

Building Simulation Assignment

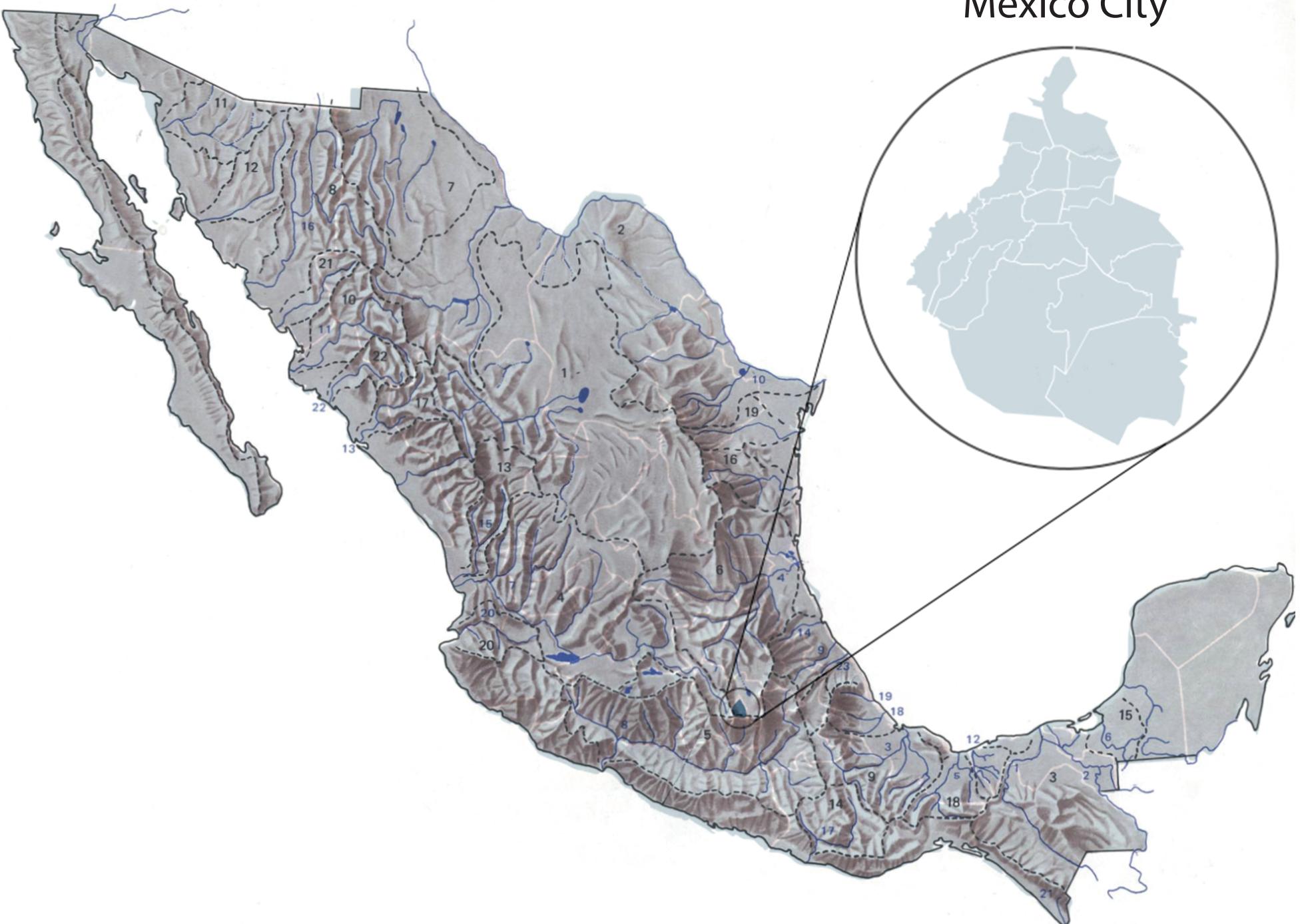
Mexico City passive design strategy research

Fang Cai

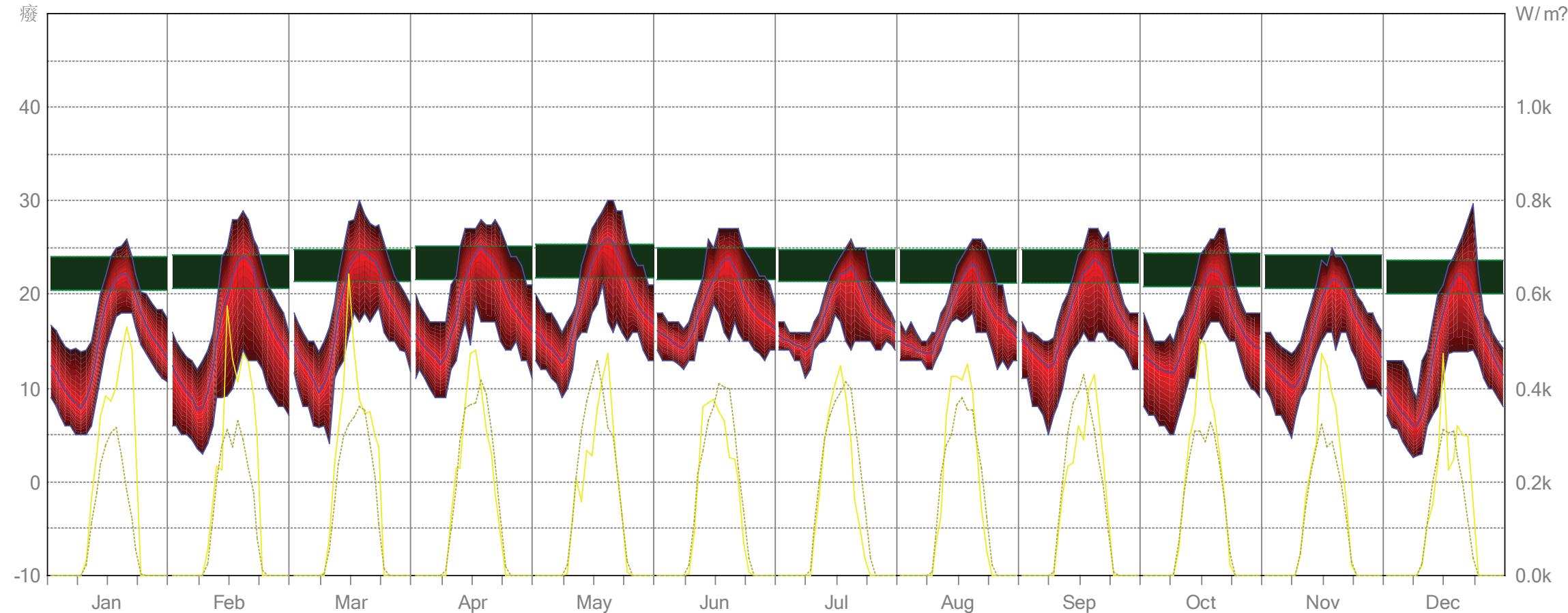
General Climate Condition

Mexico City

Mexico City has a subtropical highland climate, with warm summers and mild winters, and an annual average temperature of 64°F (18°C). Seasonal variations in temperature are small, but May is the warmest month of the year, and January the coldest, when night frosts are possible. The maximum temperatures of late spring and summer may reach up to 90°F (32°C), and the lowest winter temperatures reach 23°F (-5°C) in low-lying regions but these extremes are rare. Mexico City has a high average annual rainfall, most falling in summer, the wettest month being July, and the driest month February. Even during the summer rainy season, travellers are likely to get plenty of sunshine between showers. Mexico City suffers from terrible air pollution and the city is often smoggy, with poor visibility. This air pollution is at its worst during winter. The city is a year-round travel destination, but the best time to visit Mexico City is in the spring months of April and May.

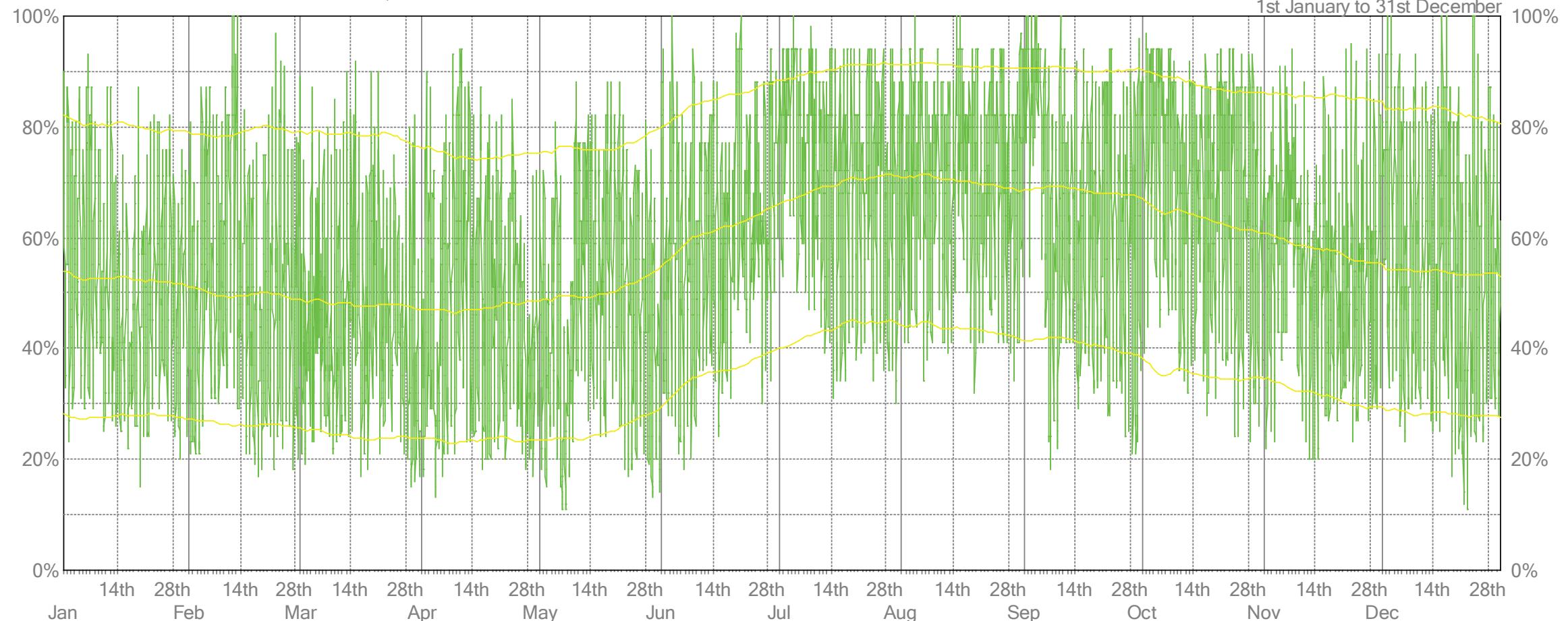


MONTHLY DIURNAL AVERAGES - MEXICO CITY, MEX



Mexico is quite humid, relative humidity is range from 55% to 80%. So in this case, dehumidify strategy is a good idea. Temp in mexico is around 18 to 28C, good orientation is a good strategy.

