CRITERIA: (Imperial Units)

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

California Energy Code Comfort Model, 2013 (select Help for definitions)

1. COMFORT: (using California Energy Code Model)

70.0	Comfort Low - Min. Comfort Dry Bulb Temp (°F)
75.0	Comfort High - Max. Comfort Dry Bulb Temp, up to 50% RH (°F)
80.0	Max. Relative Humidity (measured at Min. Comfort Temp) (%)
66.0	Max. Wet Bulb Temperature (°F)
27.0	Min. Dew Point Temperature (°F)

2. SUN SHADING ZONE: (Defaults to Comfort Low)

70.0	Min. Dry Bulb Temperature when Need for Shading Begins (°F)
100.0	Min. Global Horiz. Radiation when Need for Shading Begins (Btu/sq.ft)

3. HIGH THERMAL MASS ZONE:

15.0	Max. Outdoor Temperature Difference above Comfort High (°F)
3.0	Min. Nighttime Temperature Difference below Comfort High (°F)

4. HIGH THERMAL MASS WITH NIGHT FLUSHING ZONE:

30.0	Max. Outdoor Temperature Difference above Comfort High (°F)
3.0	Min. Nighttime Temperature Difference below Comfort High (°F)

5. DIRECT EVAPORATIVE COOLING ZONE: (Defined by Comfort Zone)

63.8	Max. Wet Bulb set by Max. Comfort Zone Wet Bulb (°F)
48.8	Min. Wet Bulb set by Min. Comfort Zone Wet Bulb (°F)

6. TWO-STAGE EVAPORATIVE COOLING ZONE:

7. NATURAL VENTILATION COOLING ZONE:

2.0	Terrain Category to modify Wind Speed (2=suburban)
40.0	Min. Indoor Velocity to Effect Indoor Comfort (fpm)
300.0	Max. Comfortable Velocity (per ASHRAE Std. 55) (fpm)
6.6	Max. Perceived Temperature Reduction (°F)
90.0	Max. Relative Humidity (%)
73.0	Max. Wet Bulb Temperature (°F)

8. FAN-FORCED VENTILATION COOLING ZONE:

160.0	Max. Mechanical Ventilation Velocity (fpm)
5.4	Max. Perceived Temperature Reduction (°F)
	(Min Vel, Max RH, Max WB match Natural Ventilation)

9. INTERNAL HEAT GAIN ZONE (lights, people, equipment):

55.0	Balance Point Temperature below which Heating is Needed (°F)

10. PASSIVE SOLAR DIRECT GAIN LOW MASS ZONE:

50.0	Min. South Window Radiation for 10° F Temperature Rise (Btu/sq.ft)
3.0	Thermal Time Lag for Low Mass Buildings (hours)

11. PASSIVE SOLAR DIRECT GAIN HIGH MASS ZONE:

100.0	Min. South Window Radiation for 10° F Temperature Rise (Btu/sq.ft)
12.0	Thermal Time Lag for High Mass Buildings (hours)

