

**Assignment 4:
Philadelphia Climate Data Report
Round 2**

Basic Information



Location:	Philadelphia International Airport, PA, USA
Latitude / Longitude:	39.87° North, 75.23° West
Time Zone from Greenwich:	-5
Data Source:	TMY3
Station Number:	724080 WMO
Elevation:	6 ft
Comfort Model:	California Energy Comfort Model, 2013

Weather Data Summary

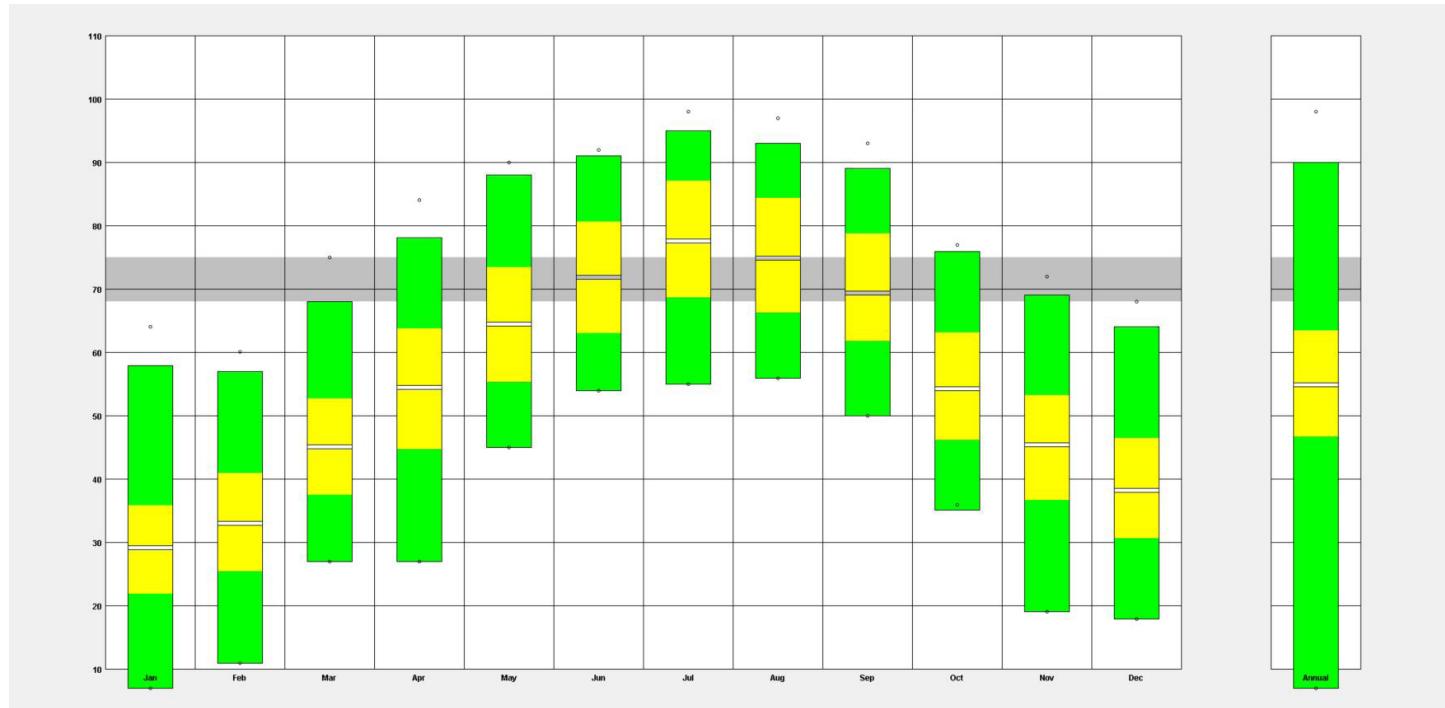
MONTHLY MEANS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Global Horiz Radiation (Avg Hourly)	67	82	102	115	126	134	124	131	112	95	72	60	Btu/sq.ft
Direct Normal Radiation (Avg Hourly)	103	105	105	104	98	102	88	109	107	112	93	94	Btu/sq.ft
Diffuse Radiation (Avg Hourly)	29	33	43	48	57	59	62	57	46	40	34	28	Btu/sq.ft
Global Horiz Radiation (Max Hourly)	160	225	272	292	302	310	294	288	267	238	172	145	Btu/sq.ft
Direct Normal Radiation (Max Hourly)	294	294	286	302	268	279	267	292	271	296	292	290	Btu/sq.ft
Diffuse Radiation (Max Hourly)	86	114	128	146	143	156	151	143	152	106	90	76	Btu/sq.ft
Global Horiz Radiation (Avg Daily Total)	639	865	1210	1515	1792	1981	1811	1783	1383	1036	705	559	Btu/sq.ft
Direct Normal Radiation (Avg Daily Total)	978	1106	1243	1370	1390	1518	1276	1484	1321	1219	915	866	Btu/sq.ft
Diffuse Radiation (Avg Daily Total)	286	343	514	632	825	879	903	775	566	438	340	264	Btu/sq.ft
Global Horiz Illumination (Avg Hourly)	2106	2591	3220	3653	3983	4241	3962	4143	3541	2968	2237	1894	footcandles
Direct Normal Illumination (Avg Hourly)	2725	2917	2970	3008	2848	3001	2583	3207	3099	3130	2519	2438	footcandles
Dry Bulb Temperature (Avg Monthly)	29	32	45	54	64	71	77	74	69	54	45	38	degrees F
Dew Point Temperature (Avg Monthly)	19	20	31	37	50	60	65	63	58	42	36	24	degrees F
Relative Humidity (Avg Monthly)	68	59	60	56	64	70	69	70	71	67	72	60	percent
Wind Direction (Monthly Mode)	310	300	300	310	70	240	240	230	0	240	280	300	degrees
Wind Speed (Avg Monthly)	11	8	10	10	8	7	7	9	8	8	10	10	mph
Ground Temperature (Avg Monthly of 3 Depths)	41	38	39	42	52	60	67	70	69	64	56	48	degrees F

Tools:
Data Source:

Climate Consultant 6.0
https://energyplus.net/weather-location/north_and_central_america_wmo_region_4/USA/PA/USA_PA_Philadelphia.Intl.AP.724080_TMY3

I. Temperature

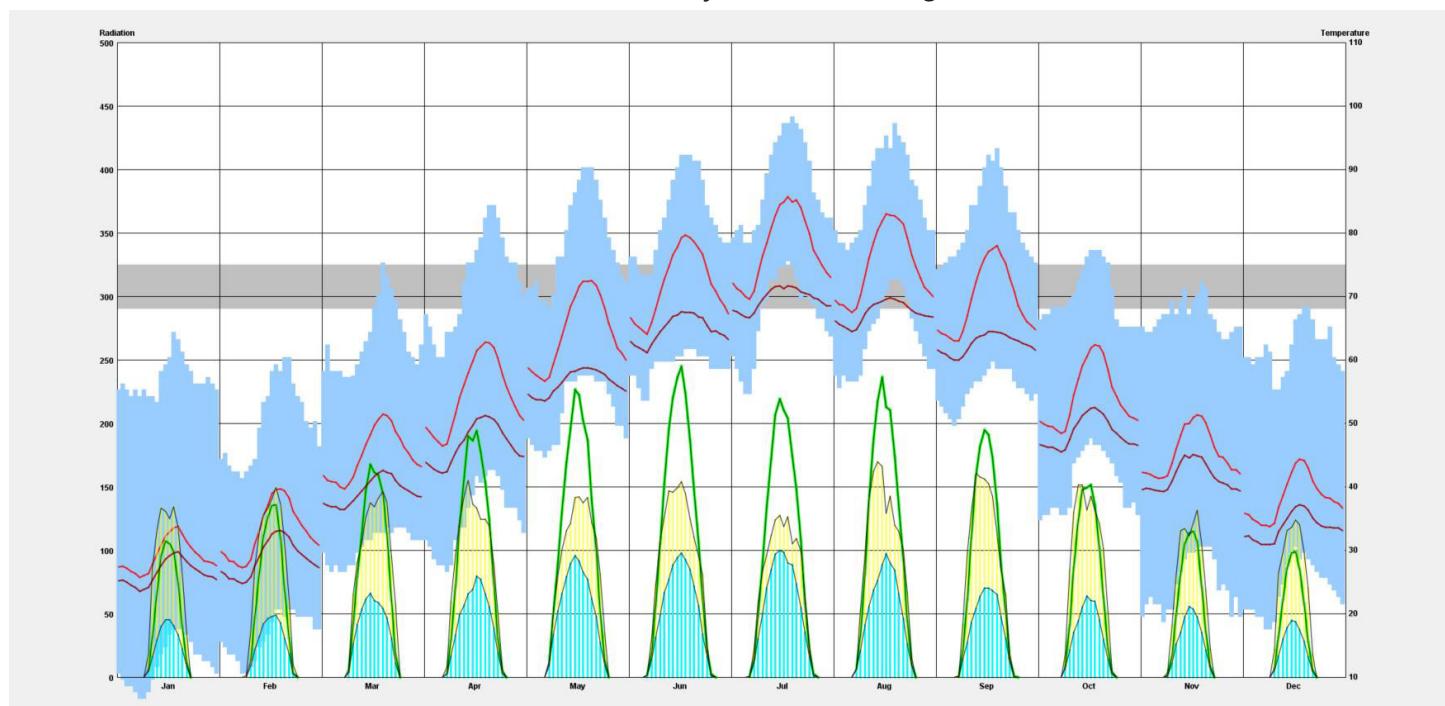
Chart 1: Temperature Range



Legend

RECORDED HIGH -	○	DESIGN HIGH -	●
DESIGN HIGH -	●	AVERAGE HIGH -	■
AVERAGE HIGH -	■	MEAN -	■
MEAN -	■	AVERAGE LOW -	■
AVERAGE LOW -	■	DESIGN LOW -	■
DESIGN LOW -	■	RECORDED LOW -	○
RECORDED LOW -	○	COMFORT ZONE	■