RELATIVE HUMIDITY - MEXICO CITY, MEX



An effective passive solar heating design assumes that the building is orientated to receive as much solar radiation as possible in winter, when heating is required, whilst rejecting as much as possible in summer when it is not.

The most favourable orientations occur where the amount of incident radiation in winter is greater than that incident in summer, where the blue line extends out beyond the red line. So the best orientation for mexico city is direction of yellow arrow.

Optimum Orientation

Location: MEXICO CITY, MEX

Orientation based on average daily incident radiation on a vertical surface.

Underheated Stress: 0.0

Overheated Stress: 69.6

Compromise: 167.5?

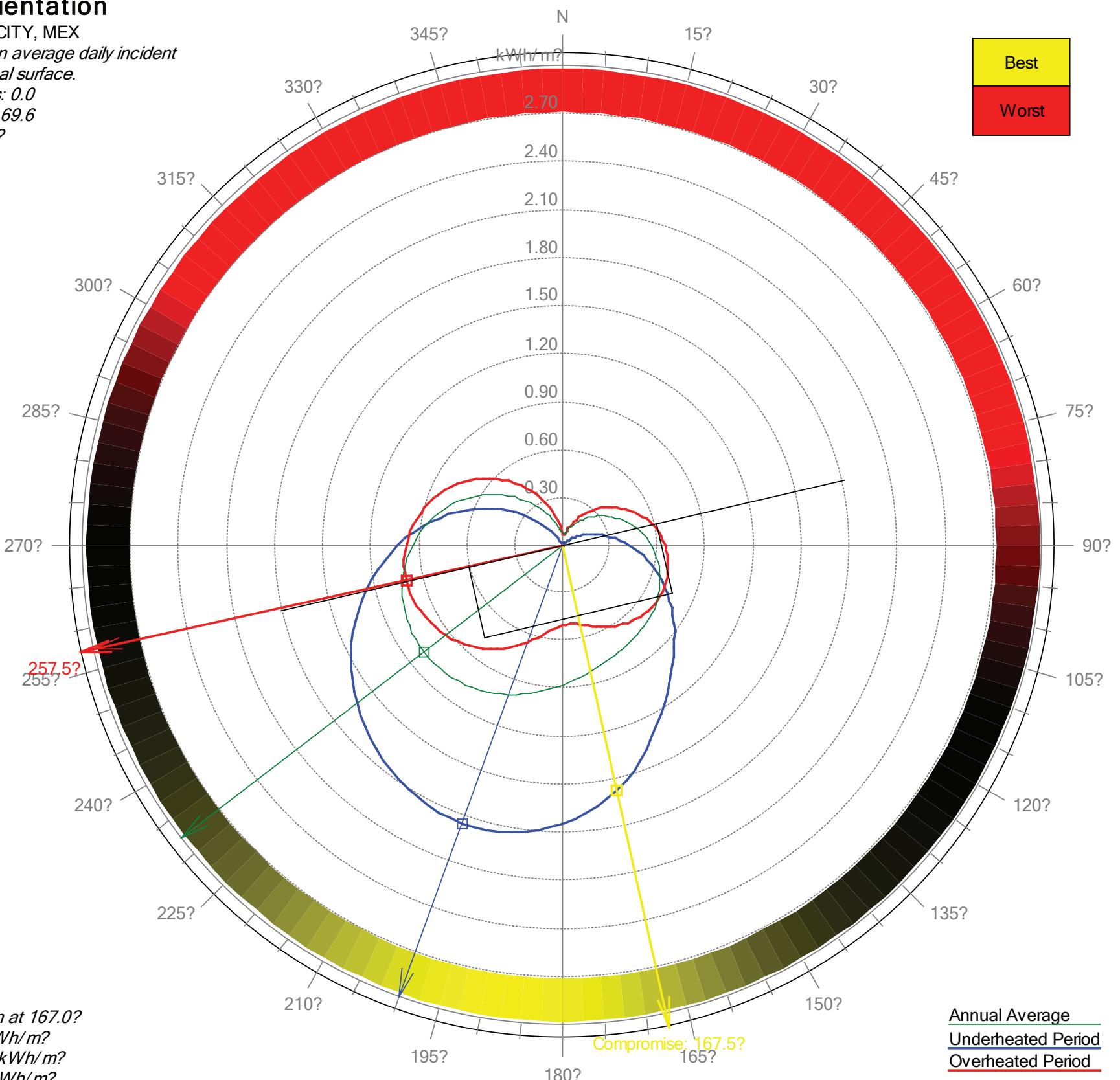
?Weather Tool

Avg. Daily Radiation at 167.0?

Entire Year: 0.79 kWh/m²

Underheated: 1.52 kWh/m²

Overheated: 0.51 kWh/m²

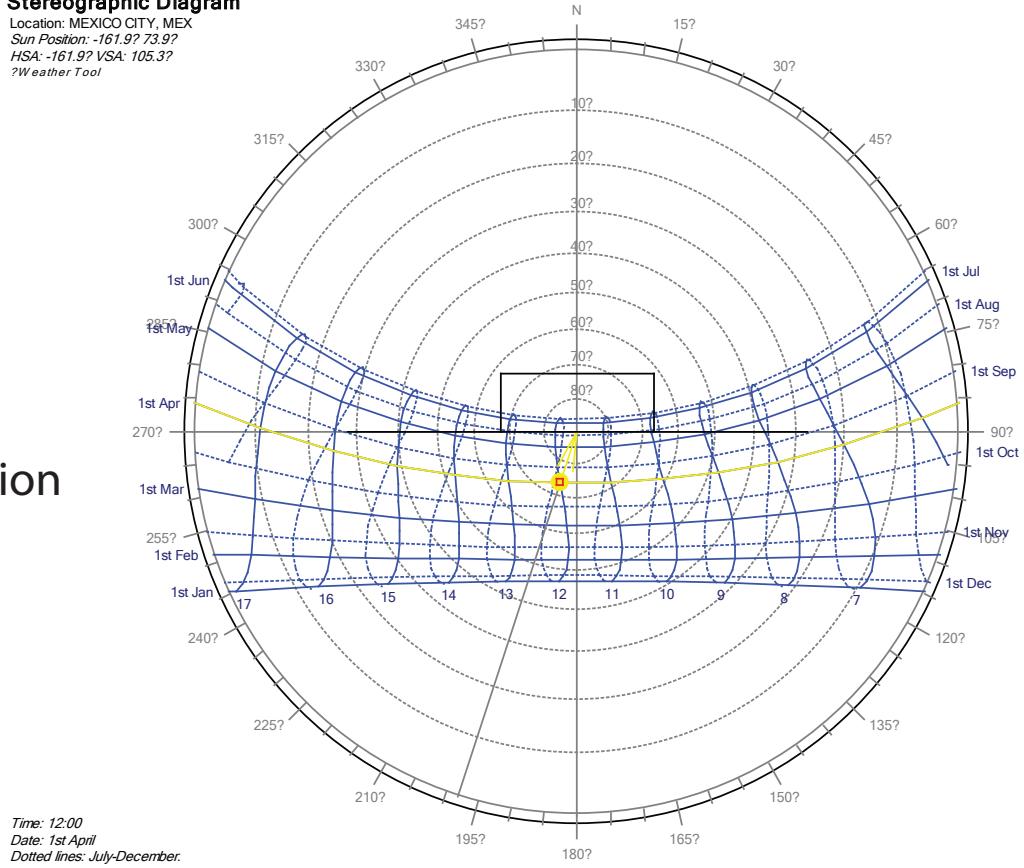


Annual Average

Underheated Period

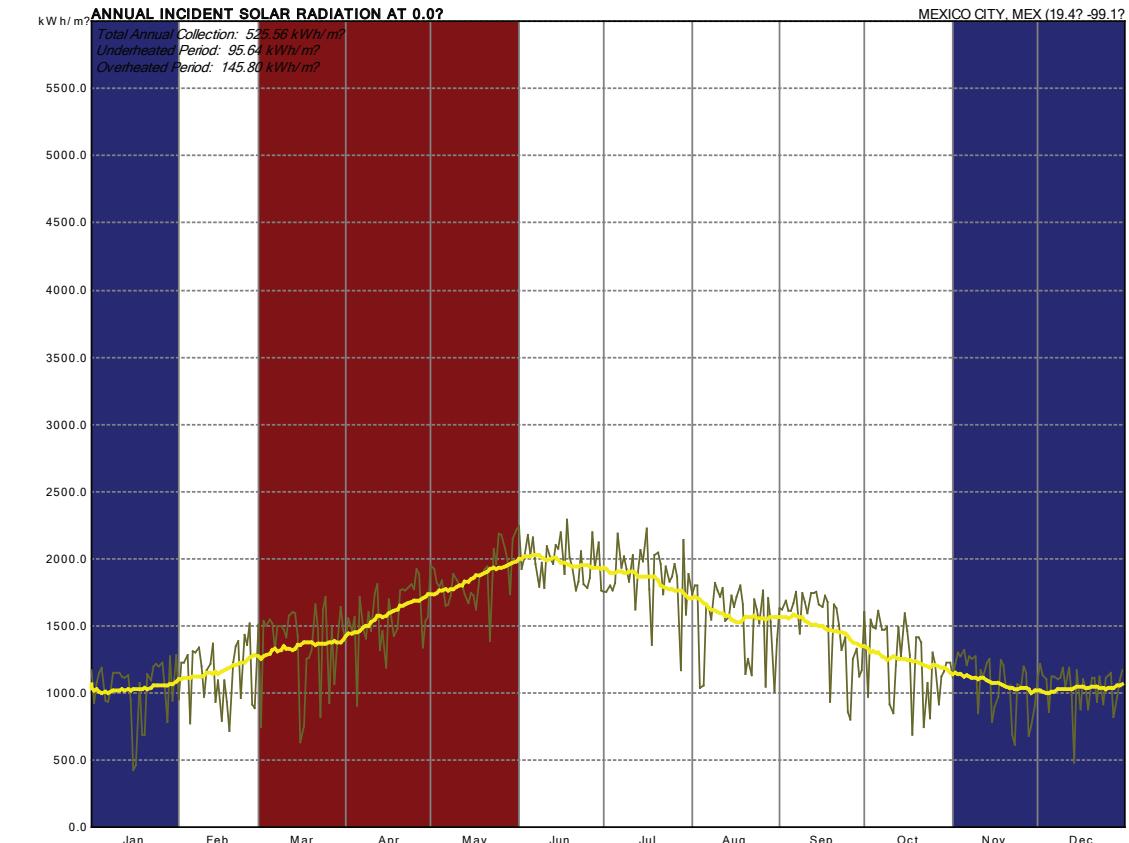
Overheated Period

Stereographic Diagram
Location: MEXICO CITY, MEX
Sun Position: -161.9° 73.9°
HSA: -161.9° VSA: 105.3°
?Weather Tool

