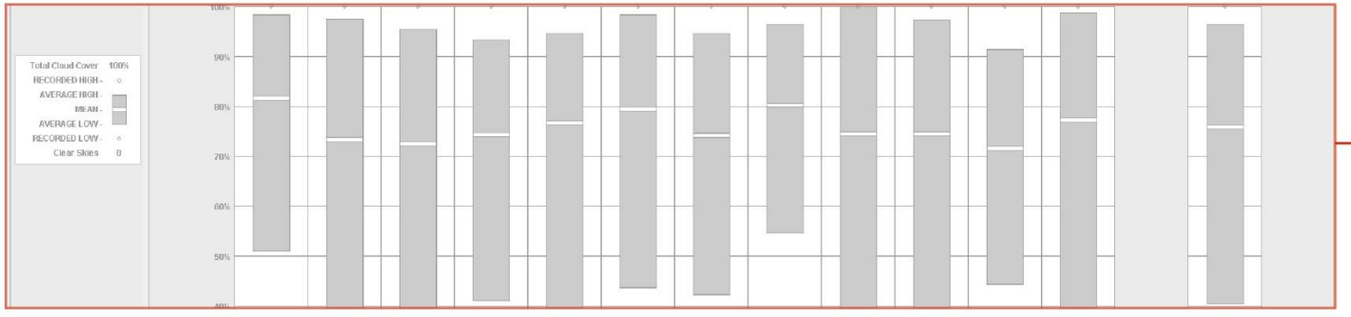


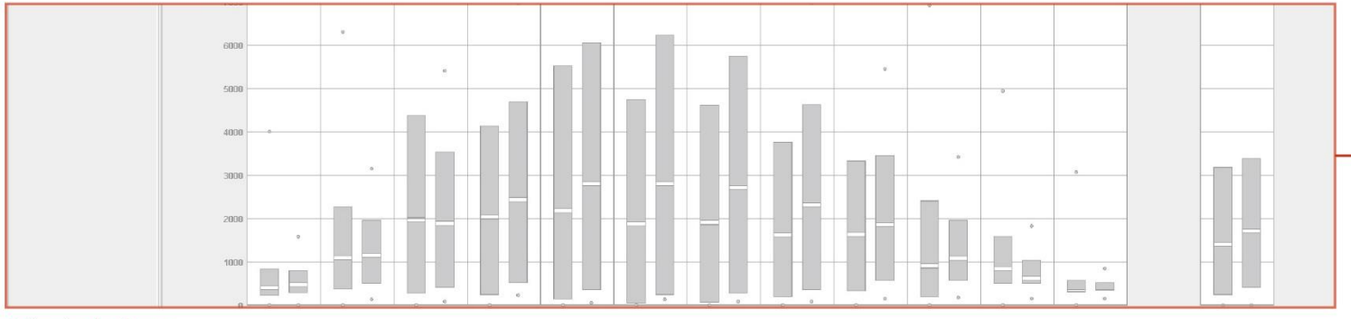
TABLE OF CONTENTS



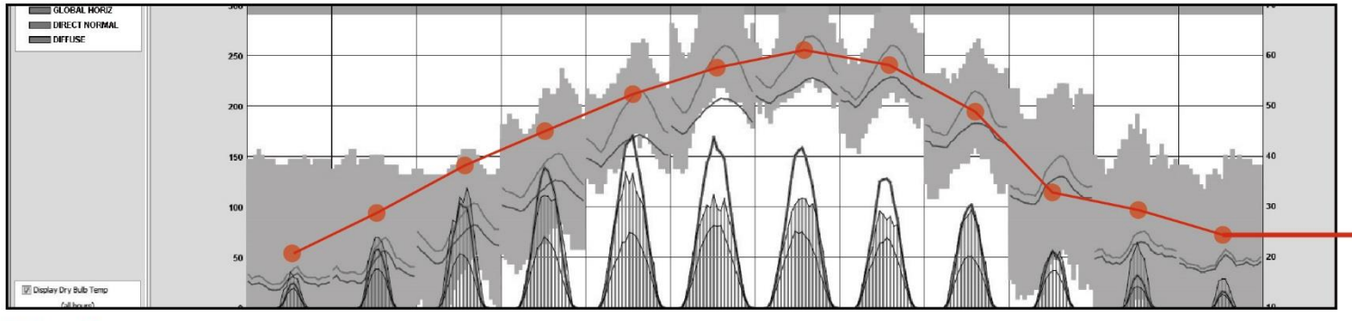
SECTION A GENERAL BACKGROUND



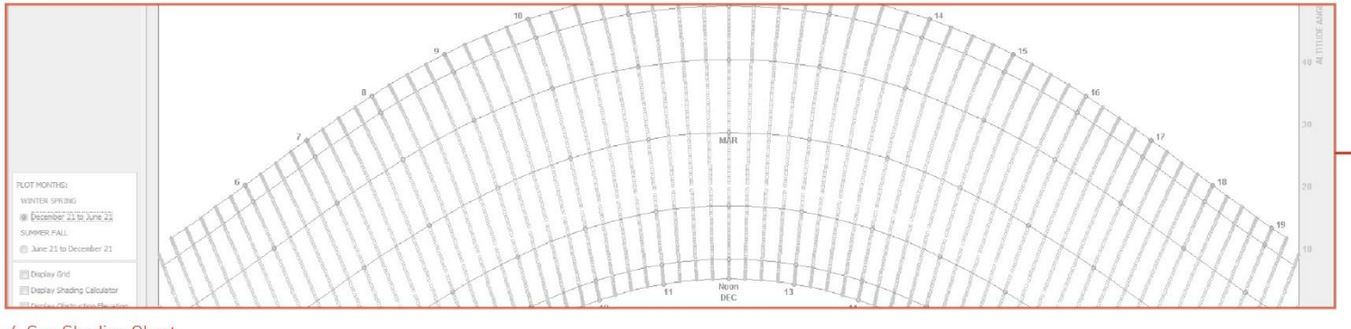
1. Sky Cover Range



2. Illumination Range

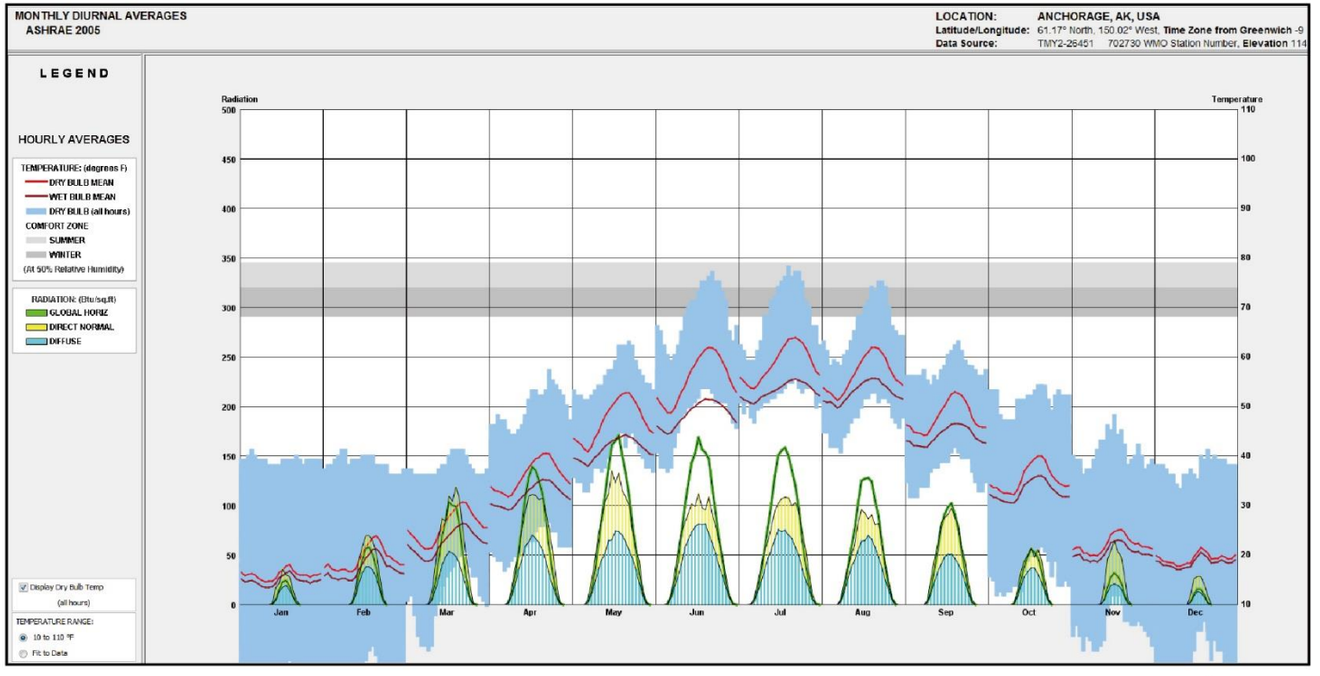


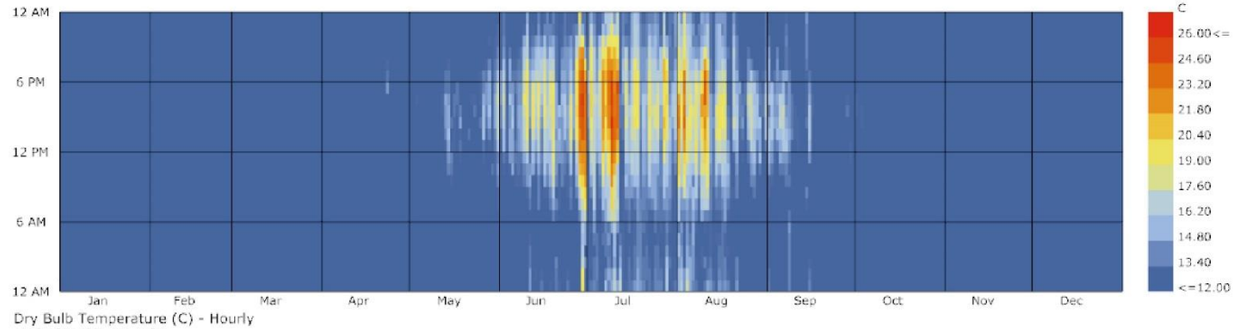
3. Diurnal Average



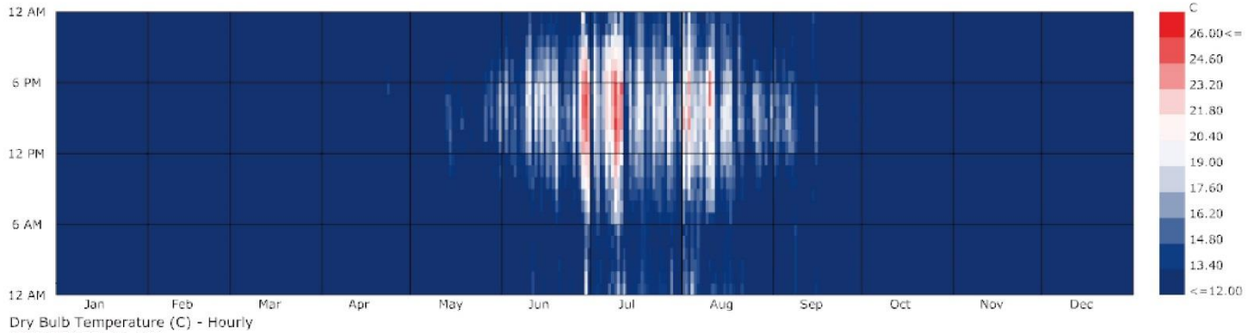
4. Sun Shading Chart

SECTION B CLIMATE ANALYSIS