Chart 2: Monthly Diurnal Averages



Legend

HOURLY AVERAGES	
TEMPERATURE: (degrees F)	
— DRY BULB MEAN	
— WET BULB MEAN	
— DRY BULB (all hours)	
— COMFORT ZONE	
RADIATION: (BTusqft)	
— GLOBAL HORIZON	
— DIRECT NORMAL	
— DIFFUSE	
<input checked="" type="checkbox"/> Display Dry Bulb Temp	
(all hours)	
TEMPERATURE RANGE:	
<input checked="" type="radio"/> 10 to 110 °F	
<input type="radio"/> Fit to Data	

Chart 3: Ground Temperature (Monthly Average)

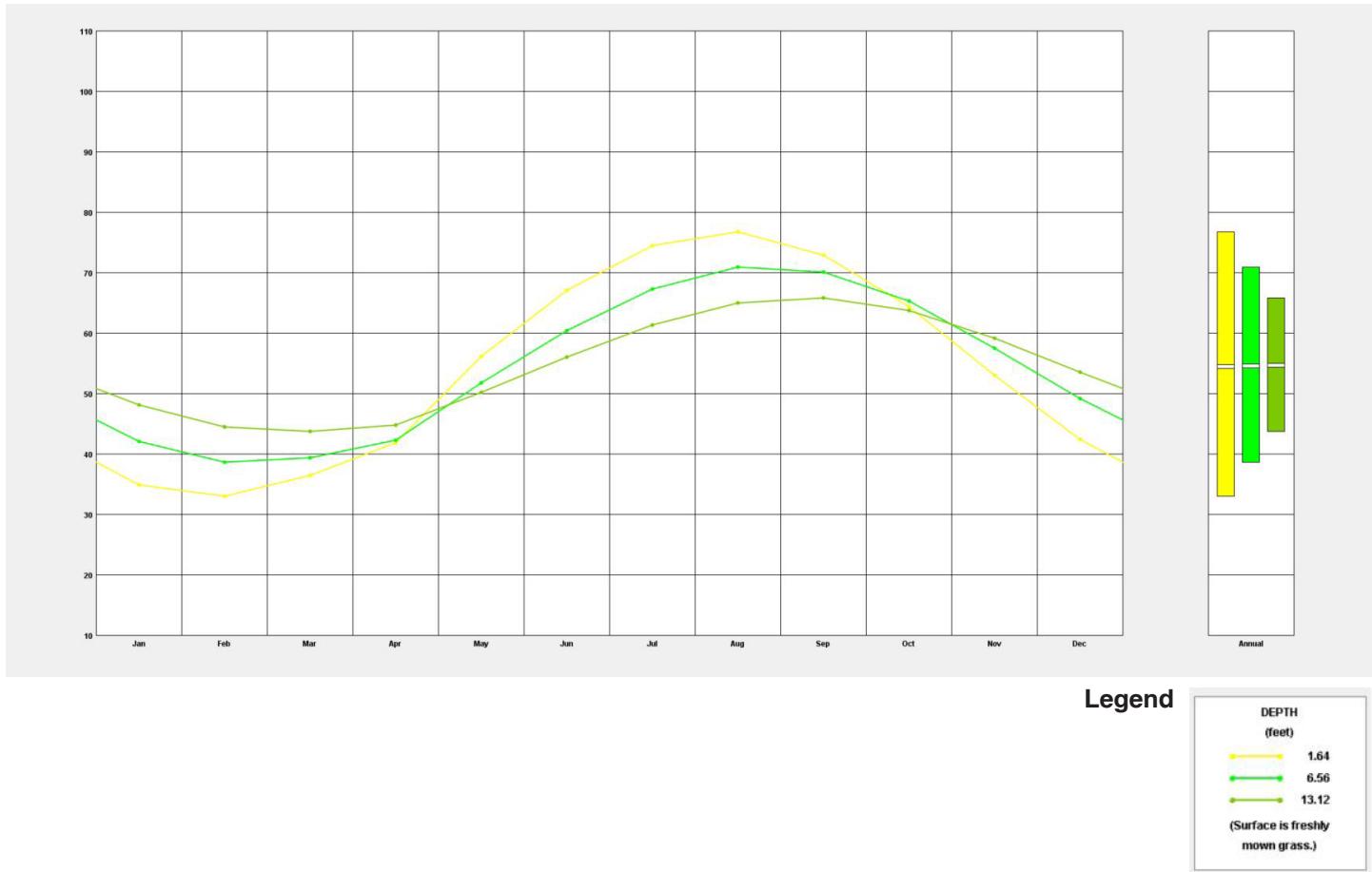


Chart 4: Illumination Range

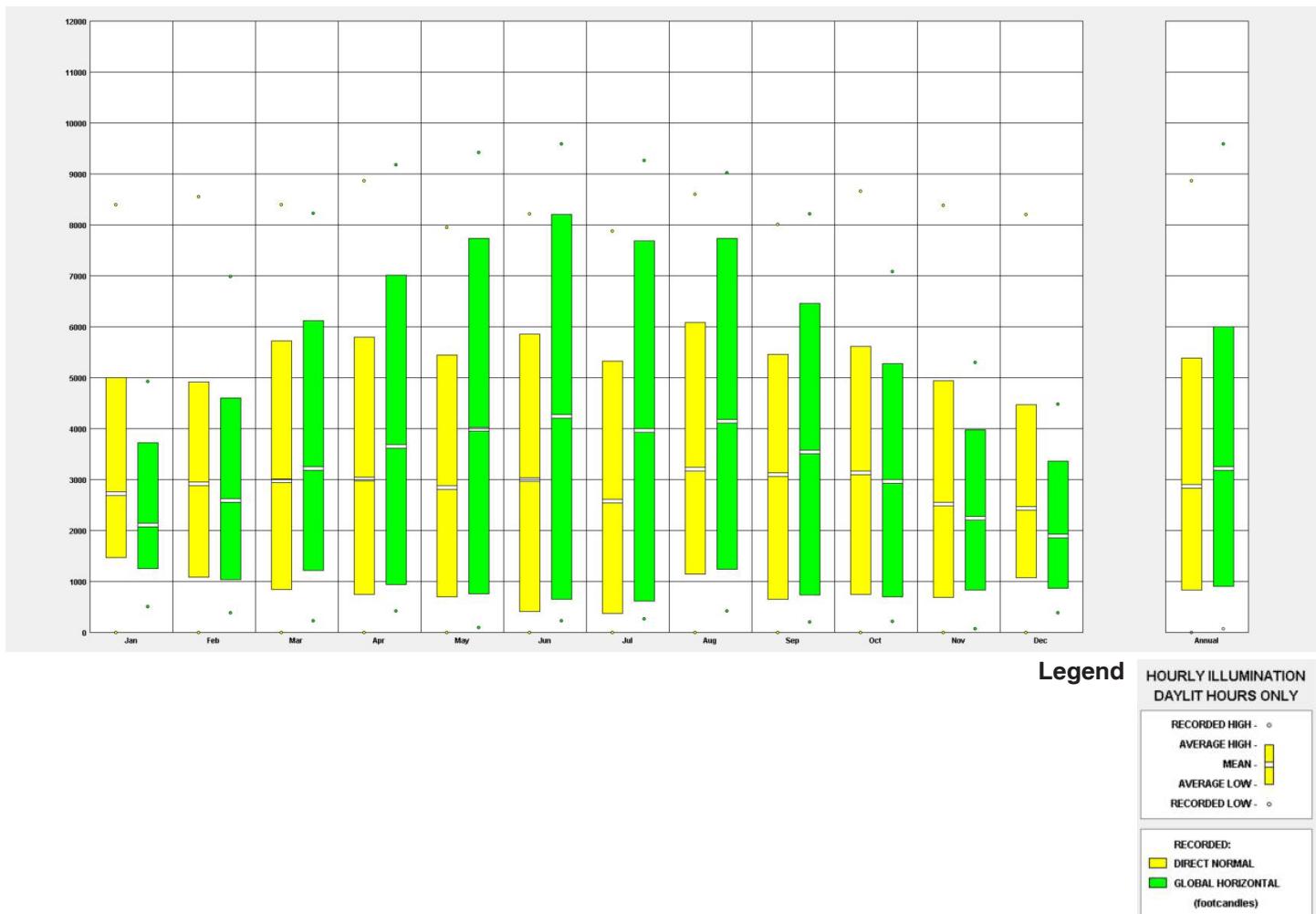


Chart 5: Dry Bulb Temperature Timetable

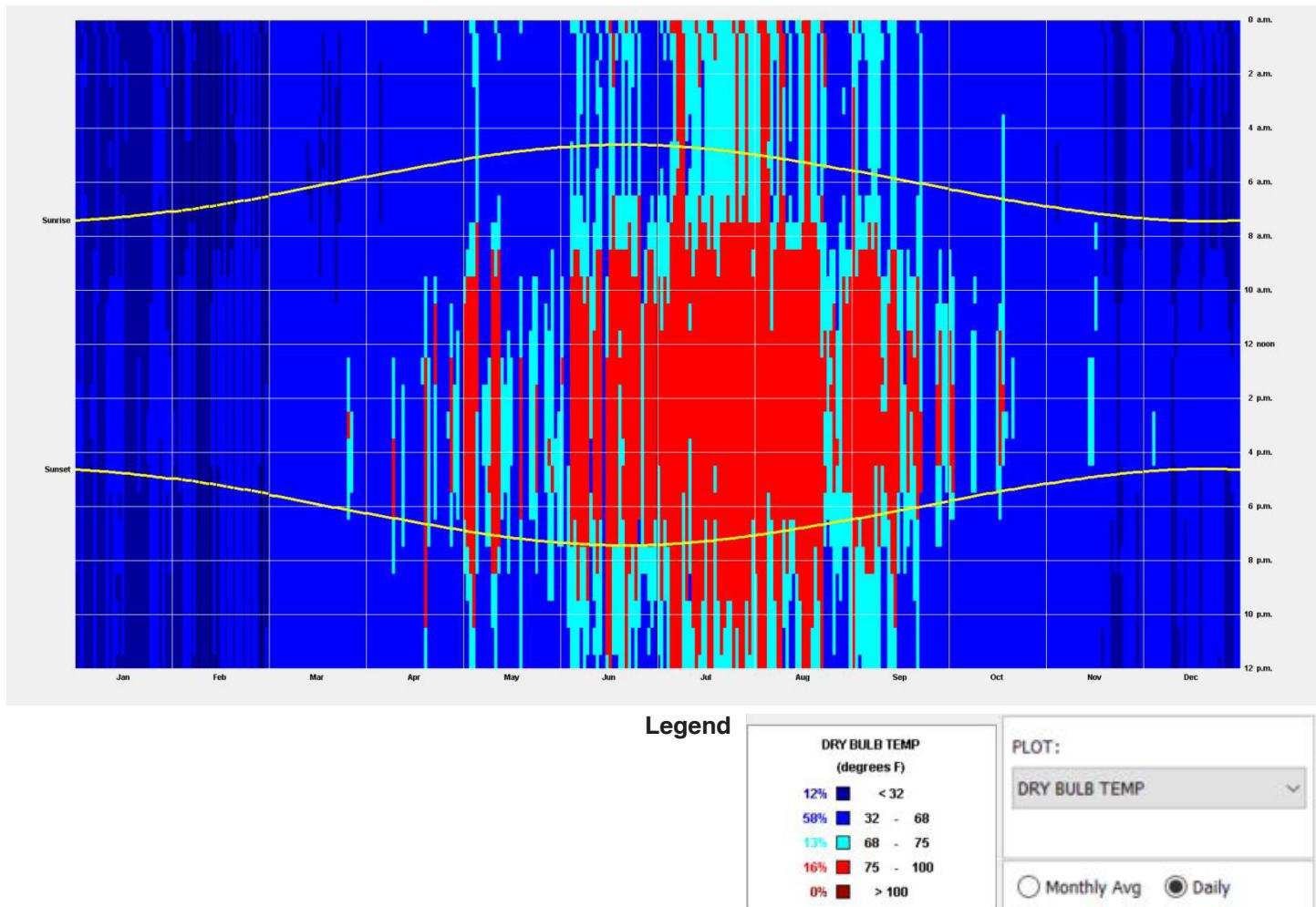
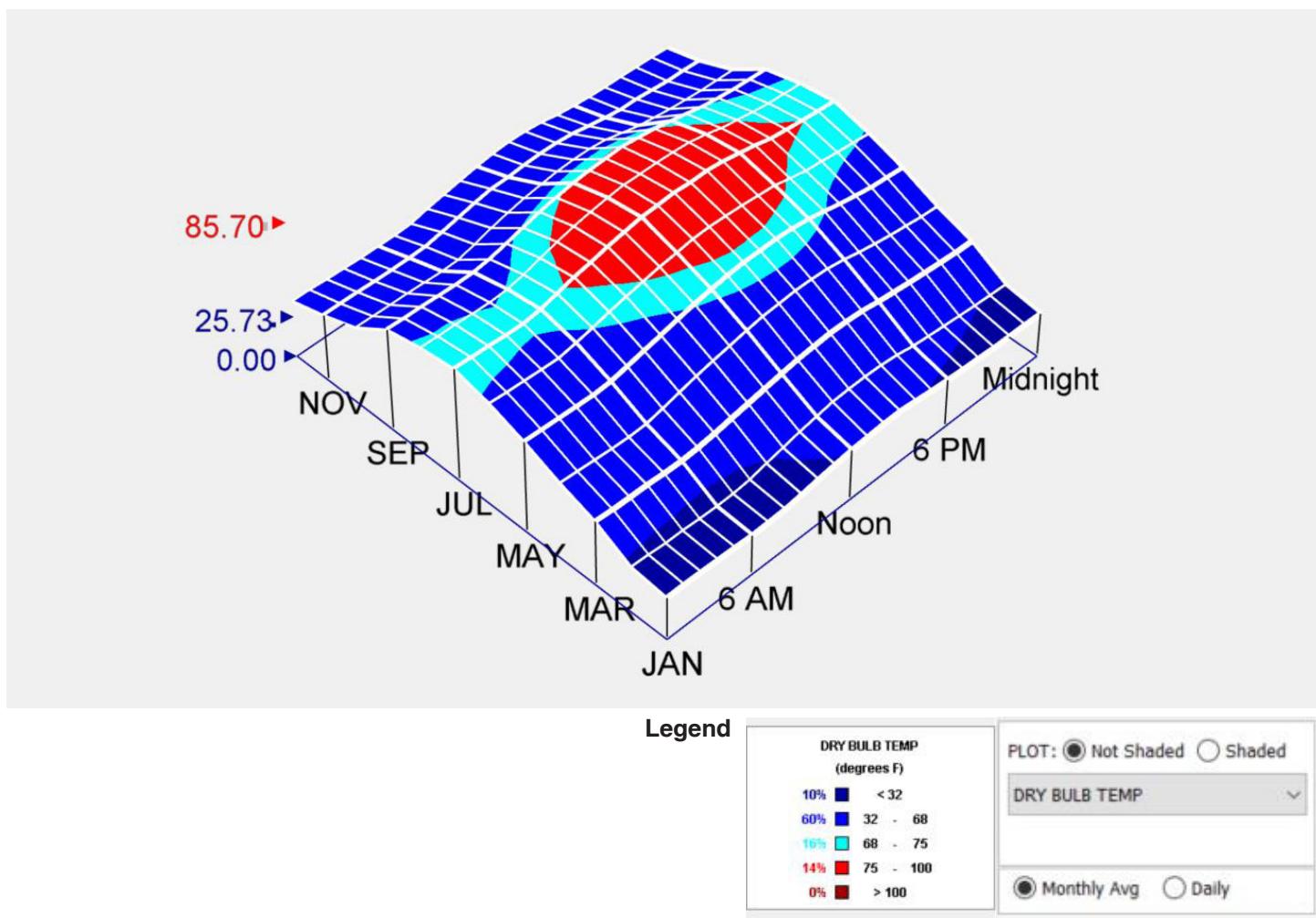