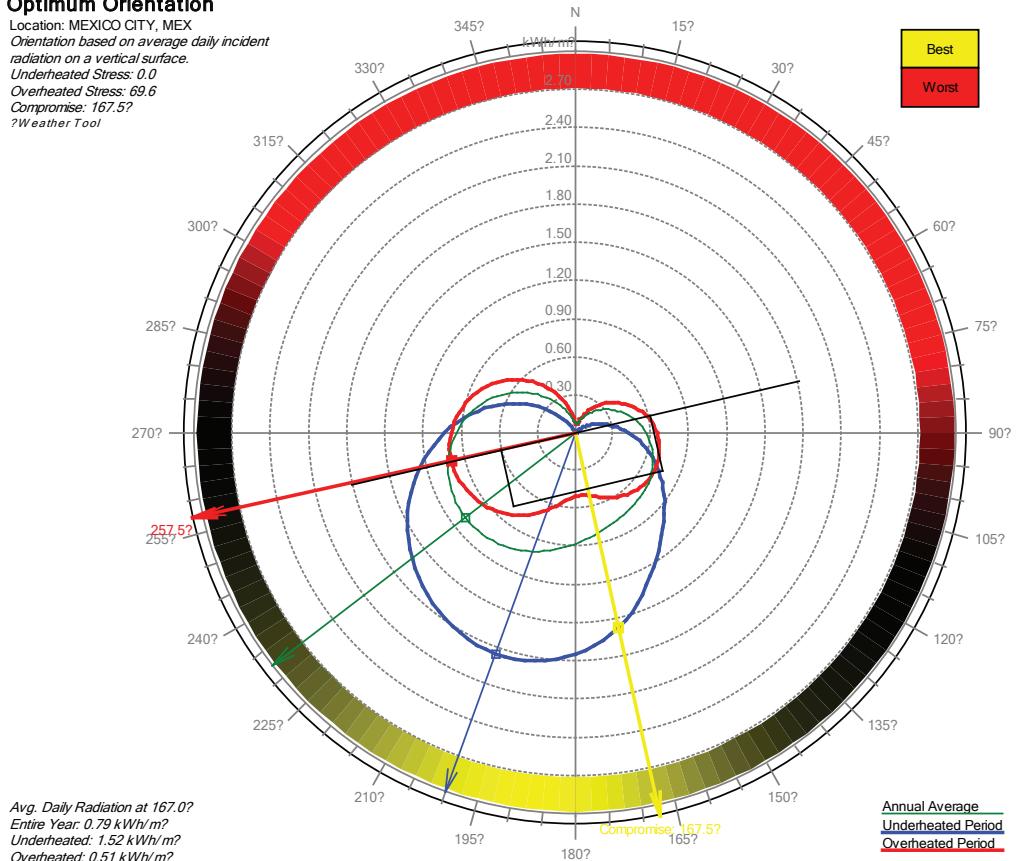


Random Orientation

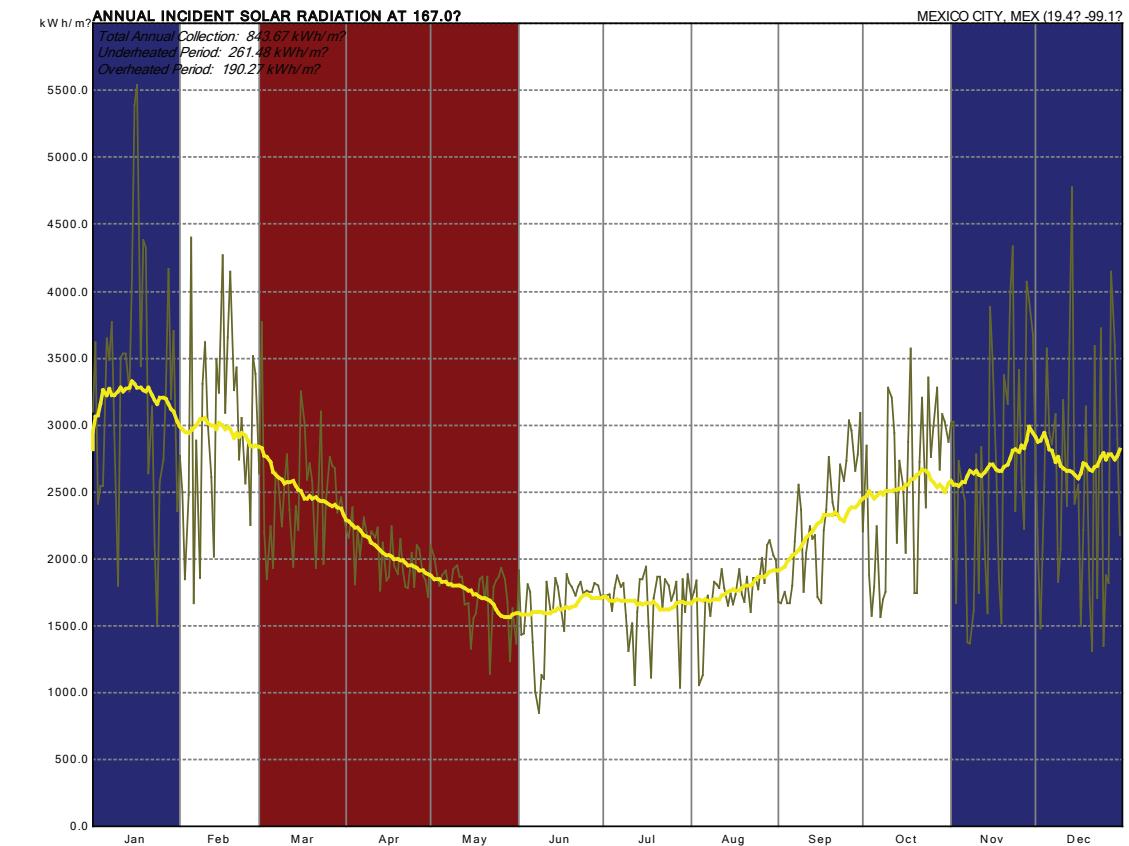
Radiation map



Optimum Orientation
Location: MEXICO CITY, MEX
Orientation based on average daily incident radiation on a vertical surface.
Underheated Stress: 0.0
Overheated Stress: 69.6
Compromise: 167.5°
?Weather Tool



Best Orientation



PASSIVE DESIGN STRATEGY 2

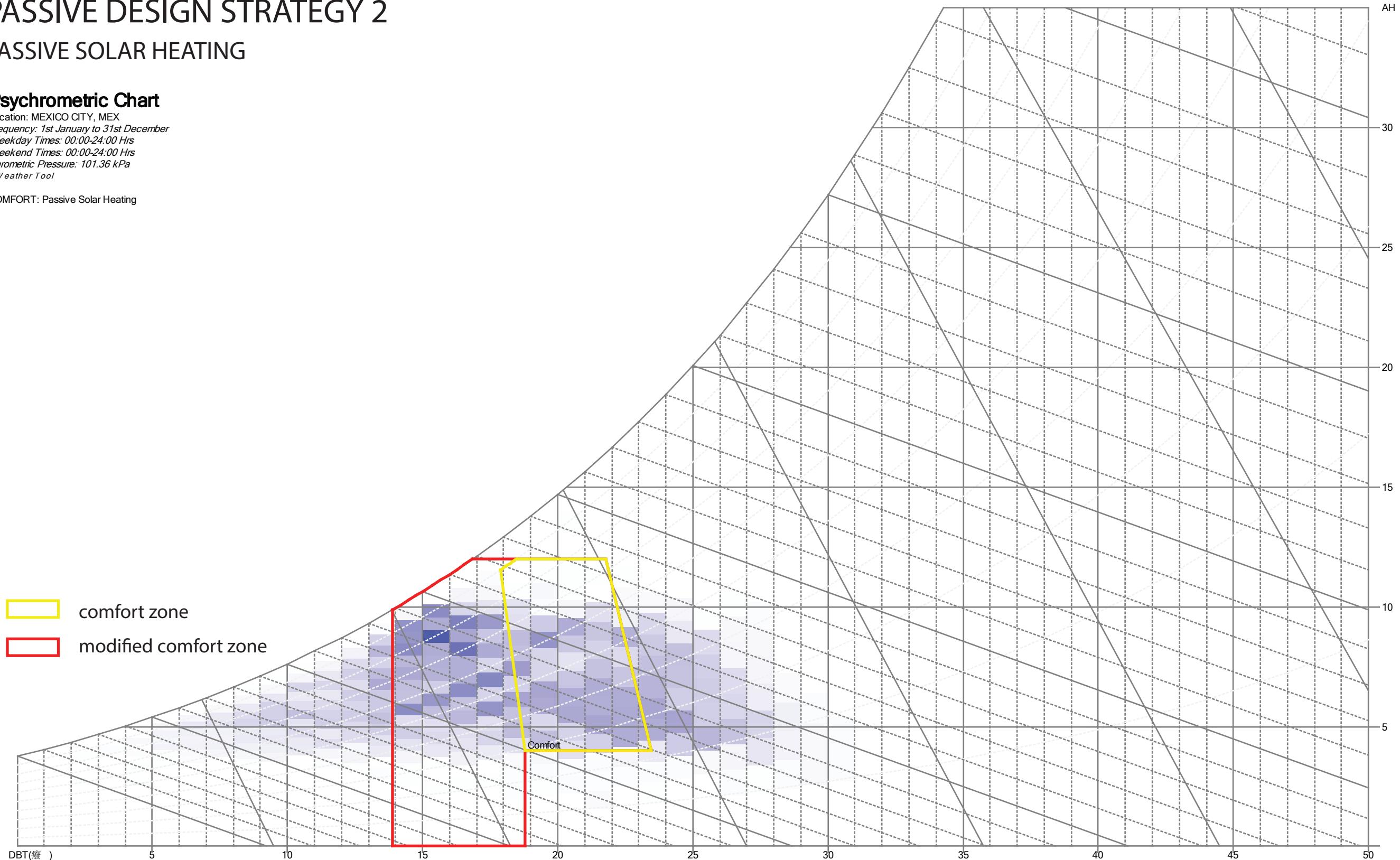
PASSIVE SOLAR HEATING

Psychrometric Chart

Location: MEXICO CITY, MEX
Frequency: 1st January to 31st December
Weekday Times: 00:00-24:00 Hrs
Weekend Times: 00:00-24:00 Hrs
Barometric Pressure: 101.36 kPa
?Weather Tool