Dry Bulb Temperature (C) - Hourly
ANCHORAGE_AK_USA
1 JAN 1:00 - 31 DEC 24:00



Dry Bulb Temperature (C) - Hourly
ANCHORAGE_AK_USA
1 JAN 1:00 - 31 DEC 24:00

SECTION B TEMPERATURE

1. TEMPERATURE

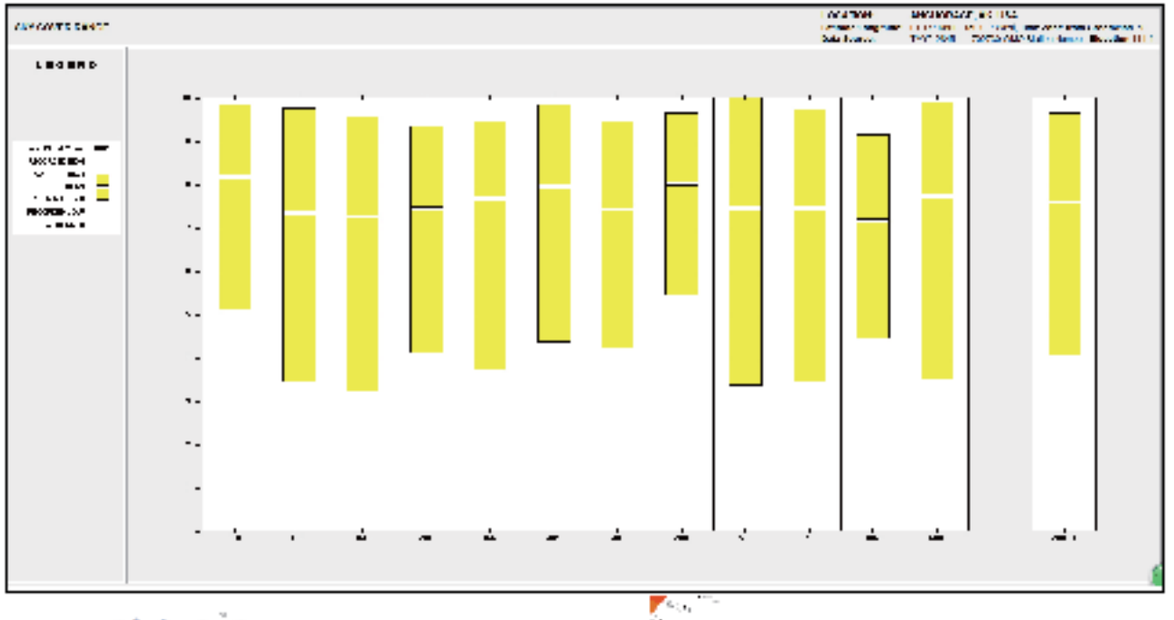
The temperature in Anchorage, AK is extremely low. In January, Febuary, March, November and December, the design high temperature is below 40 F and the mean temperature of the whole month is below 20 F. Annual mean temperature is below 40 F.