Chart 6: Dry Bulb Temperature 3D



II. Radiation

Chart 7 : Radiation Range

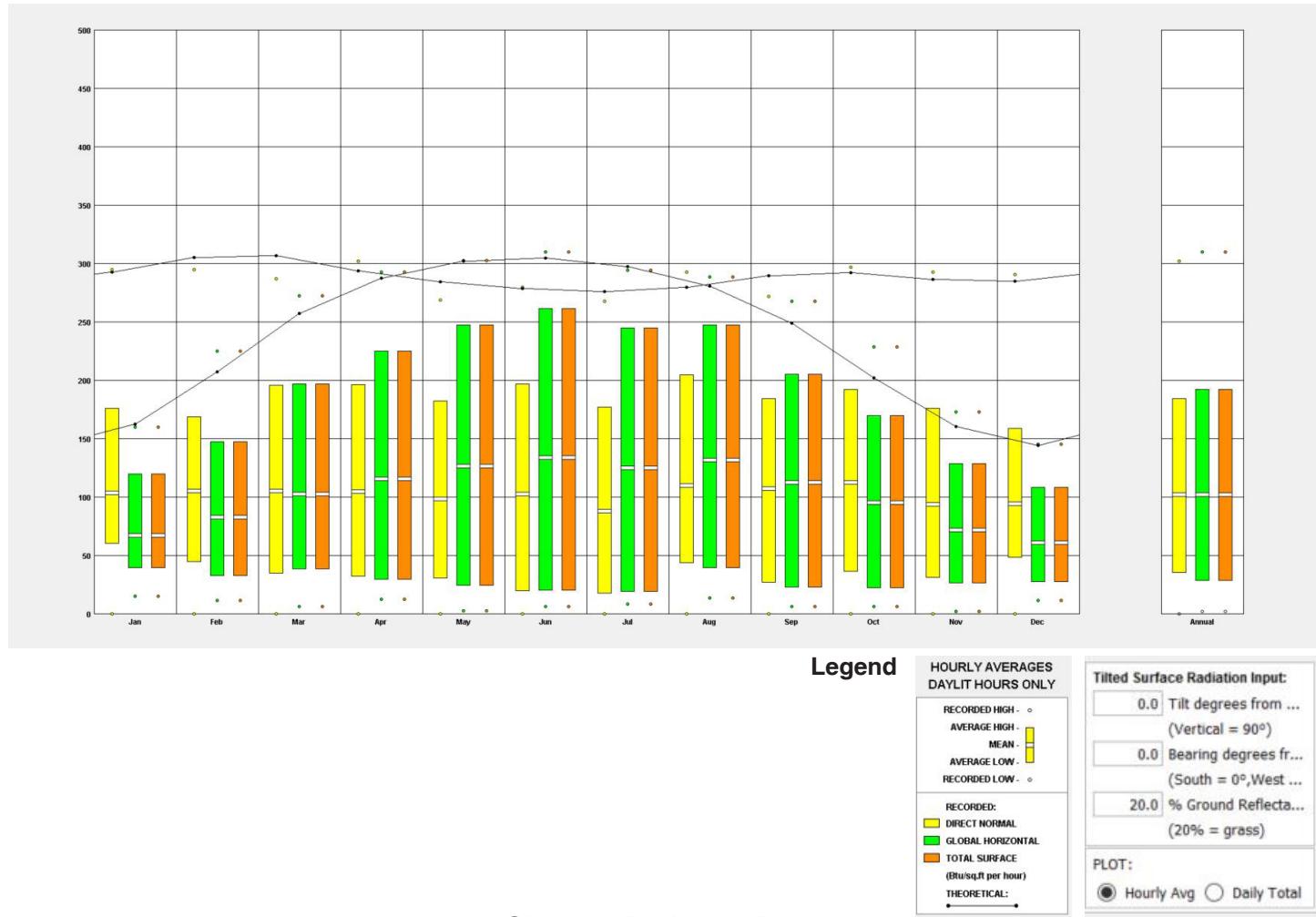


Chart 8 : Radiation Rose

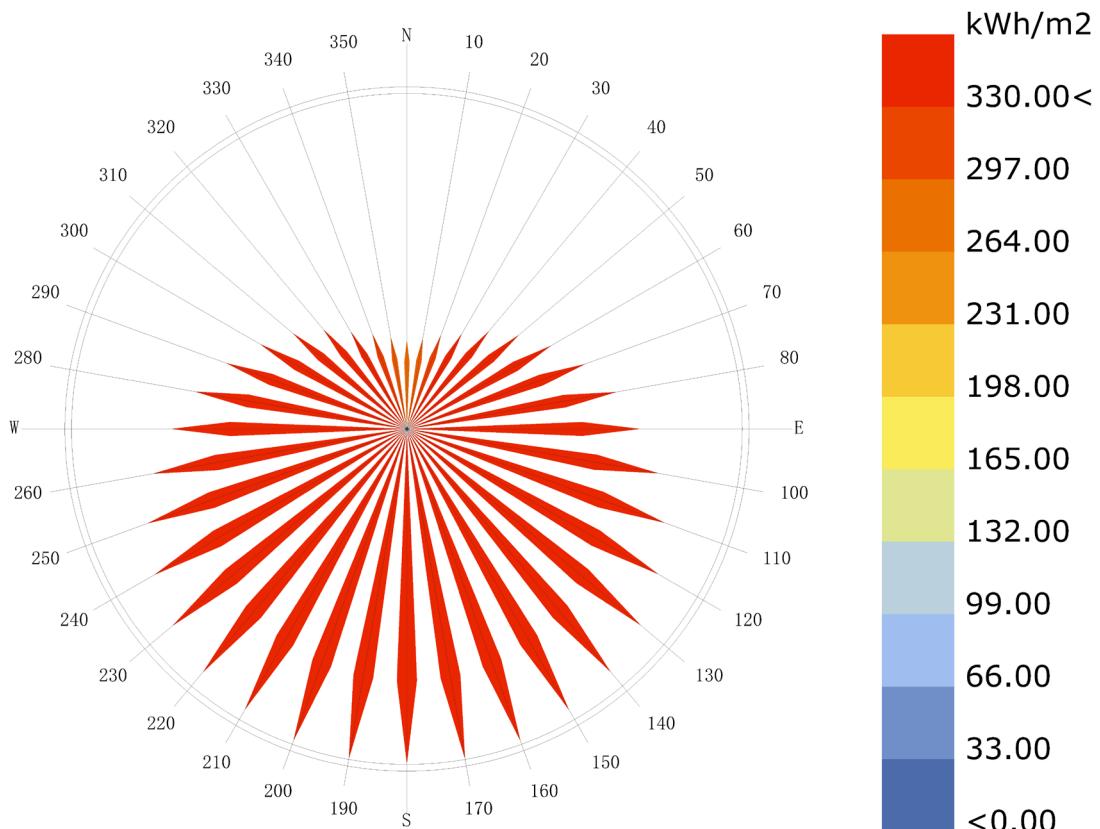


Chart 9: Annual Normal Radiation

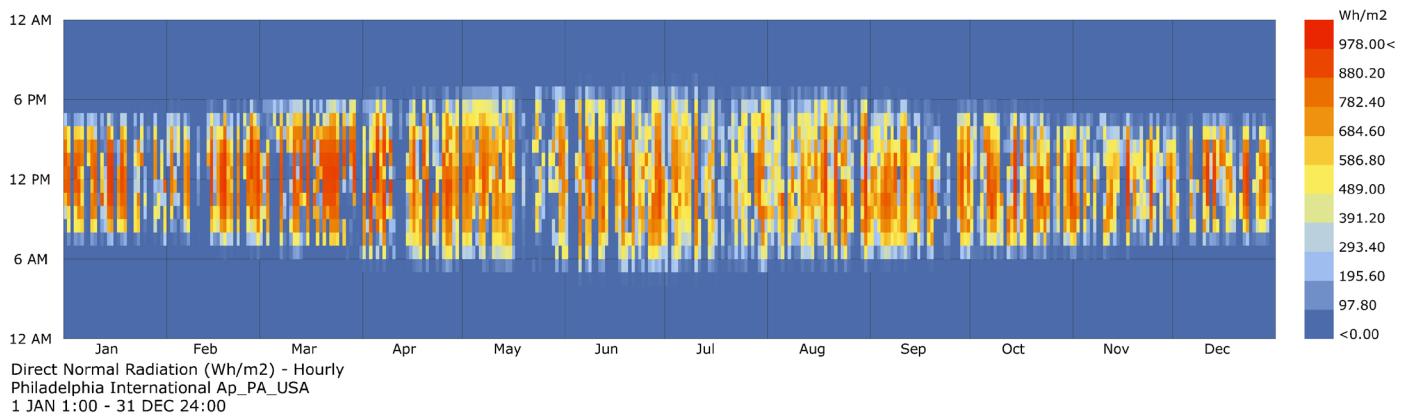


Chart 10: Annual Diffuse Horizontal Radiation