COMFORT: Passive Solar Heating

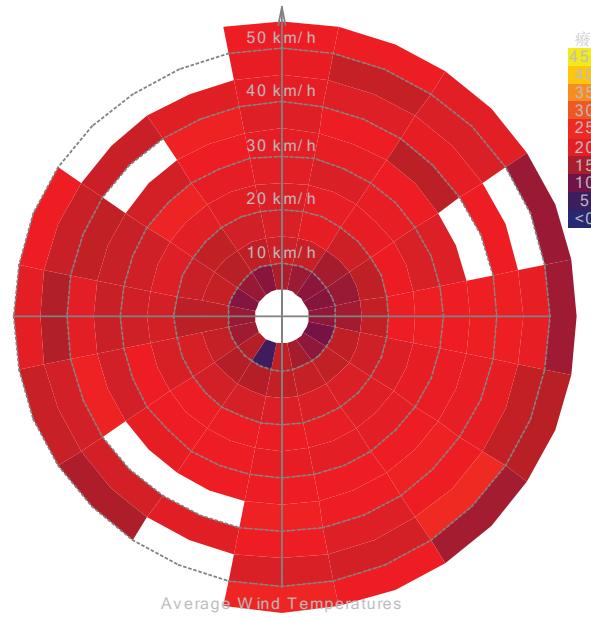
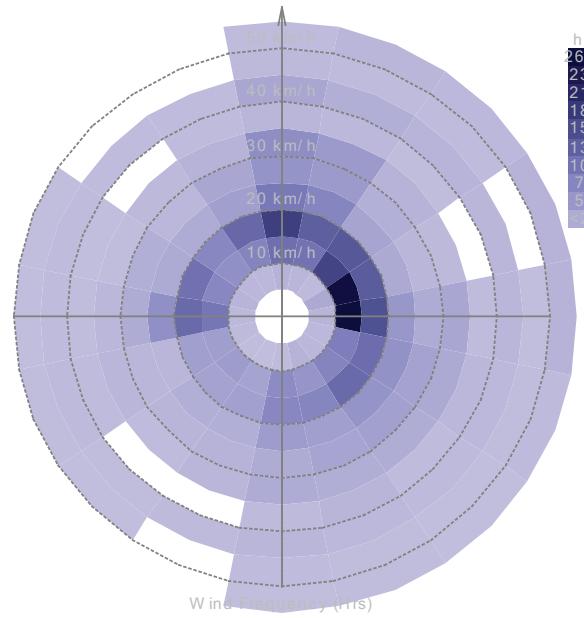
- comfort zone
- modified comfort zone



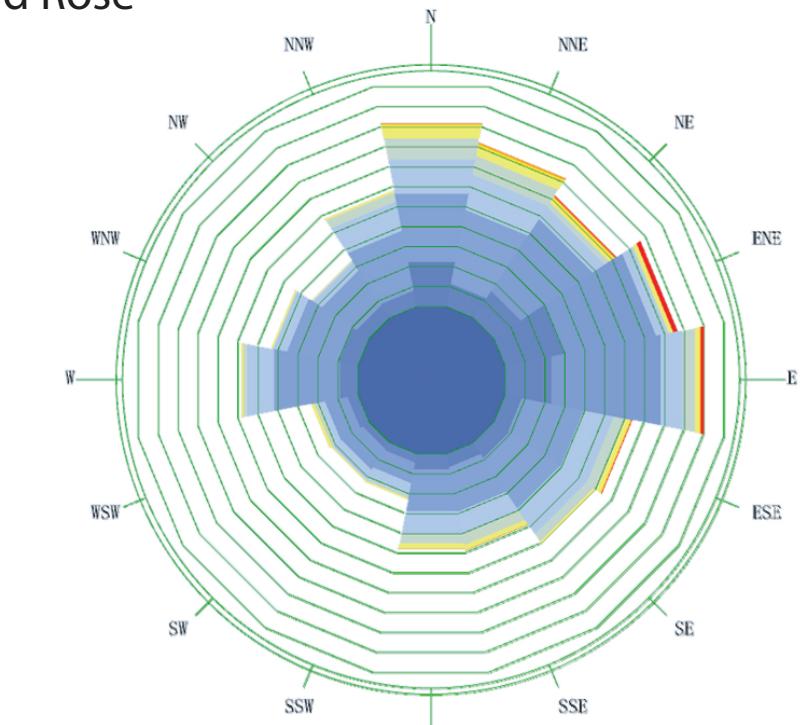
Prevailing Winds

Wind Frequency (Hrs)

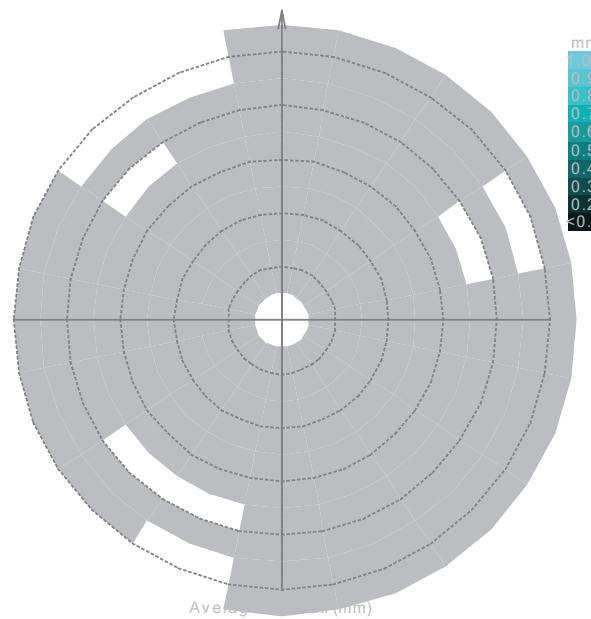
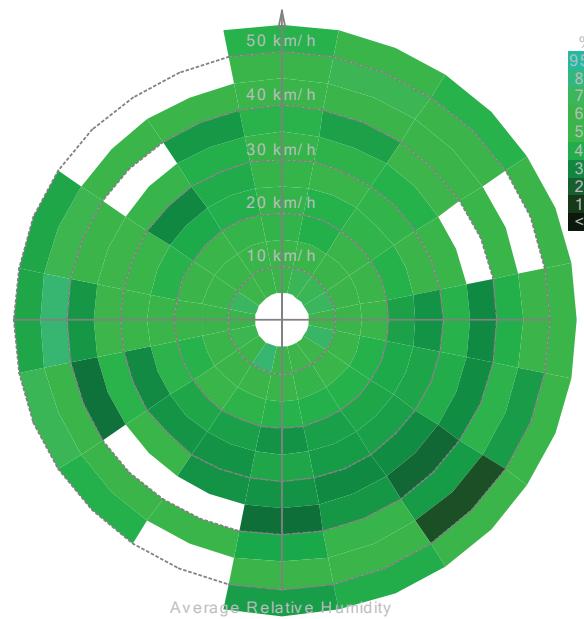
Location: MEXICO CITY, MEX (19.47 -99.17)
 Date: 1st January - 31st December
 Time: 00:00 - 24:00
 ?Weather Tool



Unfiltered Wind Rose

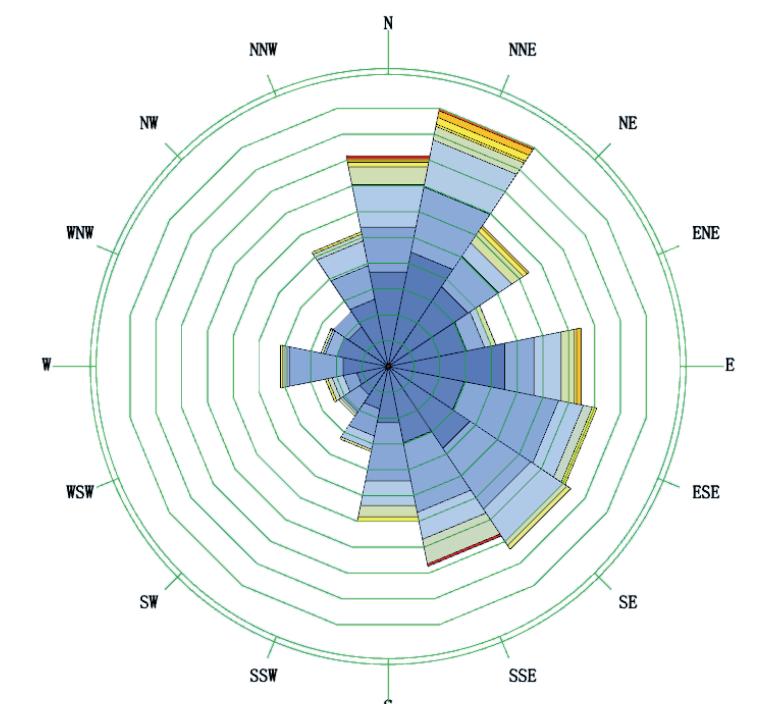


Wind-Rose
MEXICO CITY_MEX
1 JAN 1:00 - 31 DEC 24:00

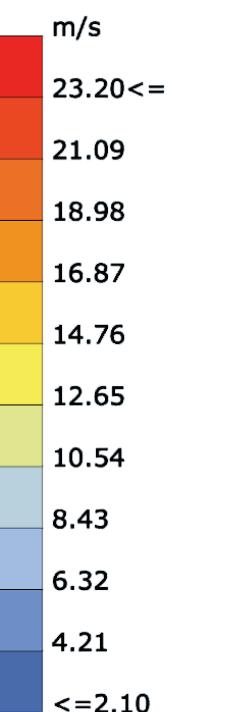
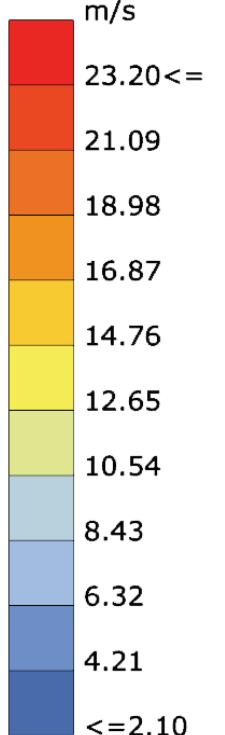