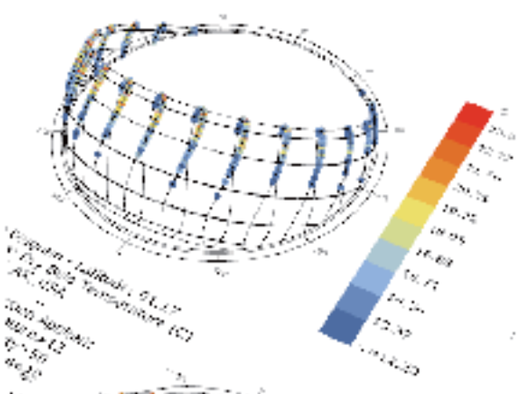
2. COMFORTABLE TEMP.

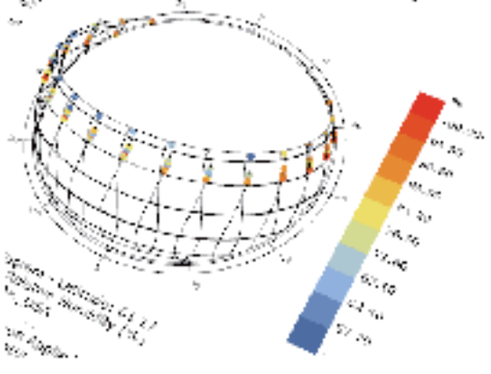
According to the diagram below,

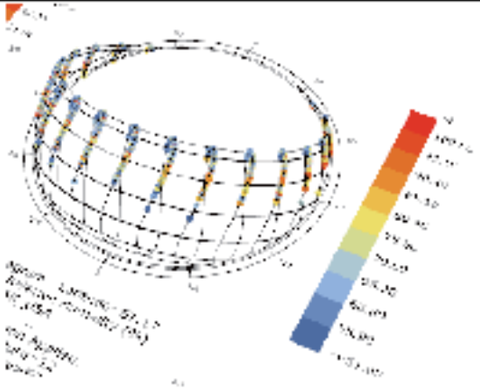
a. cold throughout the year

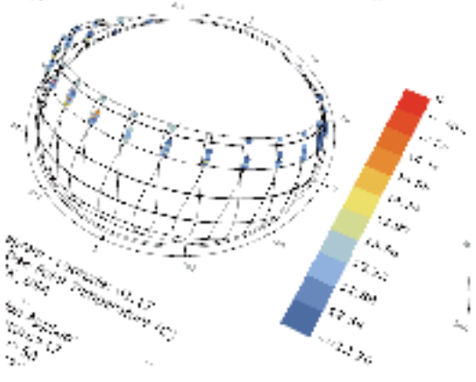
b. In most time of the year, the temperature is not in the comfort zone.