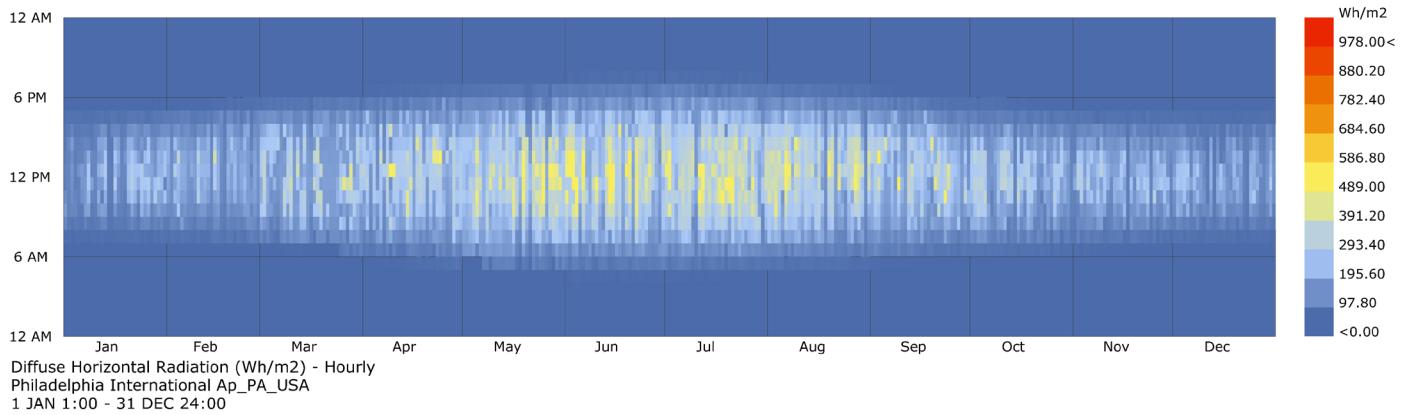


Chart 11: Global Horizontal Radiation

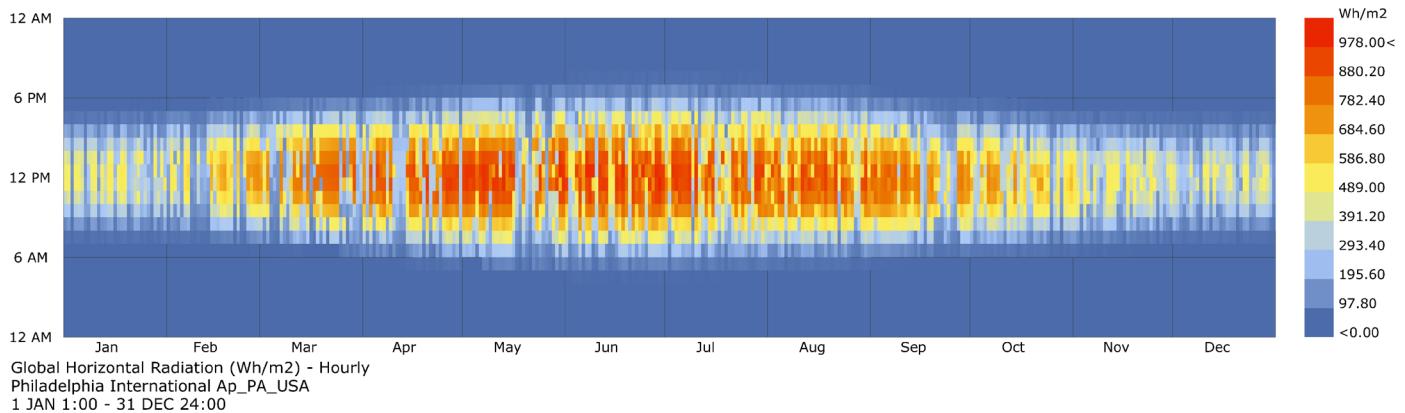


Chart 12: Universal Thermal Climate Index

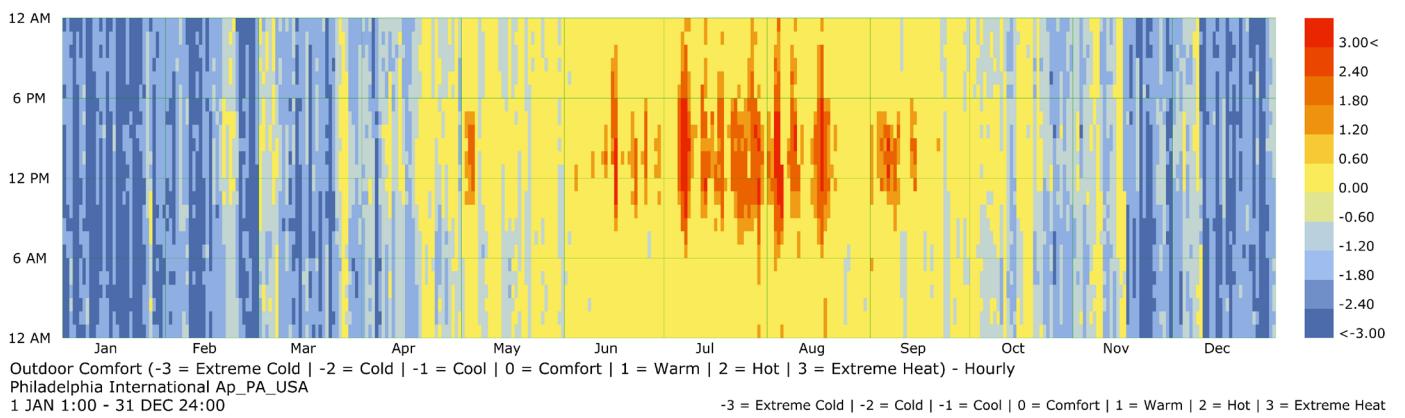


Chart 13: Outdoor Comfort

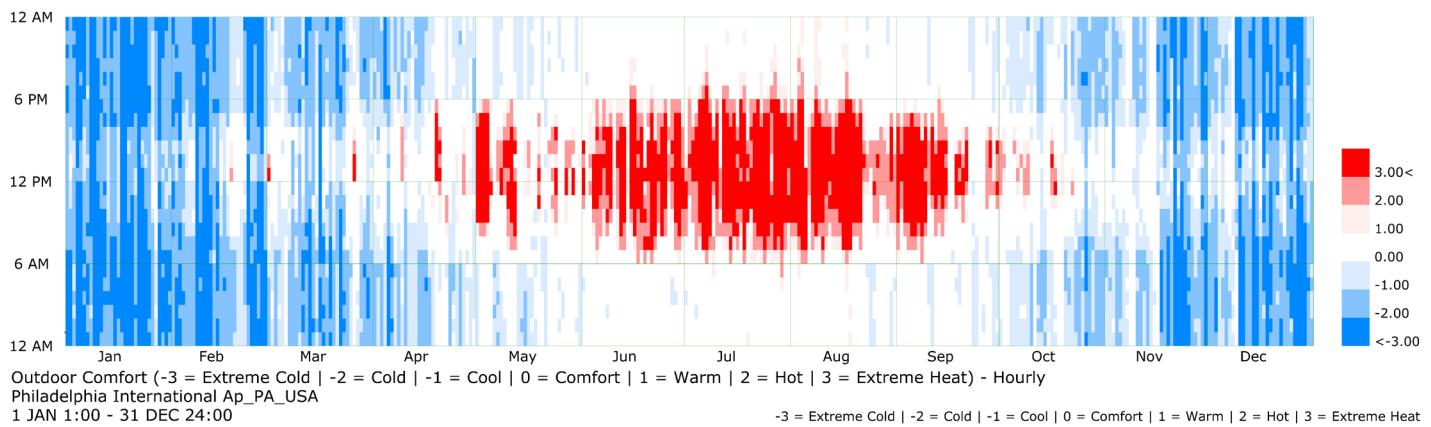
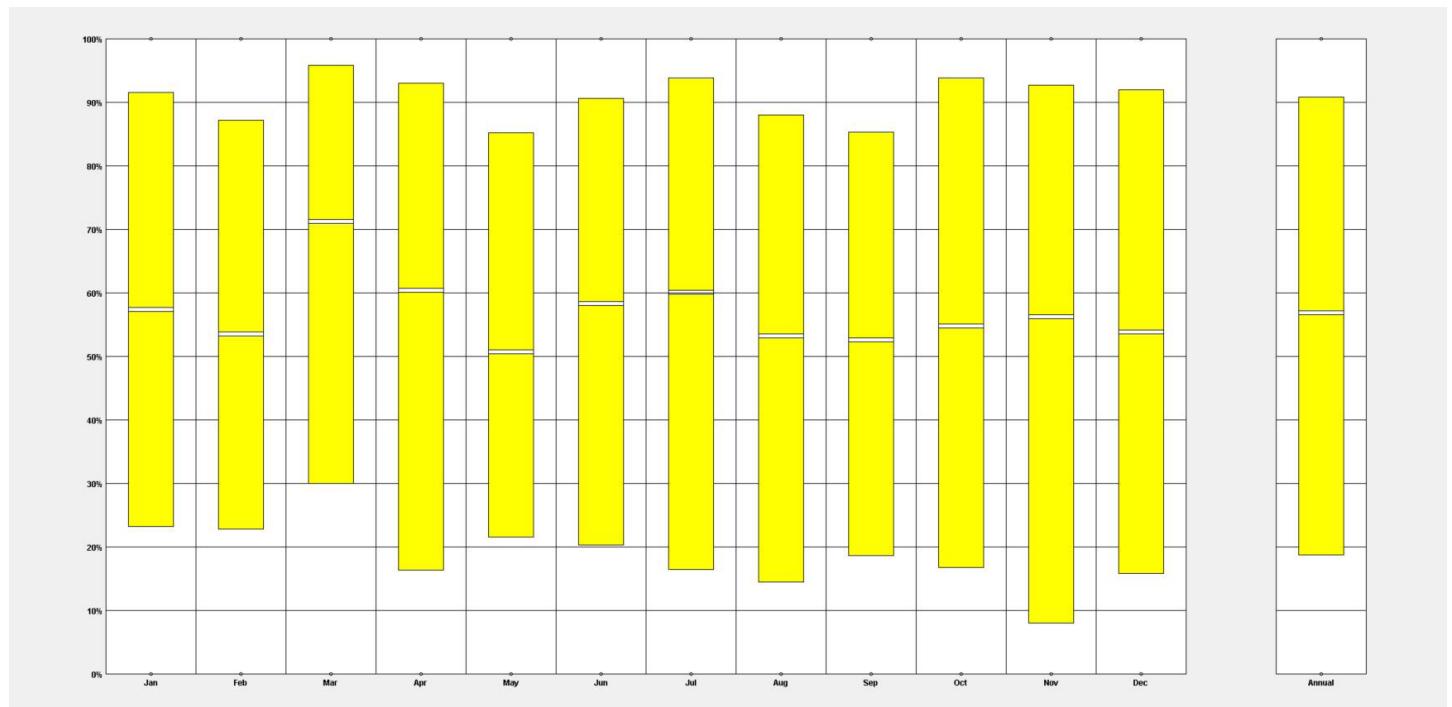