12. WIND PROTECTION OF OUTDOOR SPACES:

19.0	Velocity above which Wind Protection is Desirable (mph)
20.0	Dry Bulb Temperature Above or Below Comfort Zone (°F)

13. HUMIDIFICATION ZONE: (defined by and below Comfort Zone)

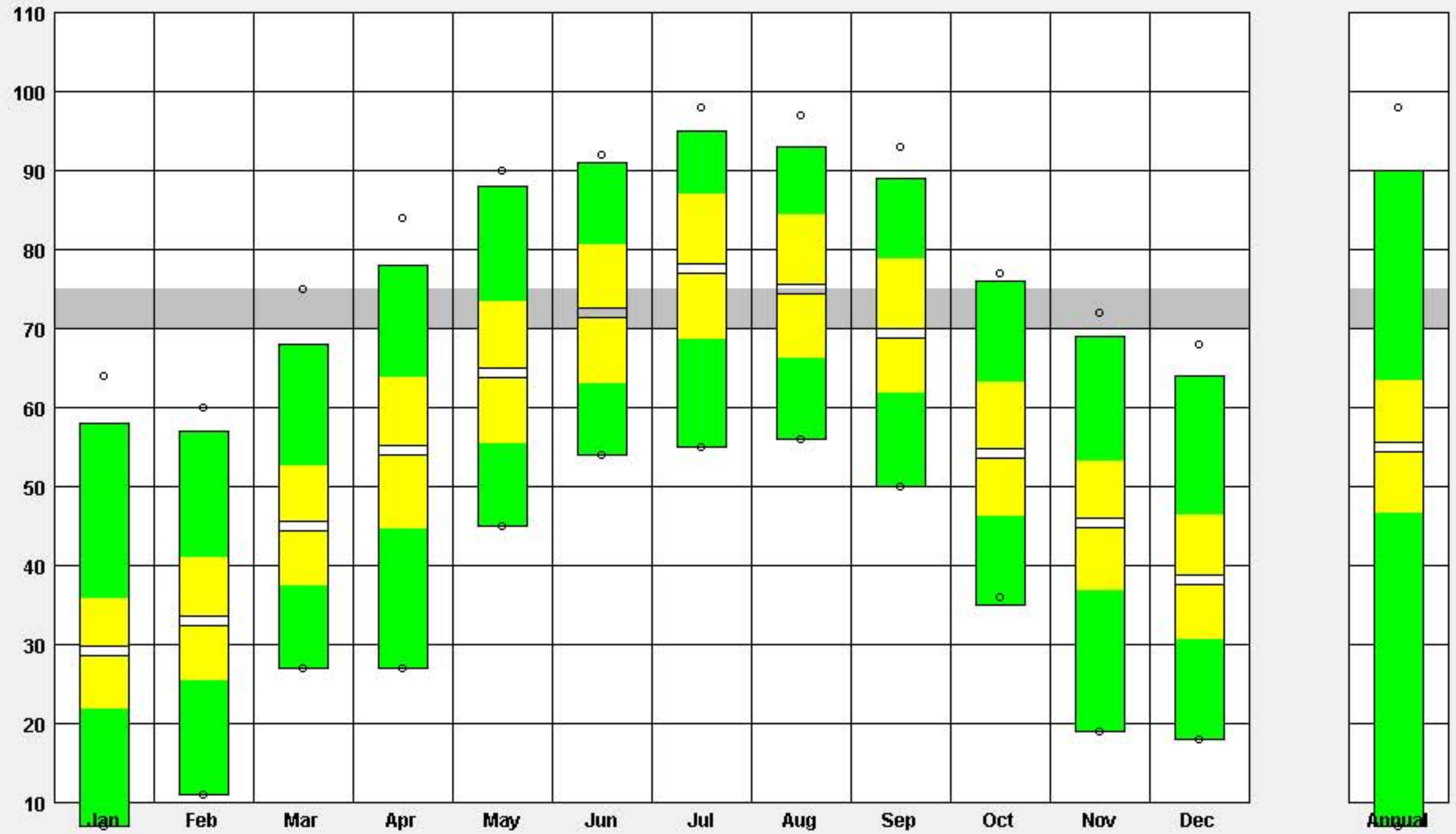
Restore Default Values | Recalculate | Back | Next

TEMPERATURE RANGE
California Energy Code

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

RECORDED HIGH -
DESIGN HIGH -
AVERAGE HIGH -
MEAN -
AVERAGE LOW -
DESIGN LOW -
RECORDED LOW -
COMFORT ZONE



DESIGN HIGH: Residential
- (•) 1% of Hours Above
- ( ) .5% of Hours Above
- ( ) 0% of Hours Above

DESIGN LOW: Residential
- ( ) 1% of Hours Below
- ( ) .5% of Hours Below
- (•) 0% of Hours Below