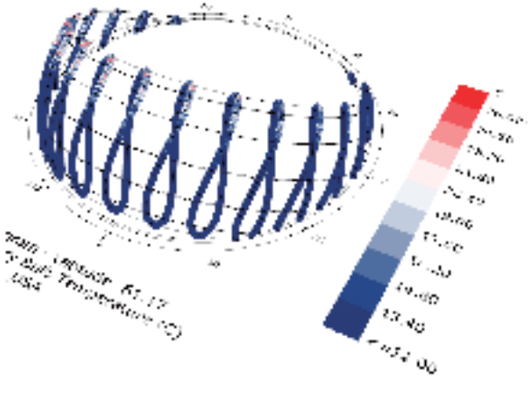












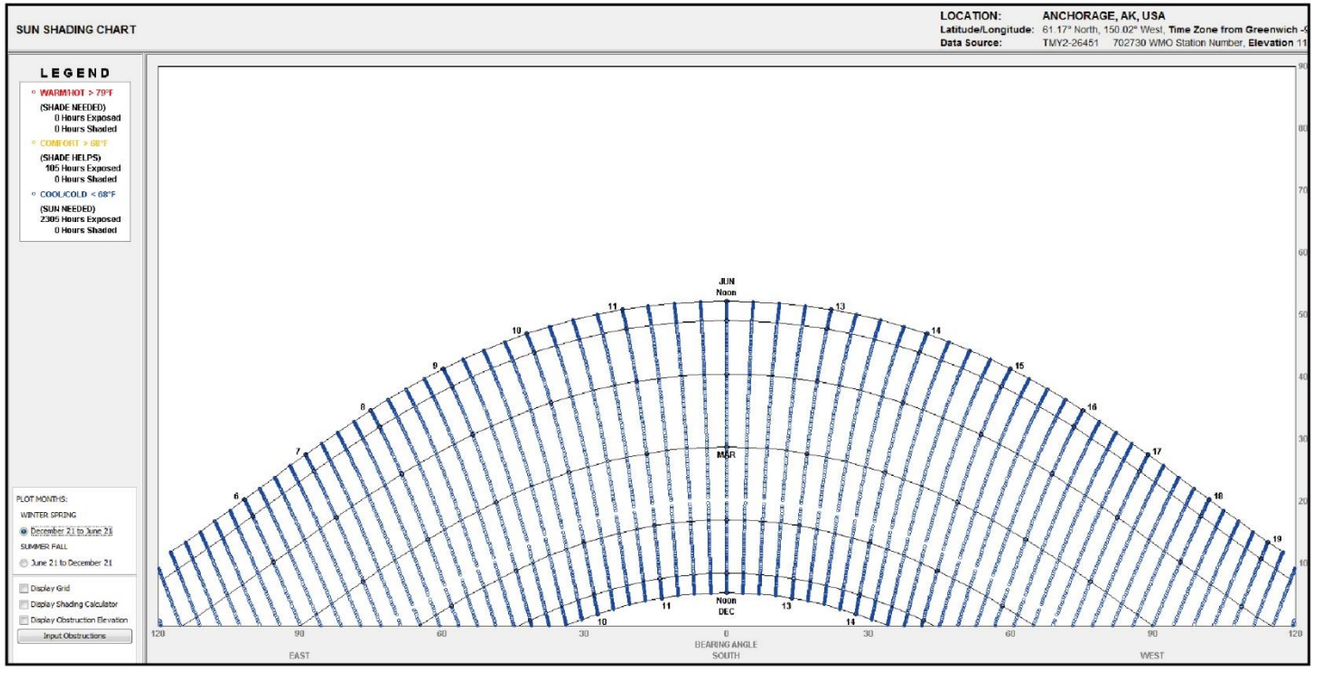
SECTION B RADIATION

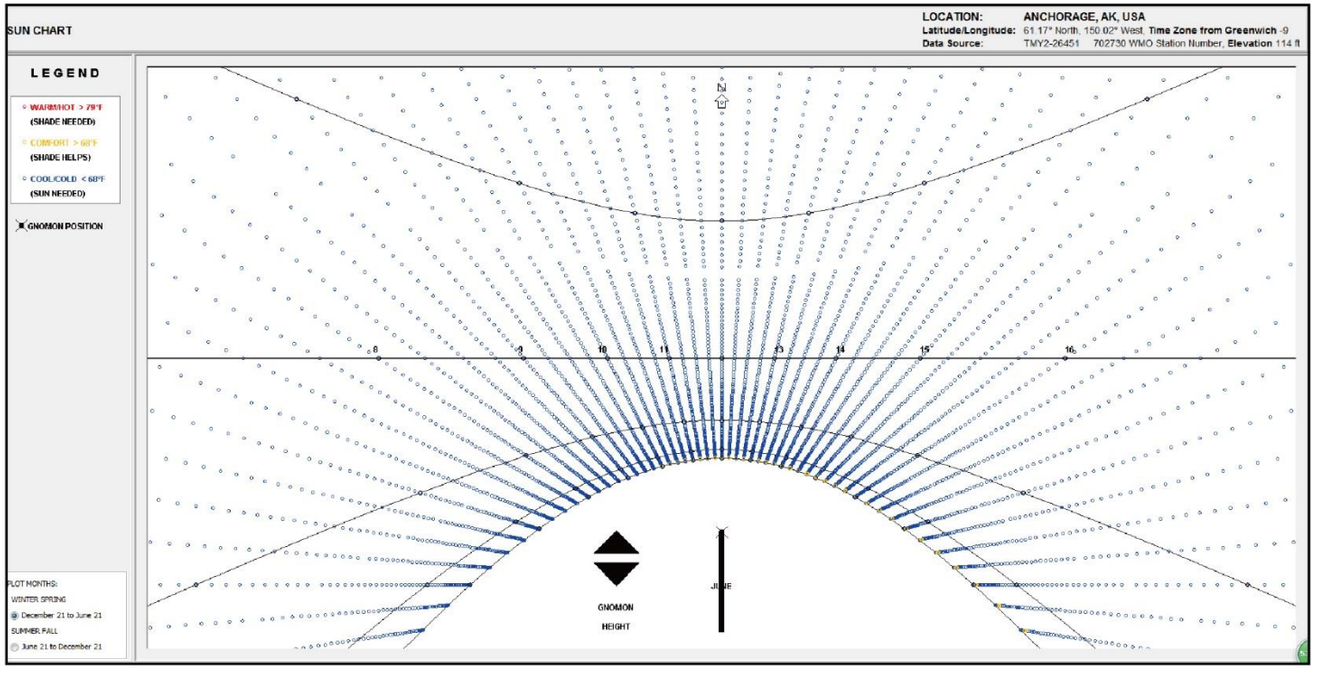
1. ILLUMINATION

The hourly illumination daylight hours vary in different seasons. The illumination daylight time in winter is very short. In December and January, the illnmination daylight time is less than 500 hours. The illumination daylight time in summer is relatively longer. Besides, the direct normal radiation is much stronger in the summer than in the winter.

2. SKY COVER RANGE

The sky cover in Anchorage is large thoughout the year, which means it is cloudy heavily there. The recorded high of sky cover is 100% through the year. Even the average high of sky cover is almost 100% and the average low of the sky cover throughout the year is above 40%. In other word, as for design, large windows are needed in order to let more sunlight in and artificial lighting is needed when necessary.