Chart 14: Sky Cover Range

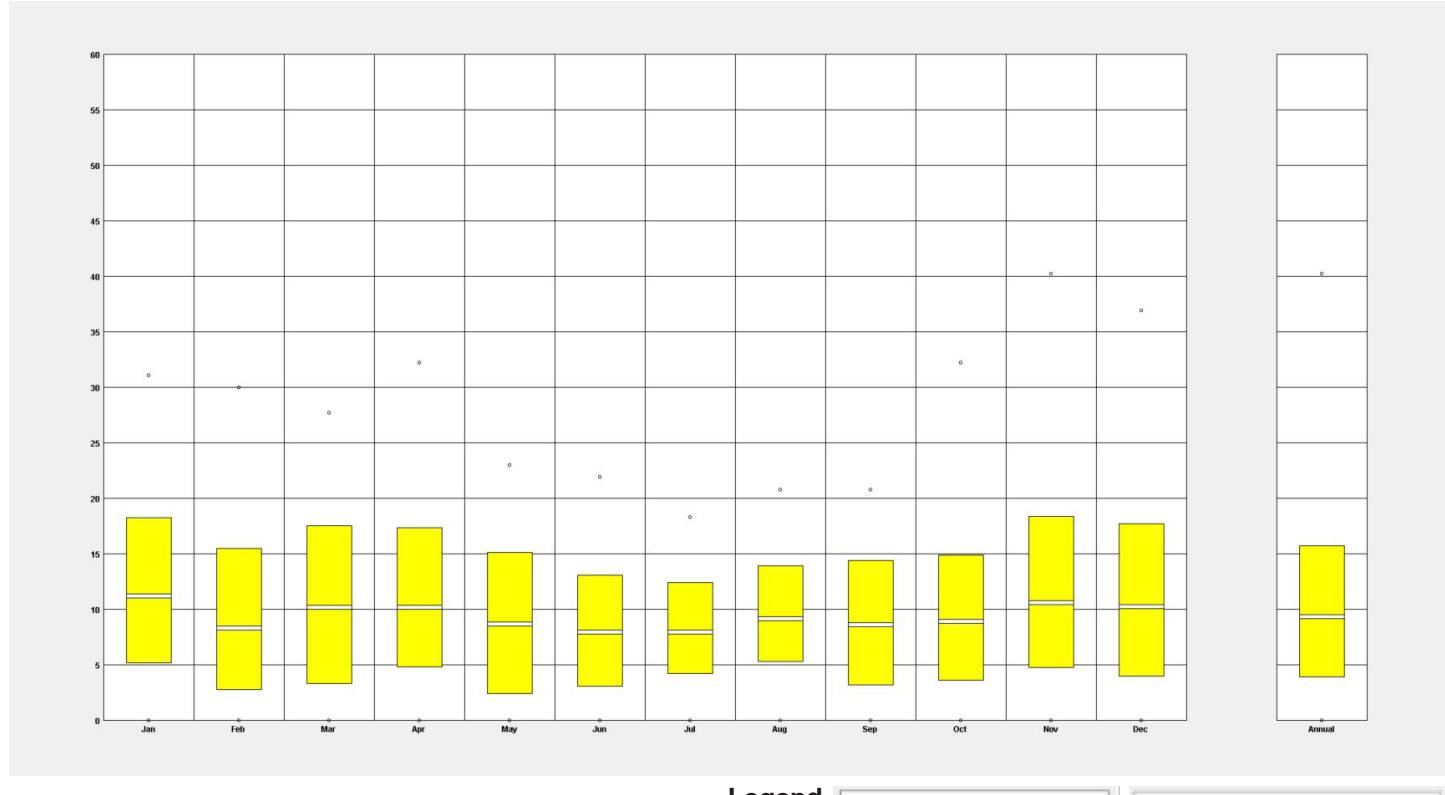


Legend

Total Cloud Cover	100%
RECORDED HIGH	○
AVERAGE HIGH	-
MEAN	■
AVERAGE LOW	-
RECORDED LOW	○
Clear Skies	0

III. Wind

Chart 15: Wind Velocity Range

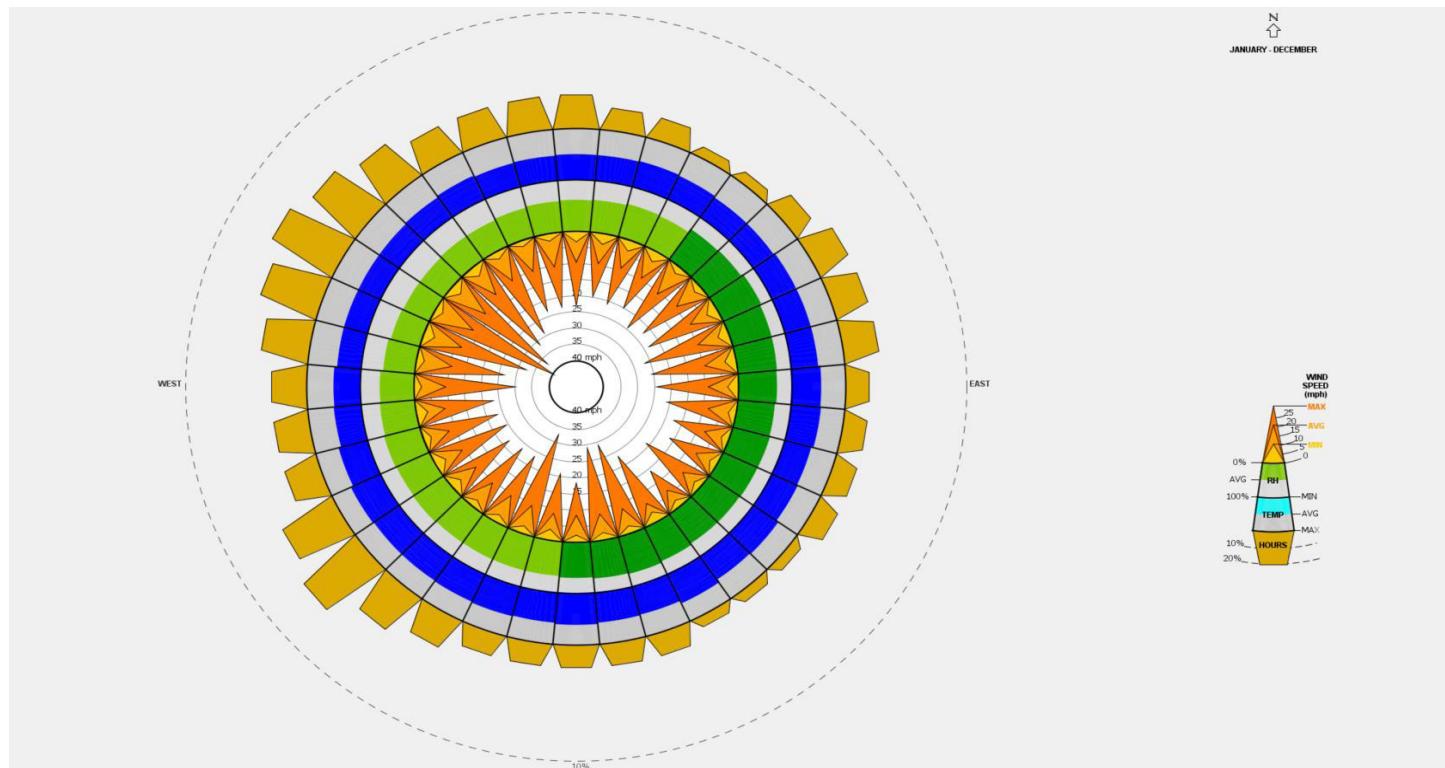


Legend

RECORDED HIGH - ○
 AVERAGE HIGH - ■
 MEAN - □
 AVERAGE LOW - □
 RECORDED LOW - ○
 (mph)