TEMPERATURE RANGE:
- (•) 10 to 110 °F
- ( ) Fit to Data

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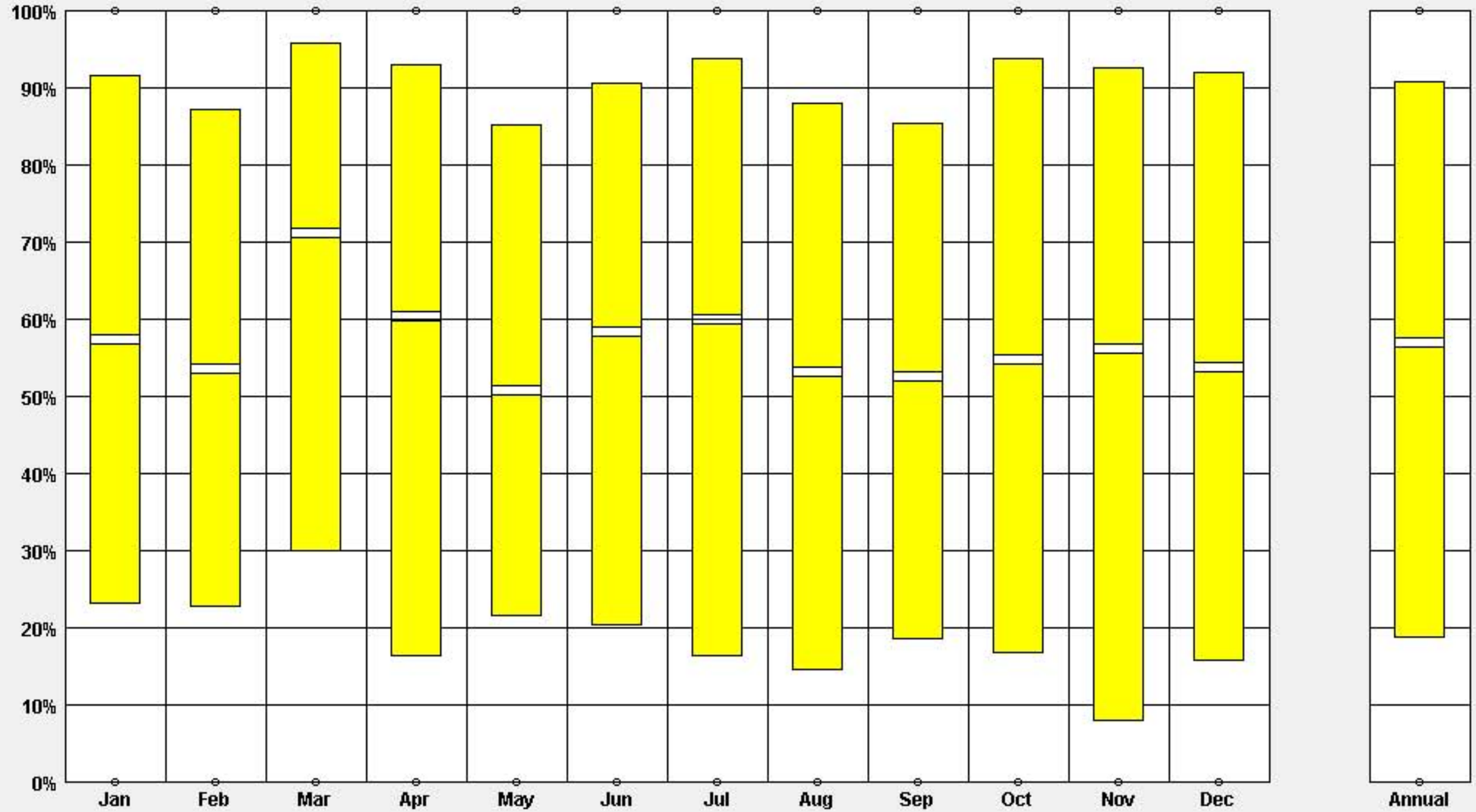
SKY COVER RANGE