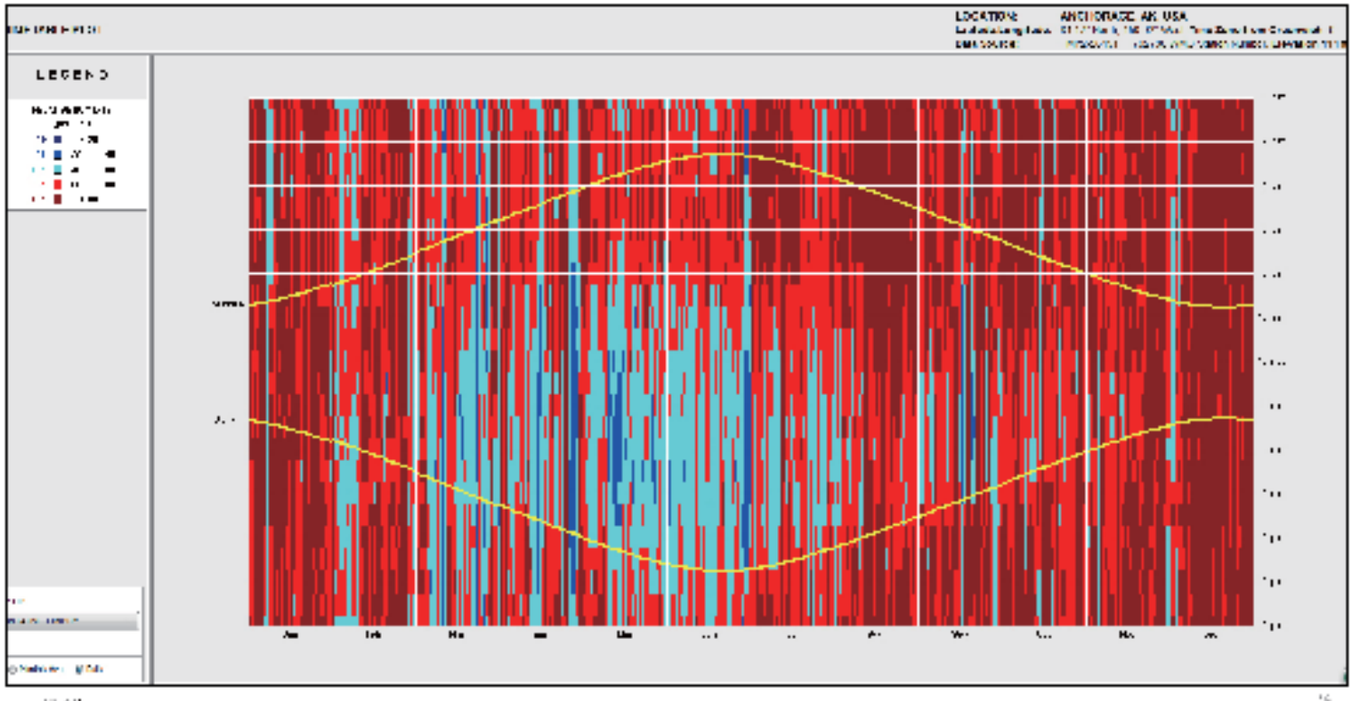


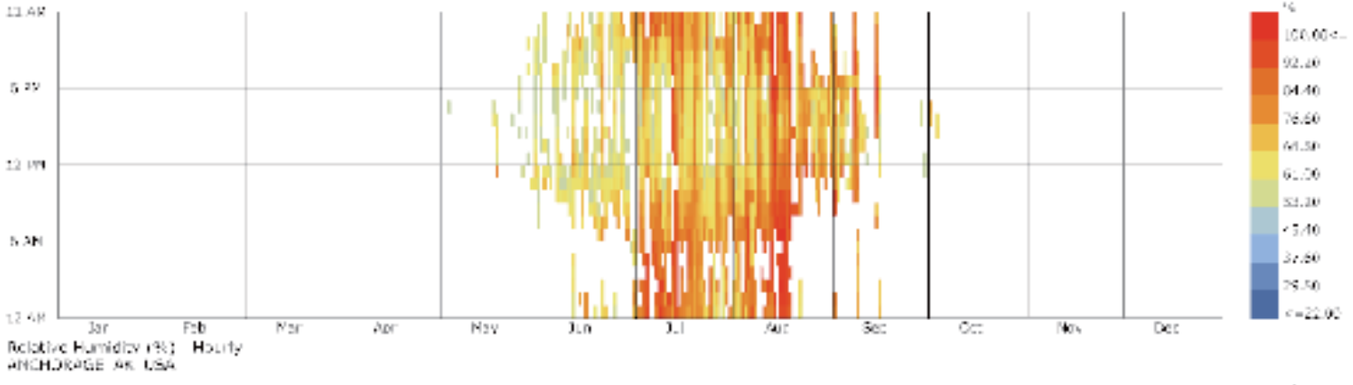
SECTION B SUN SHADING

1. SHADING

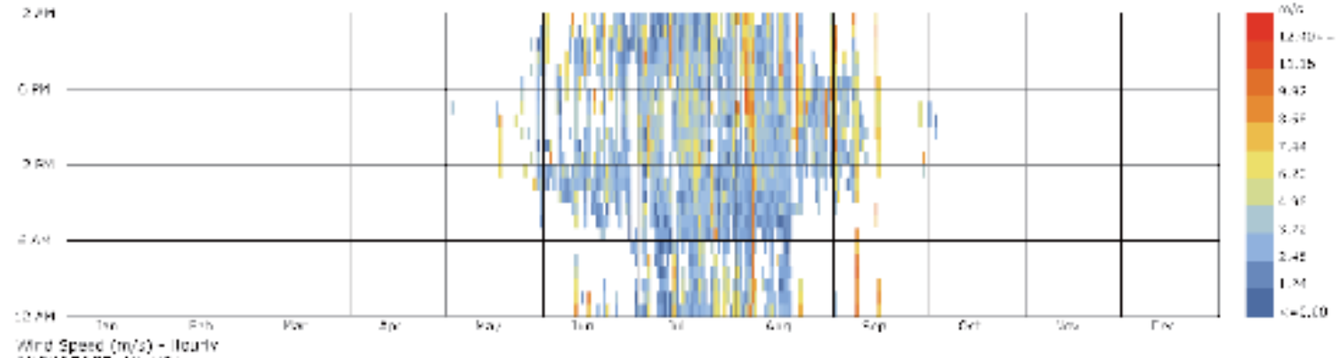
Because of the extreme cold weather and heavily cloudy, the sunlight is not enough over the year. Therefore, there is no need for shading even in summer. On the contrary, in winter extra artificial lighting is needed in order to meet the basic daylight needs.

Sun needed:
In winter: 2305 hours exposed
In Summer: 2248 hours exposed





Relative Humidity (%) - Hourly
ANCHORAGE AK USA

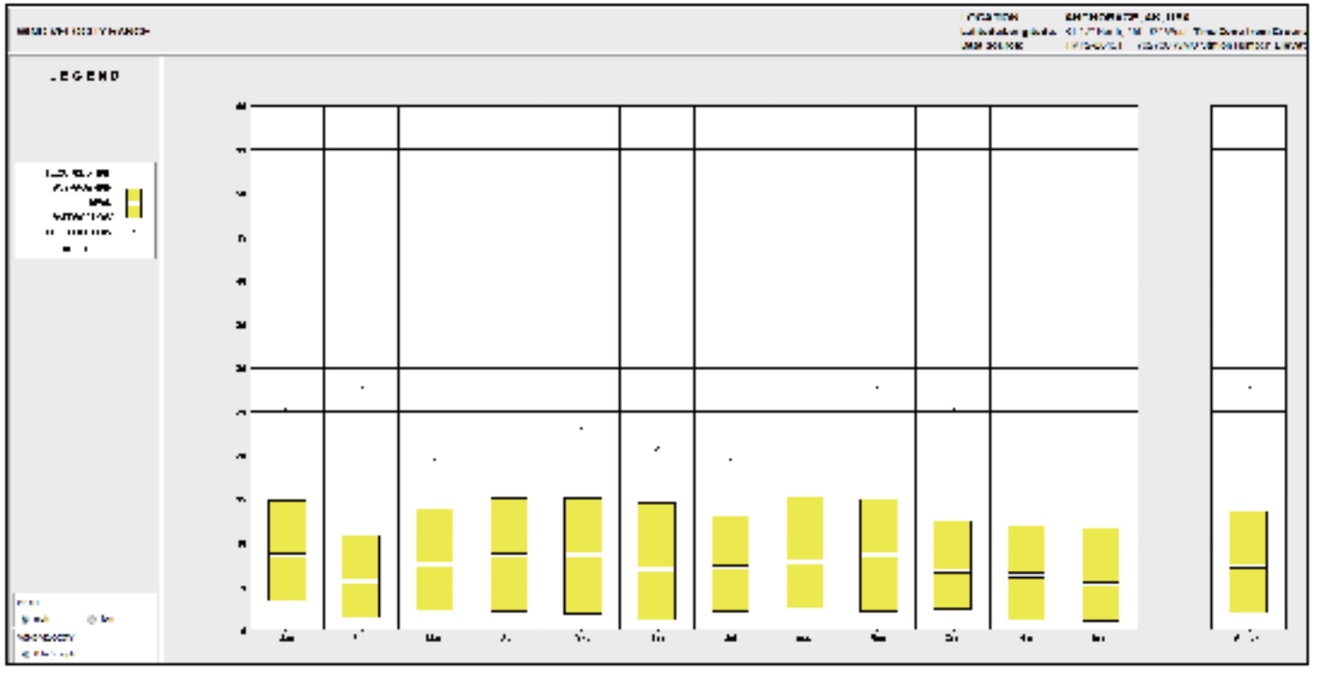


Wind Speed (m/s) - Hourly
ANCHORAGE AK USA
1 JAN 1:00 - 31 DEC 24:00

SECTION B HUMIDITY

1. HUMIDITY

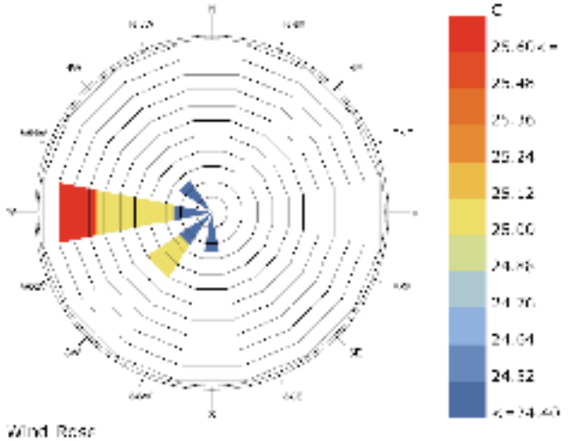
According to the diagram, the percentage of relative humidity is pretty high in the whole year. In summer, it is relatively drier. However, in winter, the relative humidity is 100% all day and night.



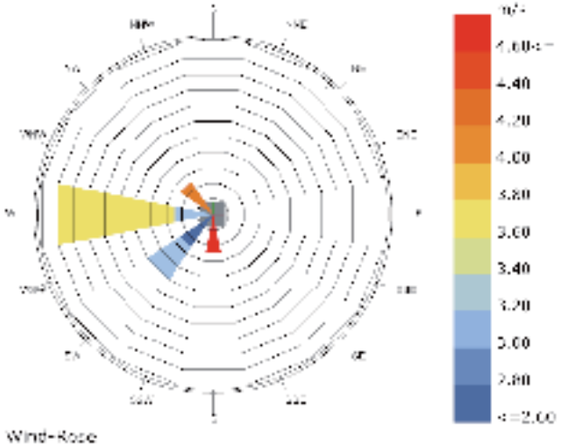
SECTION B WIND

1. WIND VELOVITY RANGE

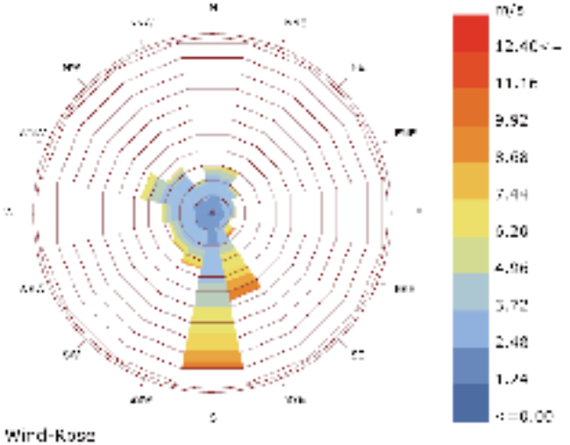
According to the chart from climate consultant, the wind is mild throughout the year. Therefore, there is no strategy is needed for avoid strong wind. In Wind-Rose diagram, the dominant wind direction is from south, so we need to avoid south wind causing the loss of heat.