Filtered Wind Rose

Temp 18-22
Humidity<80
Speed<2



Wind-Rose
MEXICO CITY_MEX
1 JAN 1:00 - 31 DEC 24:00



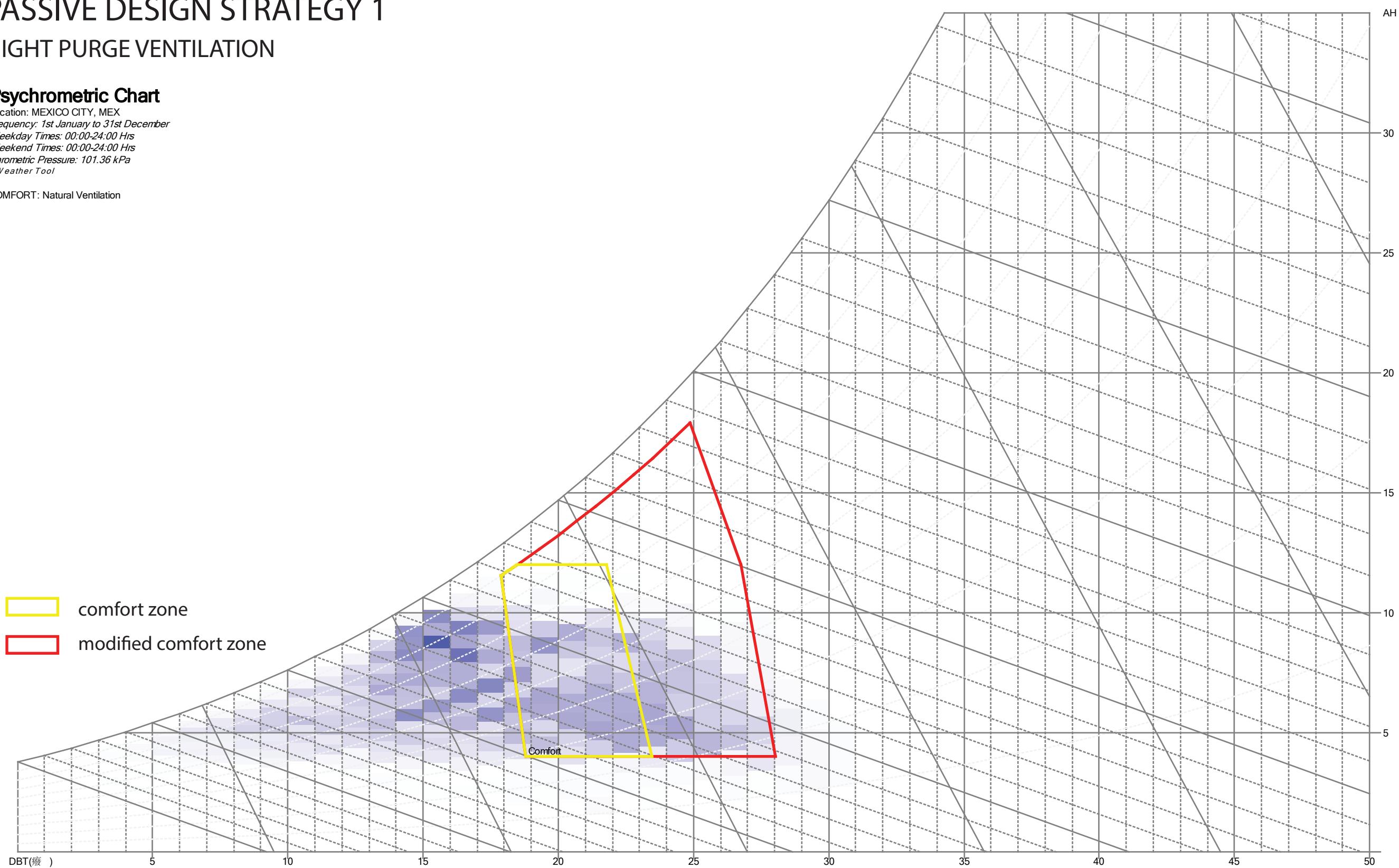
PASSIVE DESIGN STRATEGY 1

NIGHT PURGE VENTILATION

Psychrometric Chart

Location: MEXICO CITY, MEX
Frequency: 1st January to 31st December
Weekday Times: 00:00-24:00 Hrs
Weekend Times: 00:00-24:00 Hrs
Barometric Pressure: 101.36 kPa
Weather Tool

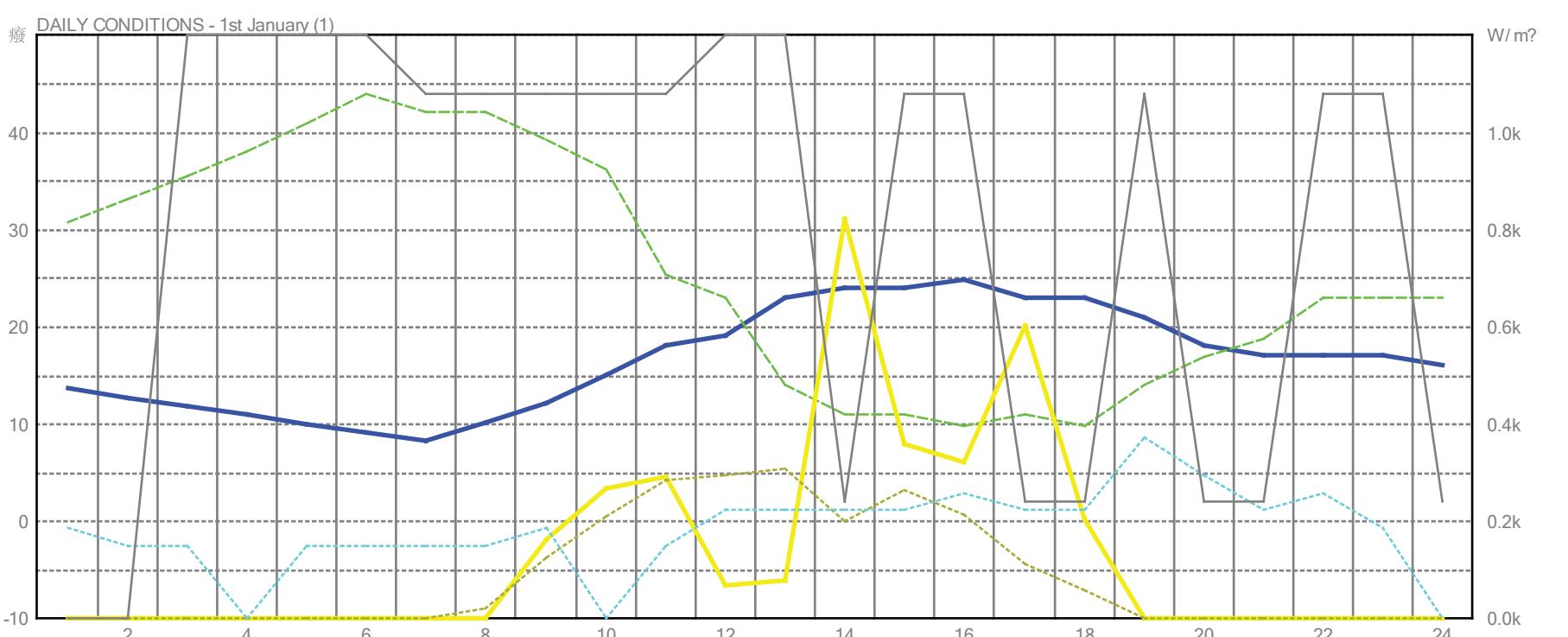
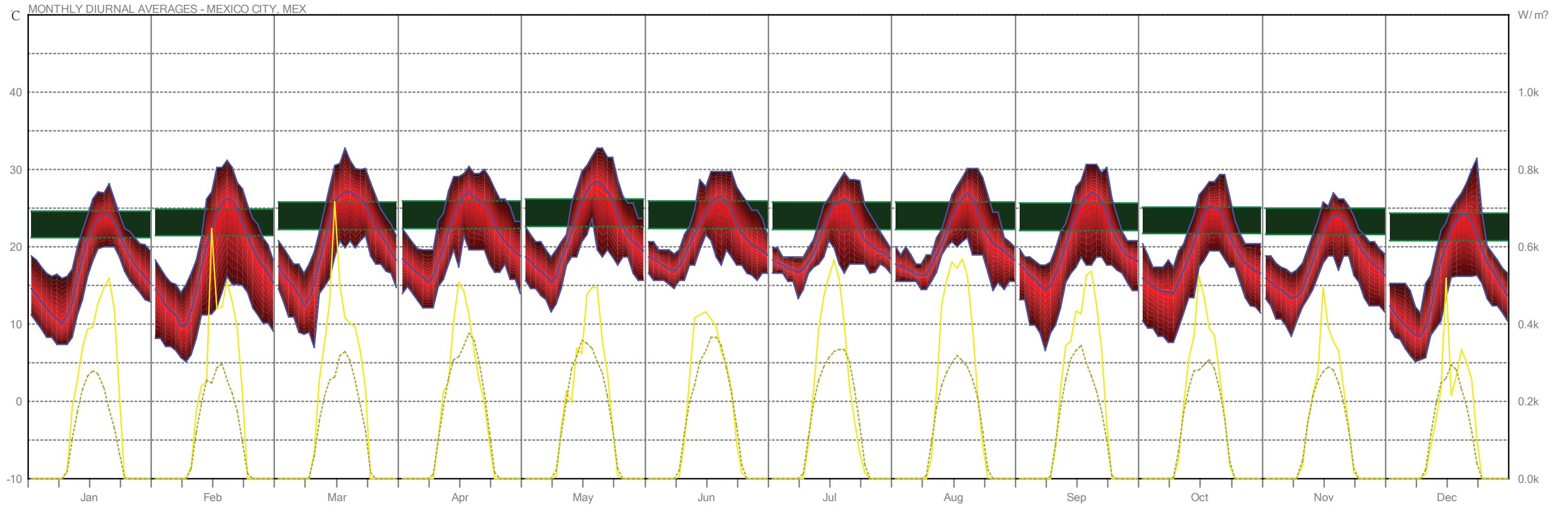
COMFORT: Natural Ventilation