PLOT:
 mph fpm
 WIND VELOCITY:
 0 to 60 mph Fit to Data

Chart 16: Wind Wheel



Legend

TEMPERATURE (Deg. F)
 < 32
 32 - 68
 68 - 75
 75 - 100
 > 100
 RELATIVE HUMIDITY (%)
 < 30
 30-70
 > 70

All Hours Selected Hours
 1 a.m. through midnight

All Months Selected Months
 JAN through DEC

One Month Next Month
 JAN JAN

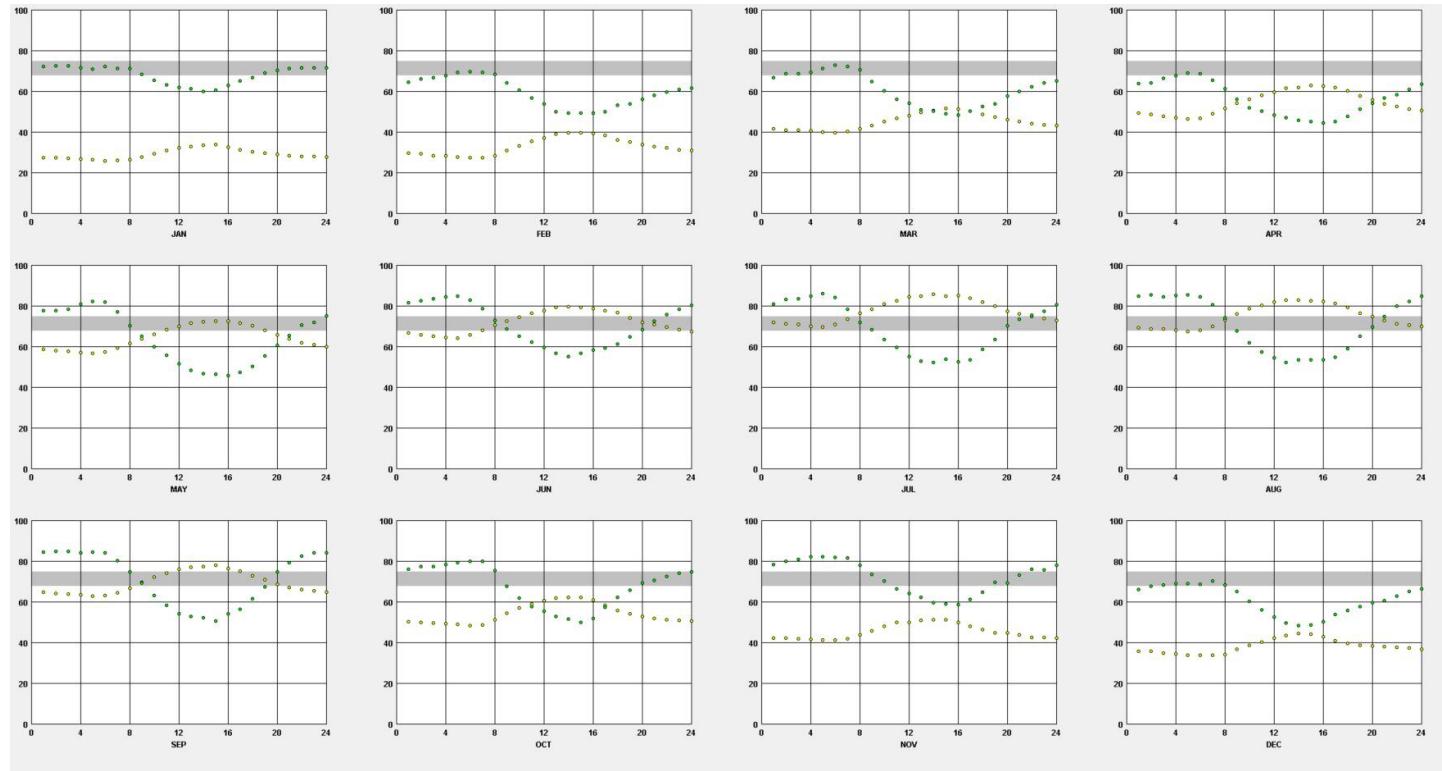
One Day Next Day
 1 Next Day

Monthly Start
 Daily Pause

Hourly Stop

IV. Humidity

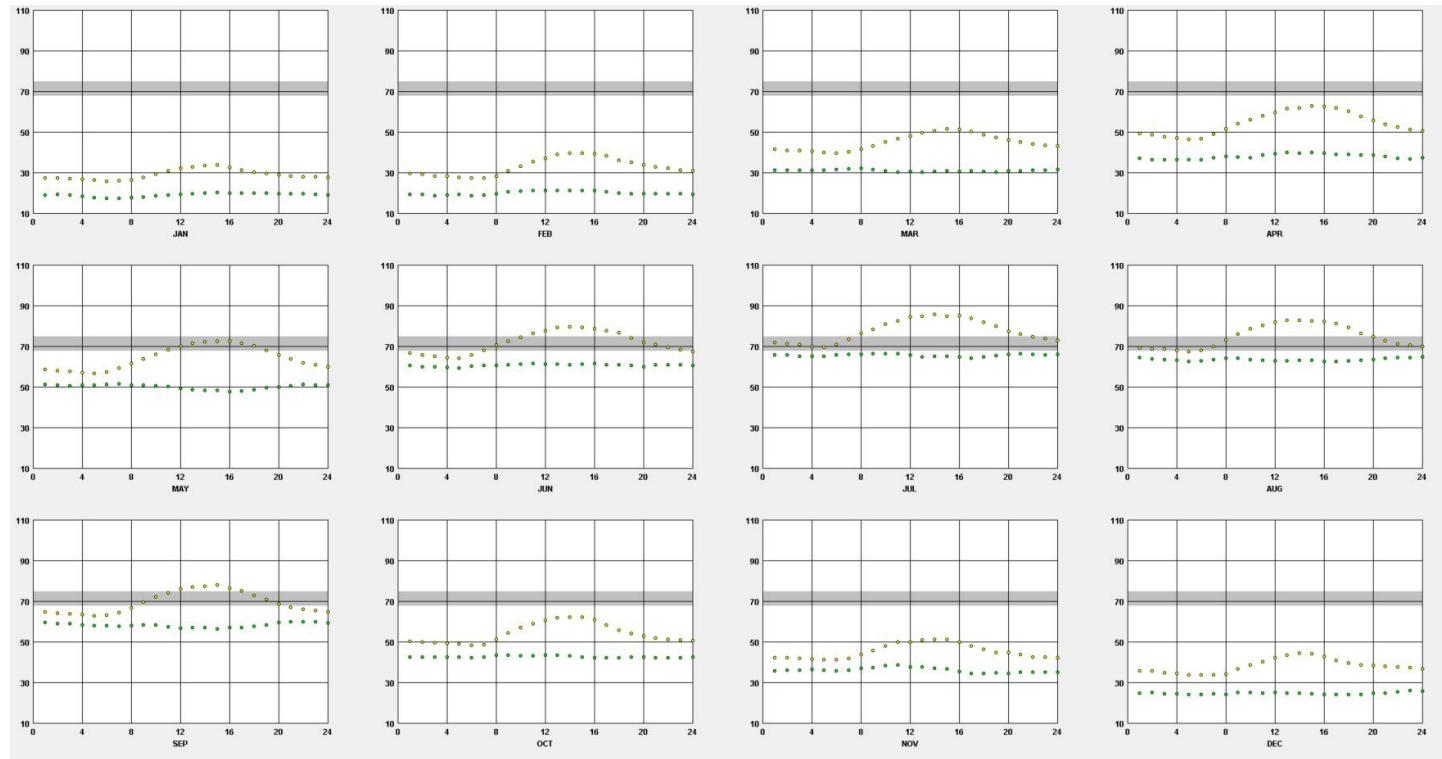
Chart 17: Dry Bulb X Relative Humidity



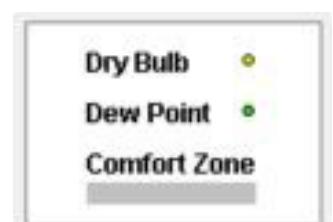
Legend



Chart 18: Dry Bulb X Dew Point

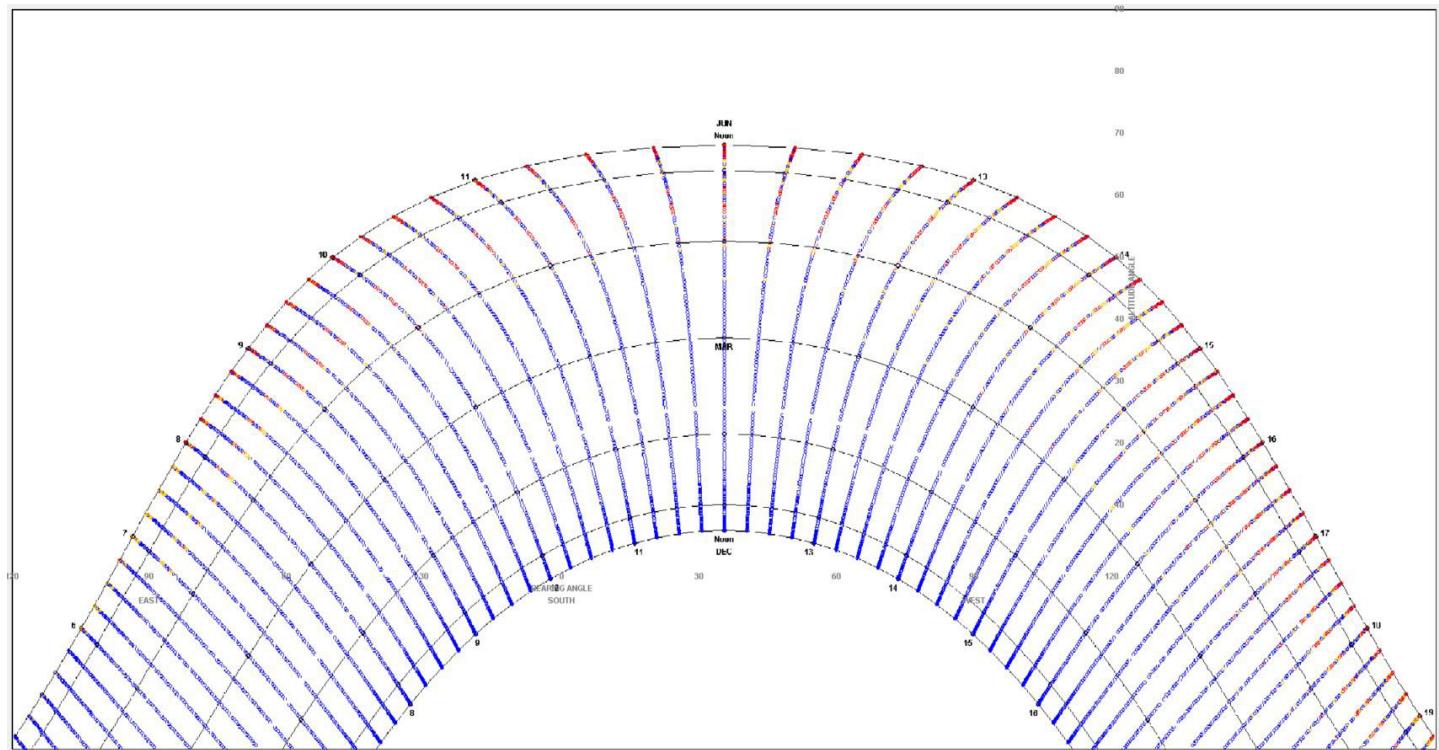


Legend



V. Sun

Chart 19: Sun Shading



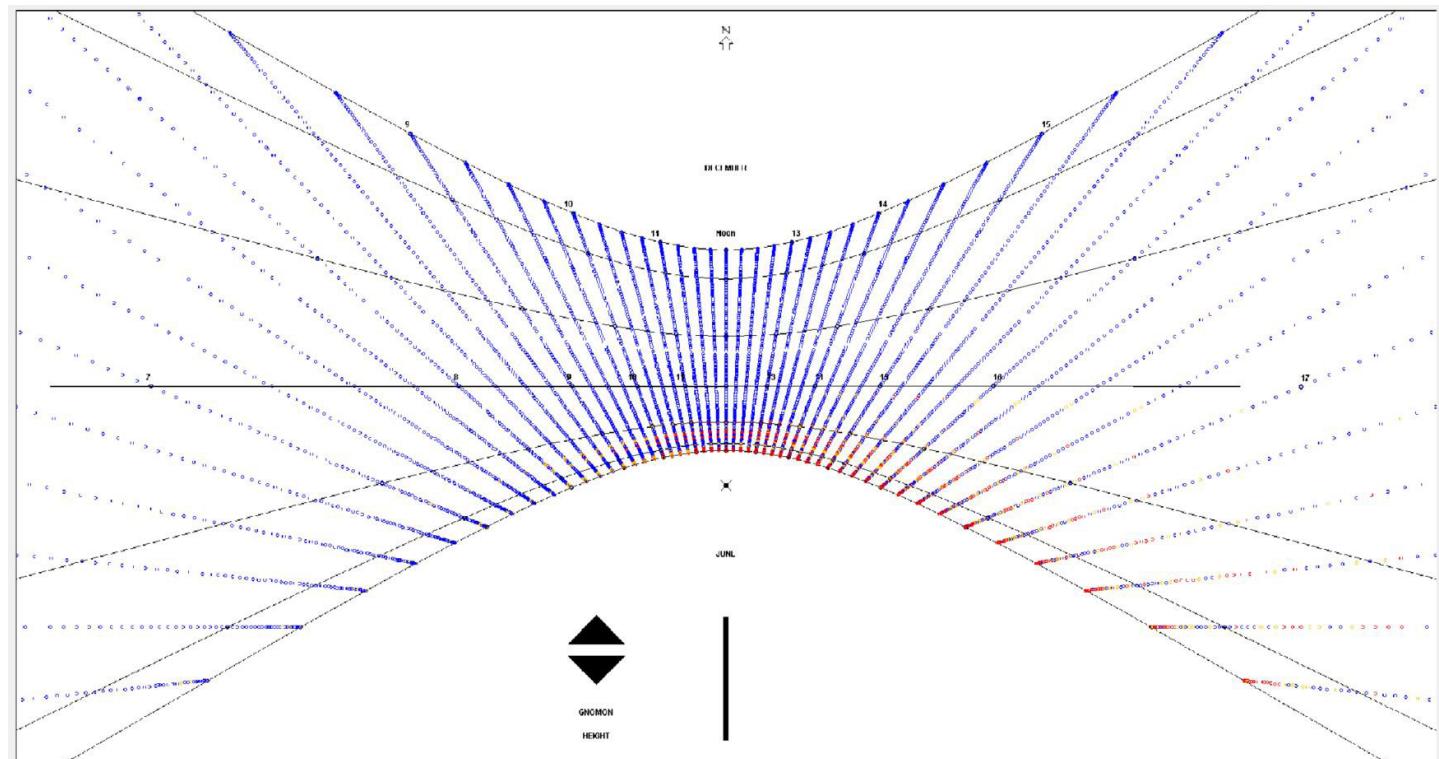
Legend

<input checked="" type="radio"/> WARMHOT > 75°F (SHADE NEEDED)
357 Hours Exposed
0 Hours Shaded
<input checked="" type="radio"/> COMFORT > 68°F (SHADE HELPS)
239 Hours Exposed
0 Hours Shaded
<input checked="" type="radio"/> COOL/COLD < 68°F (SUN NEEDED)
1914 Hours Exposed
0 Hours Shaded

PLOT MONTHS:
WINTER SPRING
 December 21 to June 21
SUMMER FALL
 June 21 to December 21

Display Grid
 Display Shading Calculator
 Display Obstruction Elevation
 Input Obstructions

Chart 20: Sun Chart



Legend

<input checked="" type="radio"/> WARMHOT > 75°F (SHADE NEEDED)
357 Hours Exposed
0 Hours Shaded
<input checked="" type="radio"/> COMFORT > 68°F (SHADE HELPS)
239 Hours Exposed
0 Hours Shaded
<input checked="" type="radio"/> COOL/COLD < 68°F (SUN NEEDED)
1914 Hours Exposed
0 Hours Shaded

PLOT MONTHS:
WINTER SPRING
 December 21 to June 21
SUMMER FALL
 June 21 to December 21

3 Most Important Passive Design Strategies