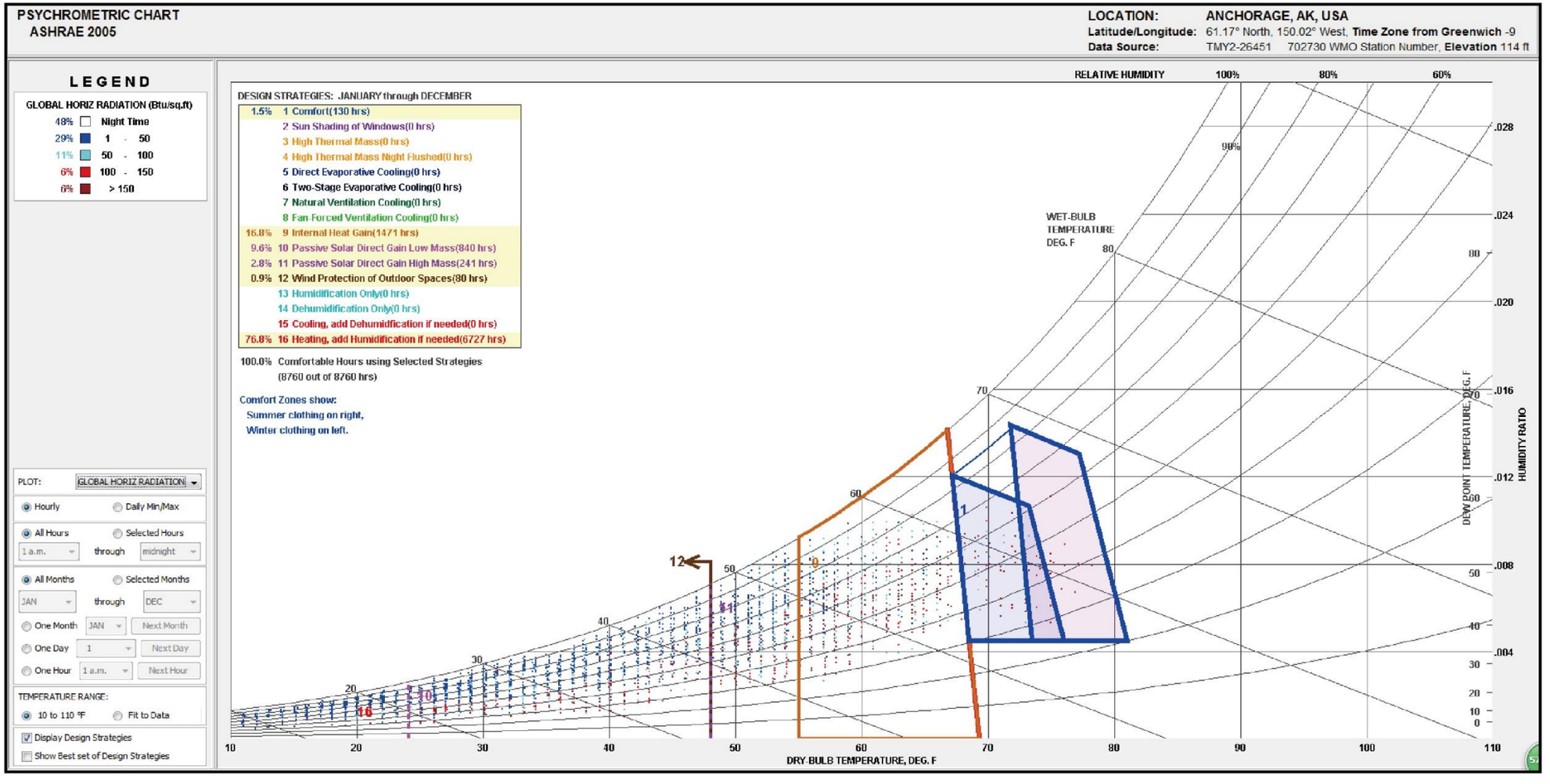
Wind Rose
ANCHORAGE_AK_USA
1 MAY 1:00 - 31 OCT 24:00
Hourly Data: Dry Bulb Temperature (C)
Calm for 0.00% of the time = 0 hours.
Each closed polyline shows frequency of 0.04% = 0 hours.



Wind-Rose
ANCHORAGE_AK_USA
1 MAY 1:00 - 31 OCT 24:00
Hourly Data: Wind Speed (m/s)
Calm for 0.00% of the time = 0 hours.
Each closed polyline shows frequency of 0.04% = 0 hours.



Wind-Rose
ANCHORAGE_AK_USA
1 MAY 1:00 - 31 OCT 24:00
Hourly Data: Wind Speed (m/s)
Calm for 3.92% of the time = 172 hours.
Each closed polyline shows frequency of 1.04% = 46 hours.



SECTION C DESIGN RECOMMENDATION

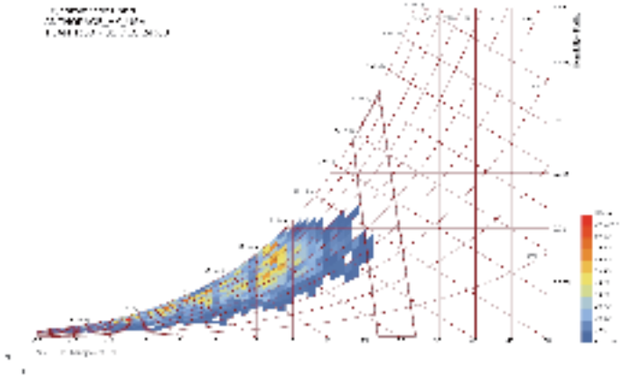
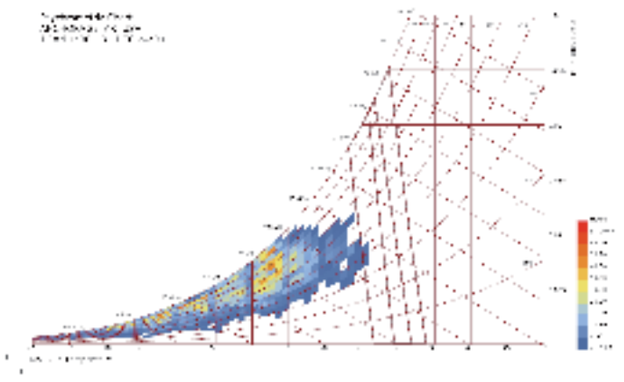
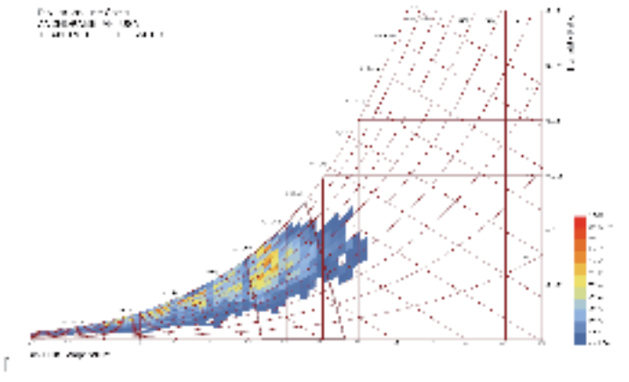
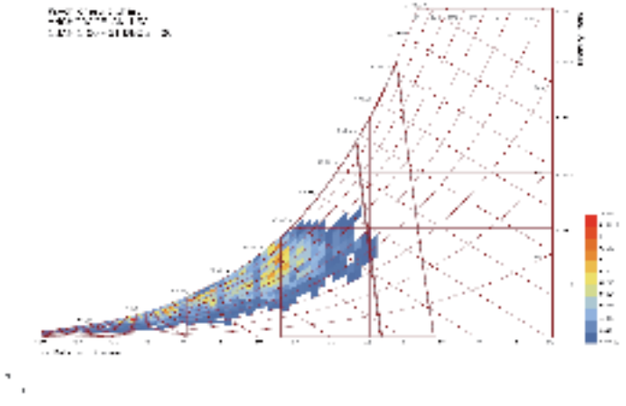
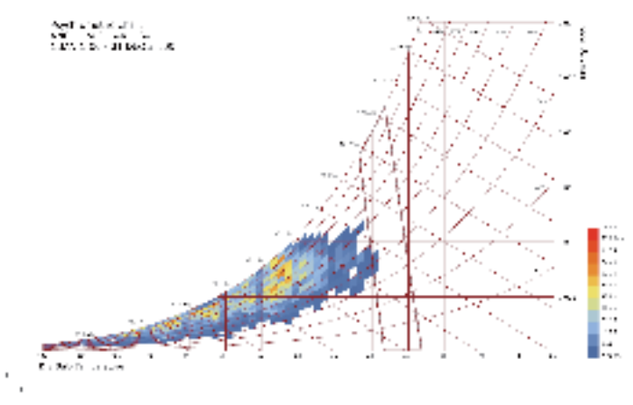
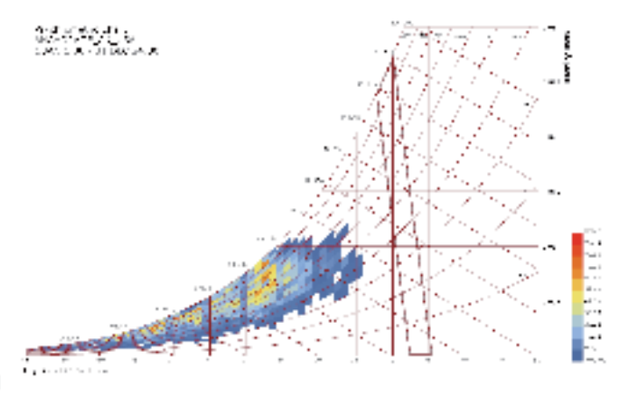
1. The temperature is extremely cold with very little time in indoor comfort zone throughout the year , especially in winter.