FURTHER DATA REQUIRED

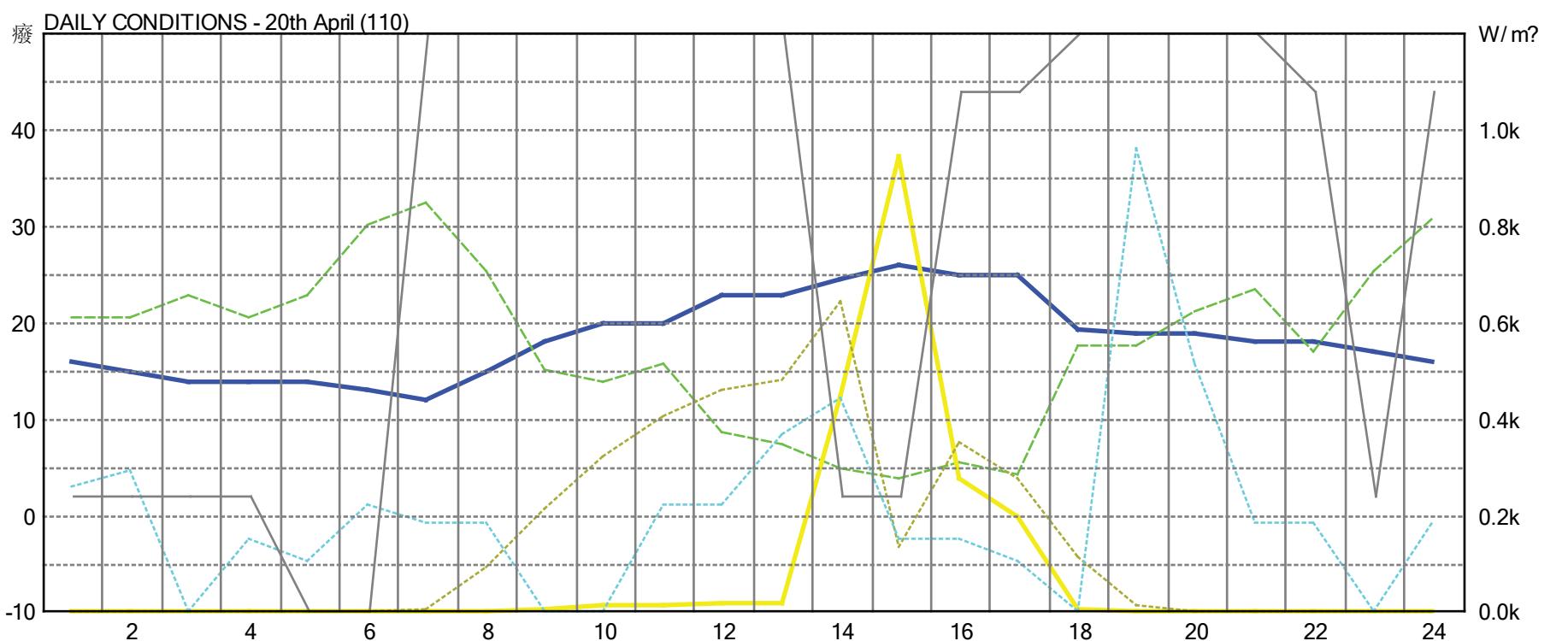
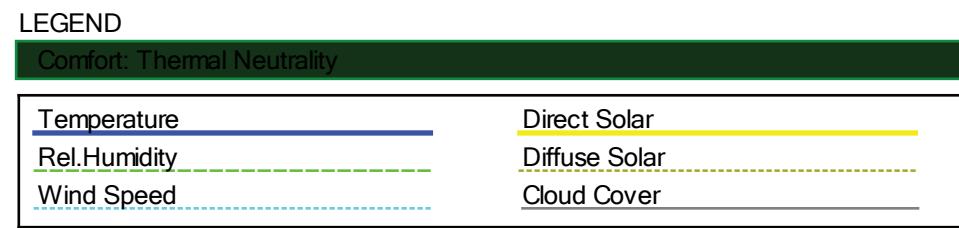
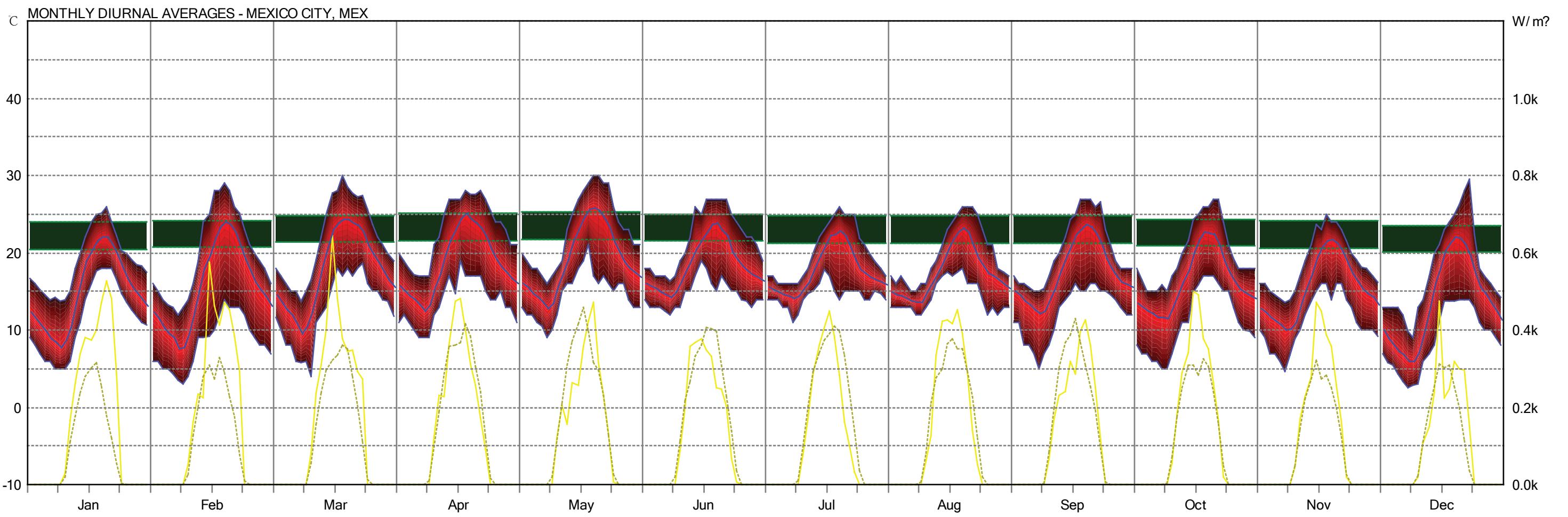
- 1 Site Specific weather data
- 2 Mixed-use building designed internal load, operation time
- 3 Building mass geometry
- 4 Building construction material

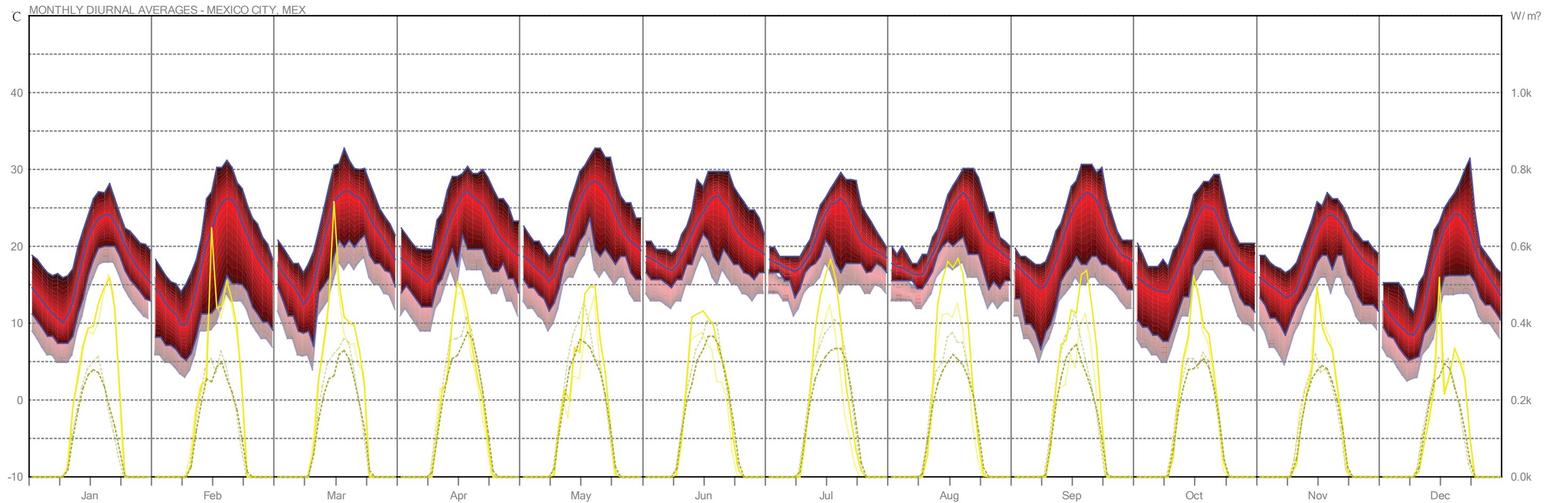
CLIMATE CHANGE IN 2050



LEGEND

Comfort: Thermal Neutrality	(Solid Dark Green Bar)
Temperature	(Solid Blue Line)
Rel.Humidity	(Dashed Green Line)
Wind Speed	(Dashed Cyan Line)
Direct Solar	(Solid Yellow Line)
Diffuse Solar	(Dotted Yellow Line)
Cloud Cover	(Dashed Grey Line)