1. The first strategy is passive heating. The temperature of Philadelphia in winter is pretty low and lowest temperature is under 0°C. Therefore, the design strategy of passive heating to harness solar radiation and capture the internal heat gains could add additional thermal energy to the building. Buildings in Philly could combine a well-insulated envelope with other elements, in order to minimize energy losses and store solar gains. To use high-performance windows, operable external shading, thermal mass, good insulation or minimize infiltration are all helpful.
2. The second strategy is to maximize the use of natural ventilation. Although the wind speeds in Philadelphia are not so high according to Wind Wheel Chart, the passive natural ventilation strategies can introduce outdoor fresh air into the interior space. At the same time, wind and buoyancy caused by air temperature differences create air pressure differences throughout occupied spaces. Therefore, buildings in Philly can be designed to enhance these air flow and take advantage of them rather than work against them. The methods to achieve natural ventilation includes operable windows, orientation, building shape, openings to corridors, double facades and so on.
3. The third passive design strategy is about Outdoor Comfort. According to UTCI and Outdoor Comfort Chart, it is necessary to protect people outside from overheating and direct sunlight in summer and from extremely cold condition in winter. Perhaps to add shading facilities in some outdoor space in July or August, and to add passive heating facilities in outdoor space and remind people to avoid outdoor activities as much as possible in December and January is feasible strategies.