2. Much HVAC or heating system is needed in order to meet the indoor comfort in winter.

3. No shading and cooling strategies are needed in Anchorage.

4. Solar Direct Gain Low Mass is needed to collect heat in the daytime to warm up the rooms at night.

5. Solar Direct Gain High Mass is needed to collect heat in the daytime to warm up the rooms at night.

SECTION C DESIGN RECOMMENDATION

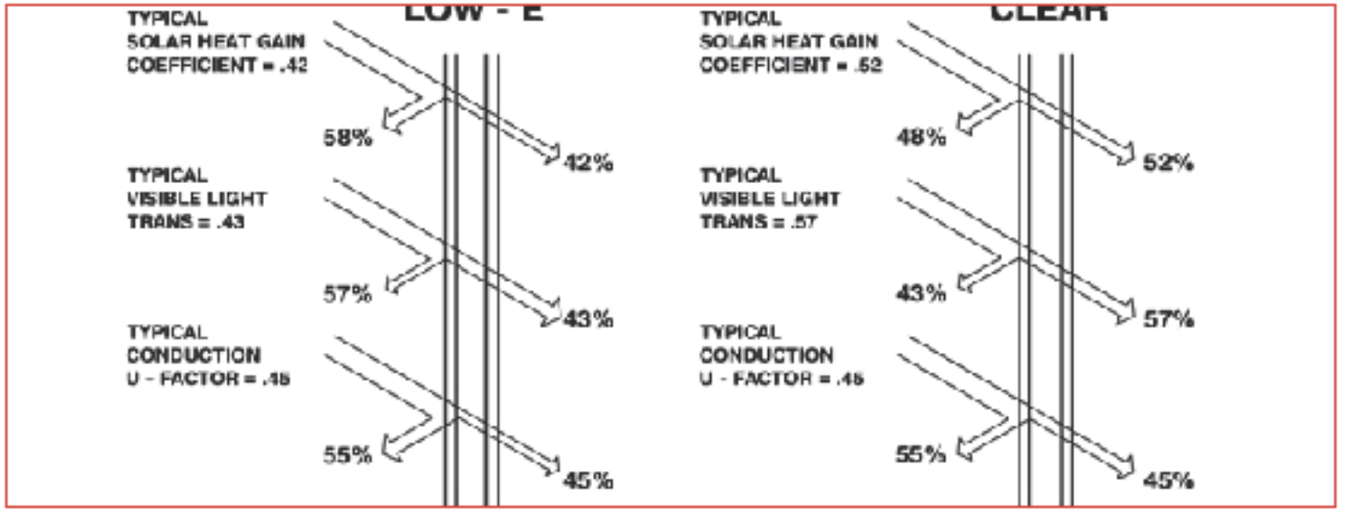
1. The temperature is extremely cold with very little time in indoor comfort zone throughout the year , especially in winter.

2. Much HVAC or heating system is needed in order to meet the indoor comfort in winter.

3. No shading and cooling strategies are needed in Anchorage.

4. Solar Direct Gain Low Mass is needed to collect heat in the daytime to warm up the rooms at night.

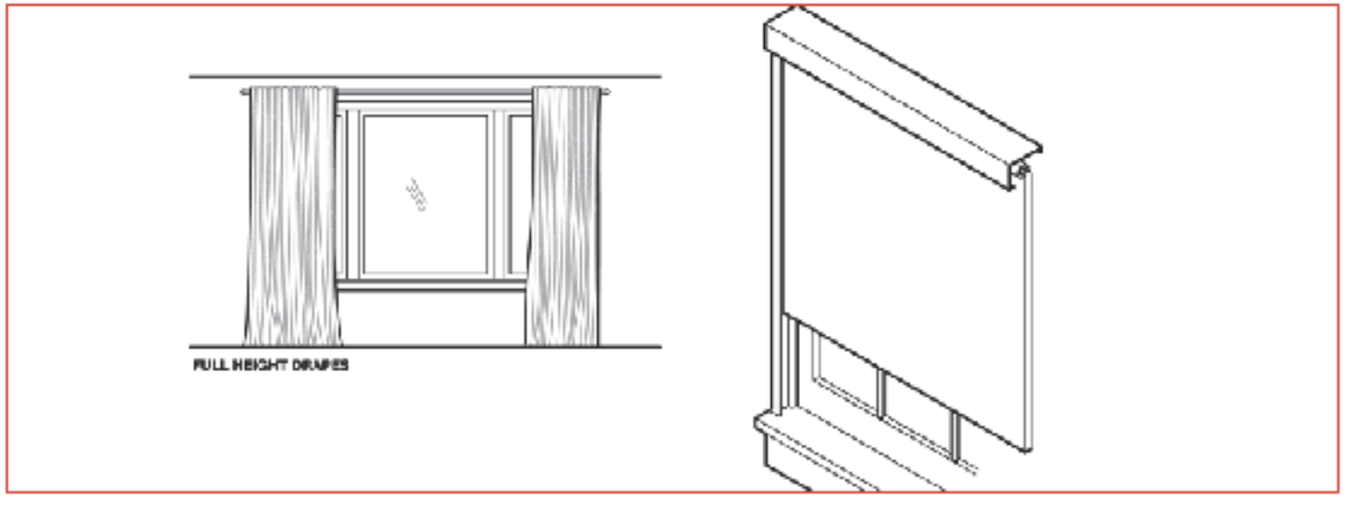
5. Solar Direct Gain High Mass is needed to collect heat in the daytime to warm up the rooms at night.