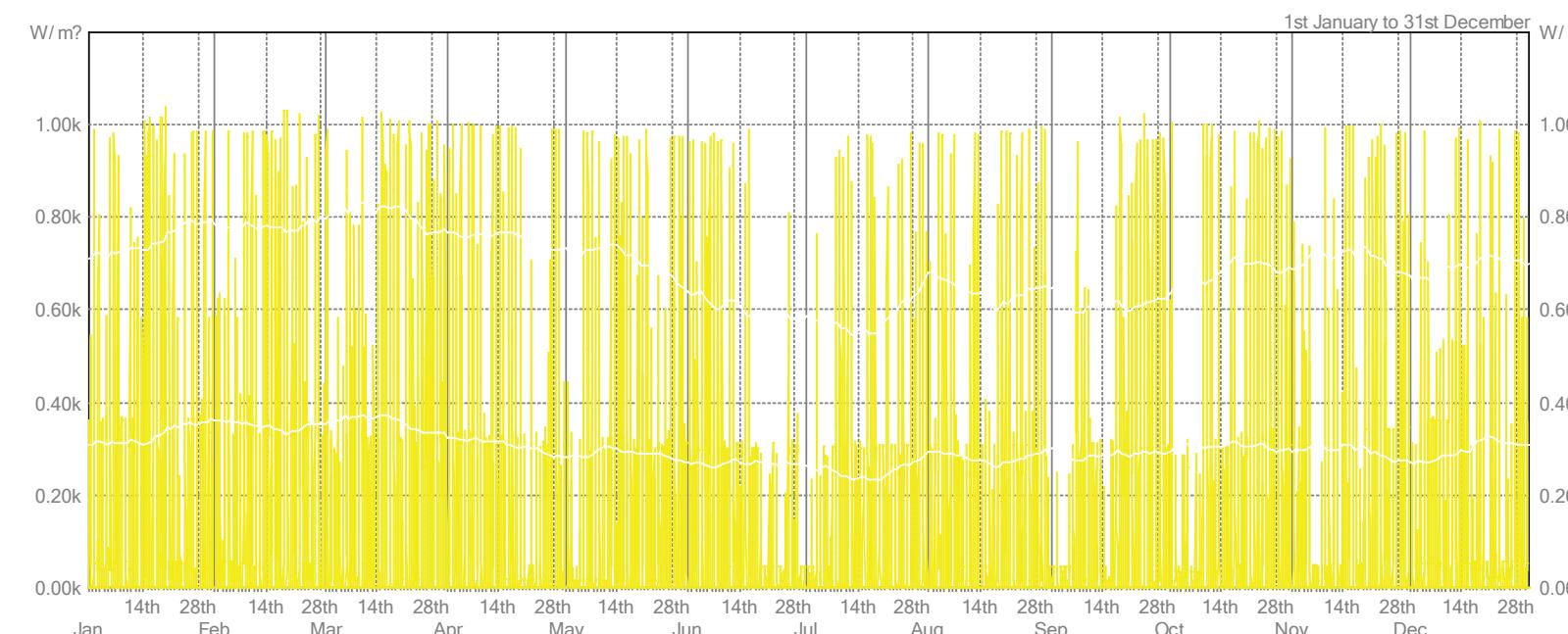




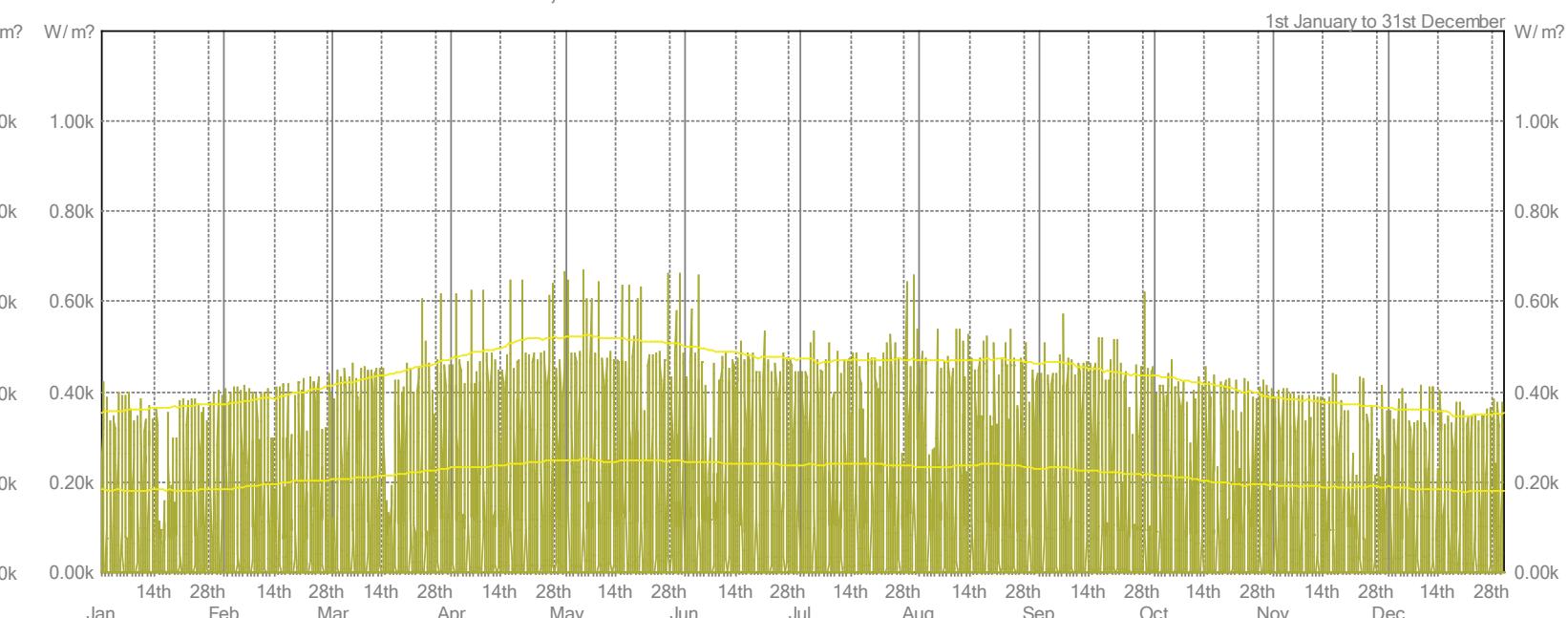
LEGEND

Comfort: Thermal Neutrality	
Temperature	Direct Solar
Rel.Humidity	Diffuse Solar
Wind Speed	Cloud Cover

DIRECT SOLAR - MEXICO CITY, MEX

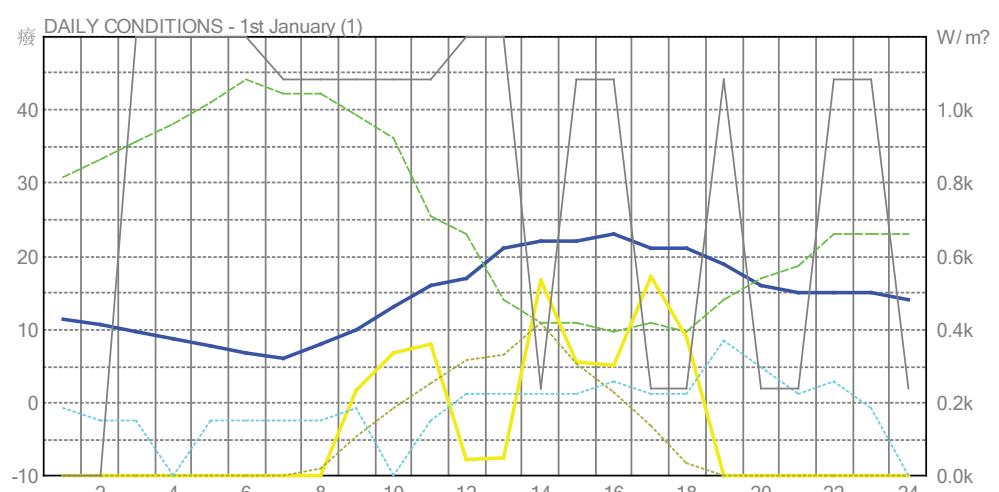


DIFFUSE SOLAR - MEXICO CITY, MEX



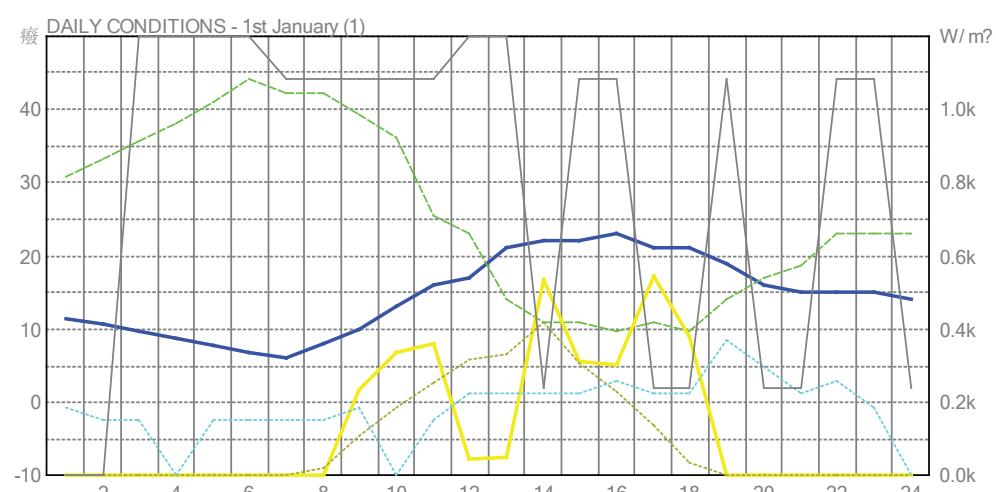
LEGEND

Temperature	Direct Solar
Rel.Humidity	Diffuse Solar
Wind Speed	Cloud Cover

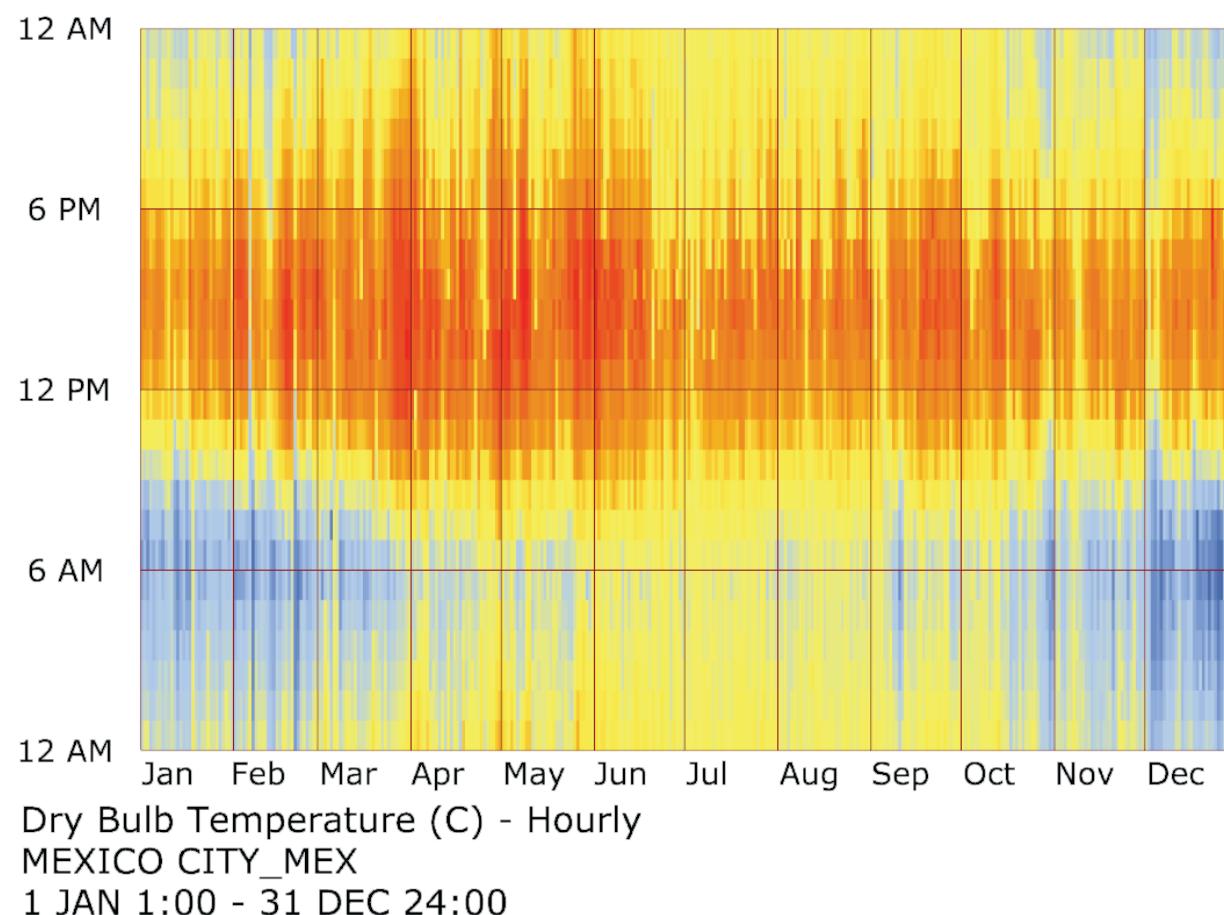


LEGEND

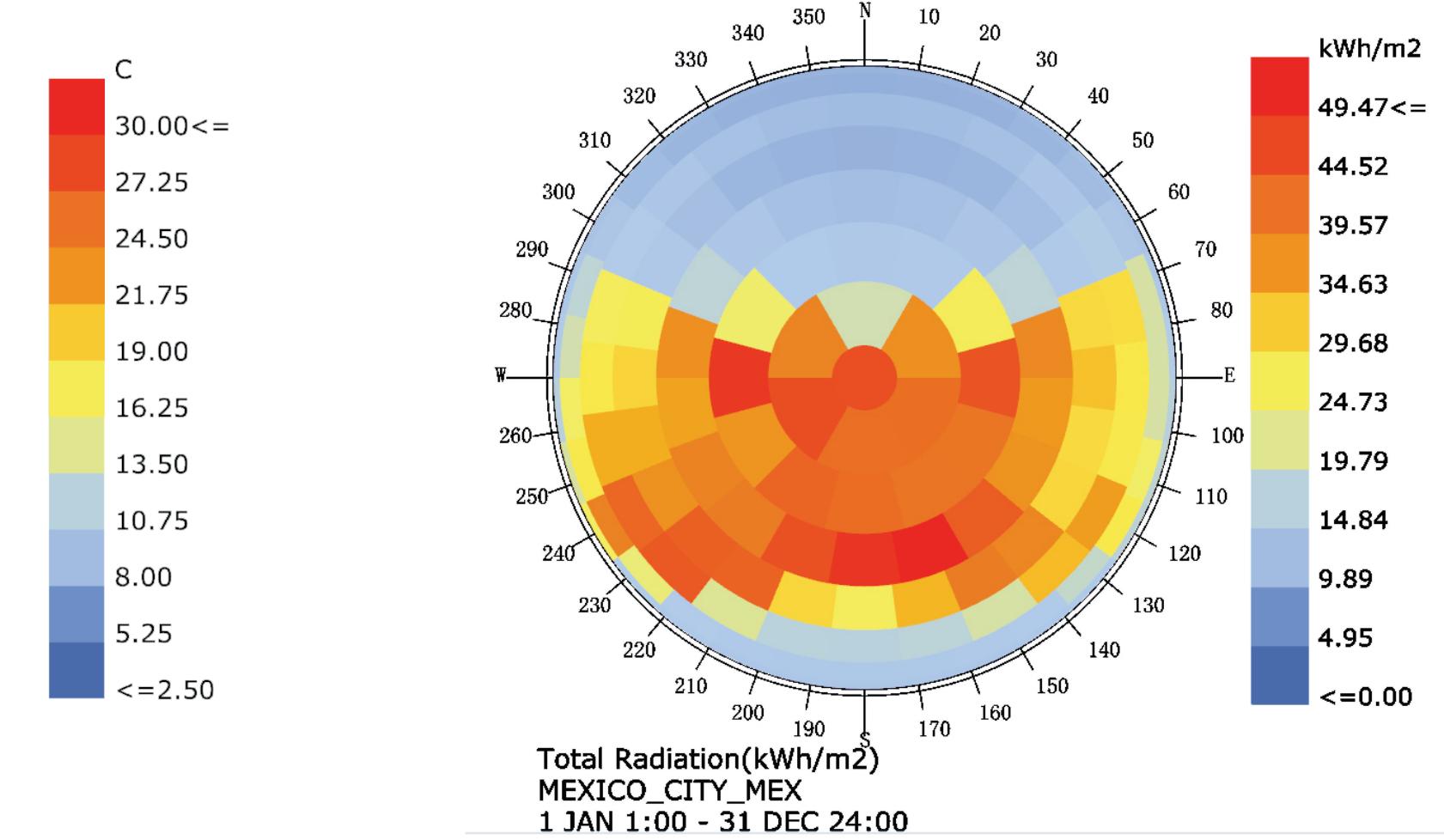
Temperature	Direct Solar
Rel.Humidity	Diffuse Solar
Wind Speed	Cloud Cover



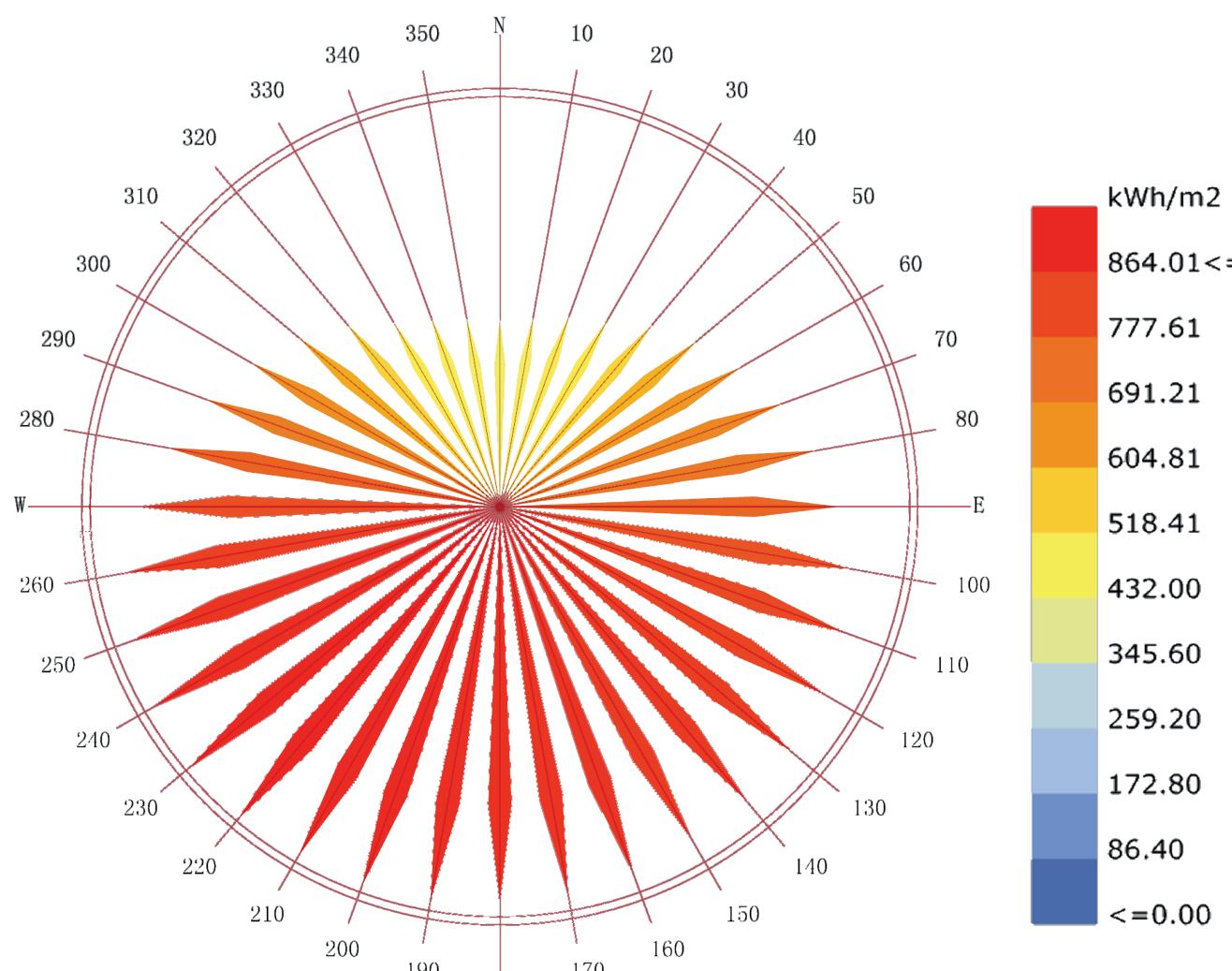
Temperature



Total Radiation

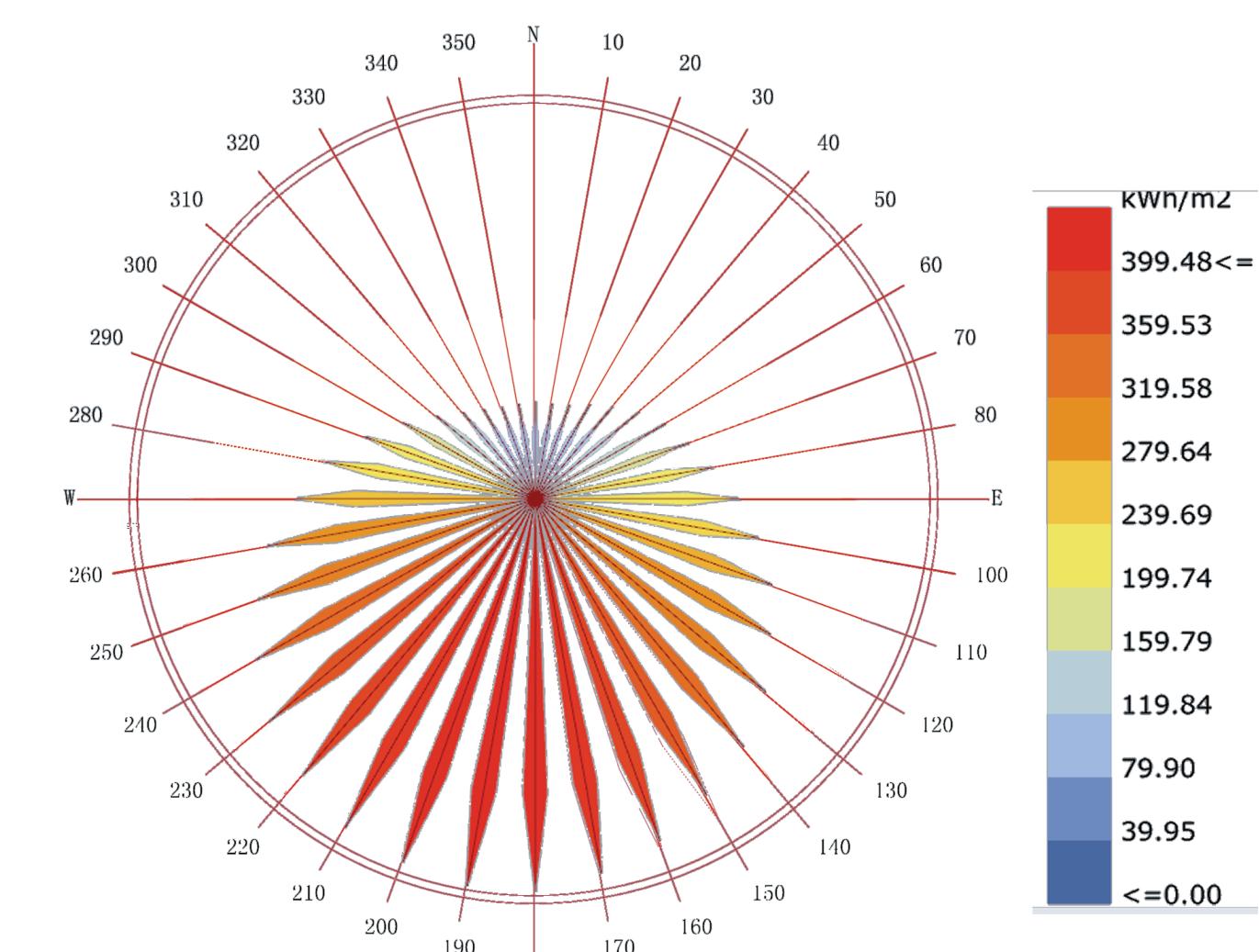


Total Radiation



Total Radiation(kWh/m²)
MEXICO_CITY_MEX
1 JAN 1:00 - 31 DEC 24:00

Winter Radiation



Total Radiation(kWh/m²)
MEXICO_CITY_MEX
1 NOV 1:00 - 28 FEB 24:00