SECTION C
DESIGN RECOMMENDATION

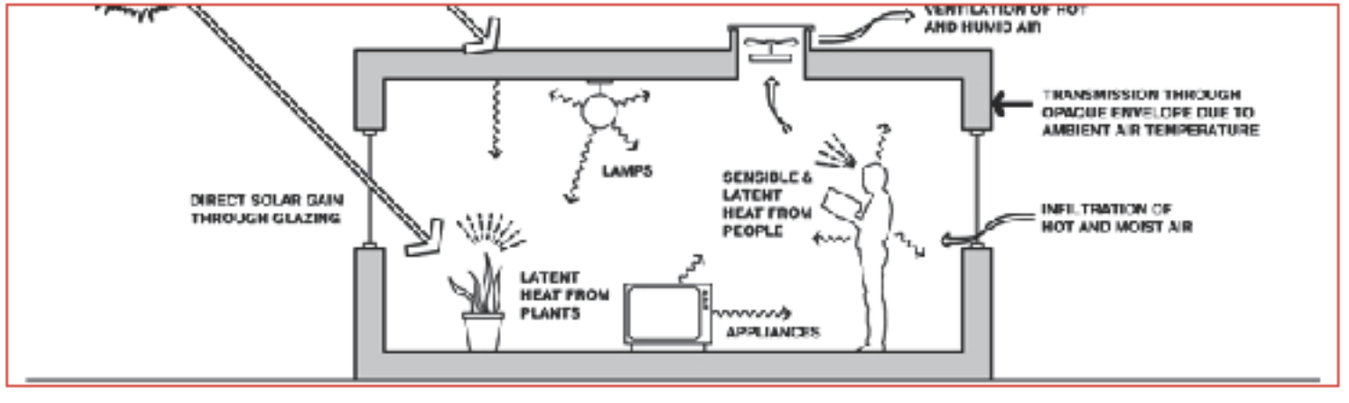
STRATEGY A BASED ON PANE

Provide double pane high performance glazing (Low-E) on west, north and east, but clear on south for maximum passive solar gain.



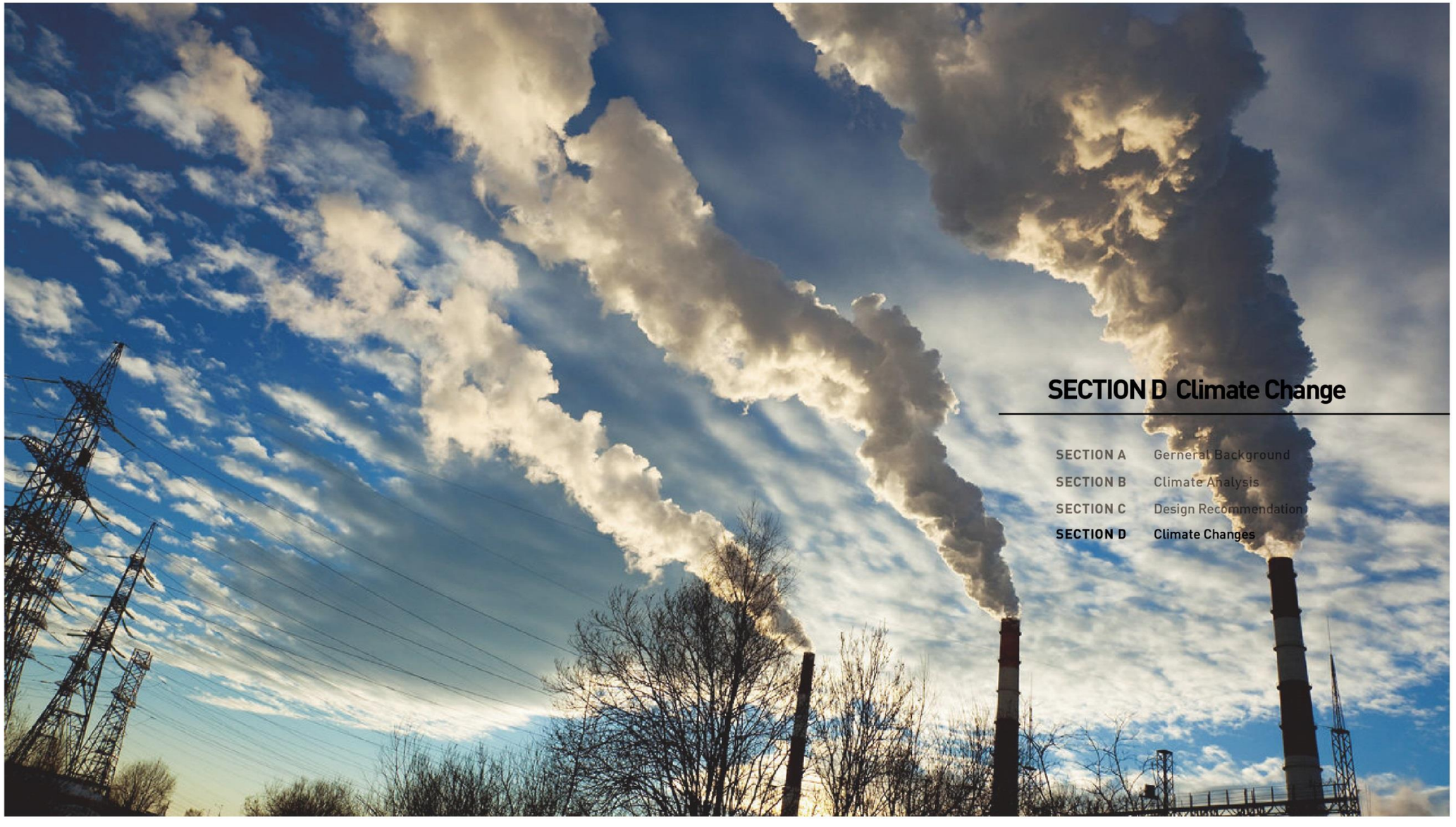
STRATEGY B INSULATION

Insulating blinds, heavy draperies, or operable window shutters will help reduce winter night time losses.



STRATEGY C HEAT GAIN

Heat gain from light, people, and equipment greatly reduces heating needs to keep home tight, well insulated (to lower Balance Point temperature).



With the air pollution becoming more and more serious, the global warming now is an important factor to affect the strategies for sustainable design.
Some possible changes are listed below:

1. The temperature becomes higher in the future, there is no need to have inslation windows or heavy draperiers.

2. No additional heating system is needed for warm up the rooms in anchorage.

3. Windows filters are needed to clean the dirty air before letting in. In summer, nature ventilation system is needed to cool down the indoor temperature.

IMPROVEMENTS

1. Temperature Diagram

The diagram before, just showed the general information of the city but not useful. The new diagram analyzes the temperature range of -12 and 26 degrees, where the most part of the comfort zone lies. In this way, the analysis can be specific for comfort design.

2. Wind Diagram

When analyzing the wind, the speed and direction are not enough. The humidity and temperature of the air are also needed to be taken into consideration. For inner comfort design, if the wind is too hot, there is no need to use the nature ventilation.

2. Comfort Diagram

When analyzing comfort zone, we should also take the inner heat, cloth and people's activities as major factors. These factors can greatly change the comfort zone.