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

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



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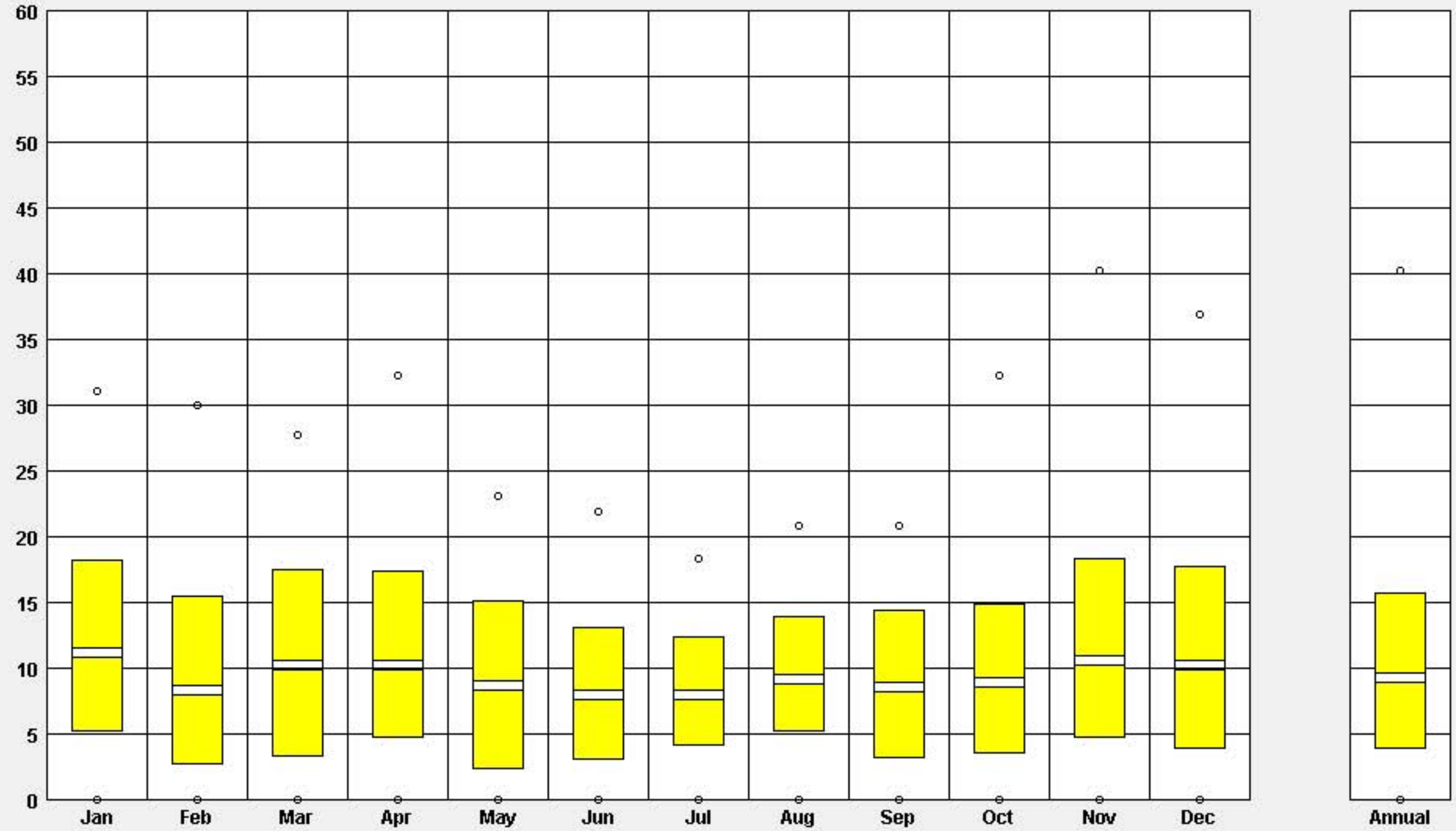
WIND VELOCITY RANGE

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

RECORDED HIGH - ○
AVERAGE HIGH - ▭
MEAN - ▭
AVERAGE LOW - ▭
RECORDED LOW - ○
(mph)



PLOT:
(◉) mph ( ) fpm

WIND VELOCITY:
(◉) 0 to 60 mph
( ) Fit to Data

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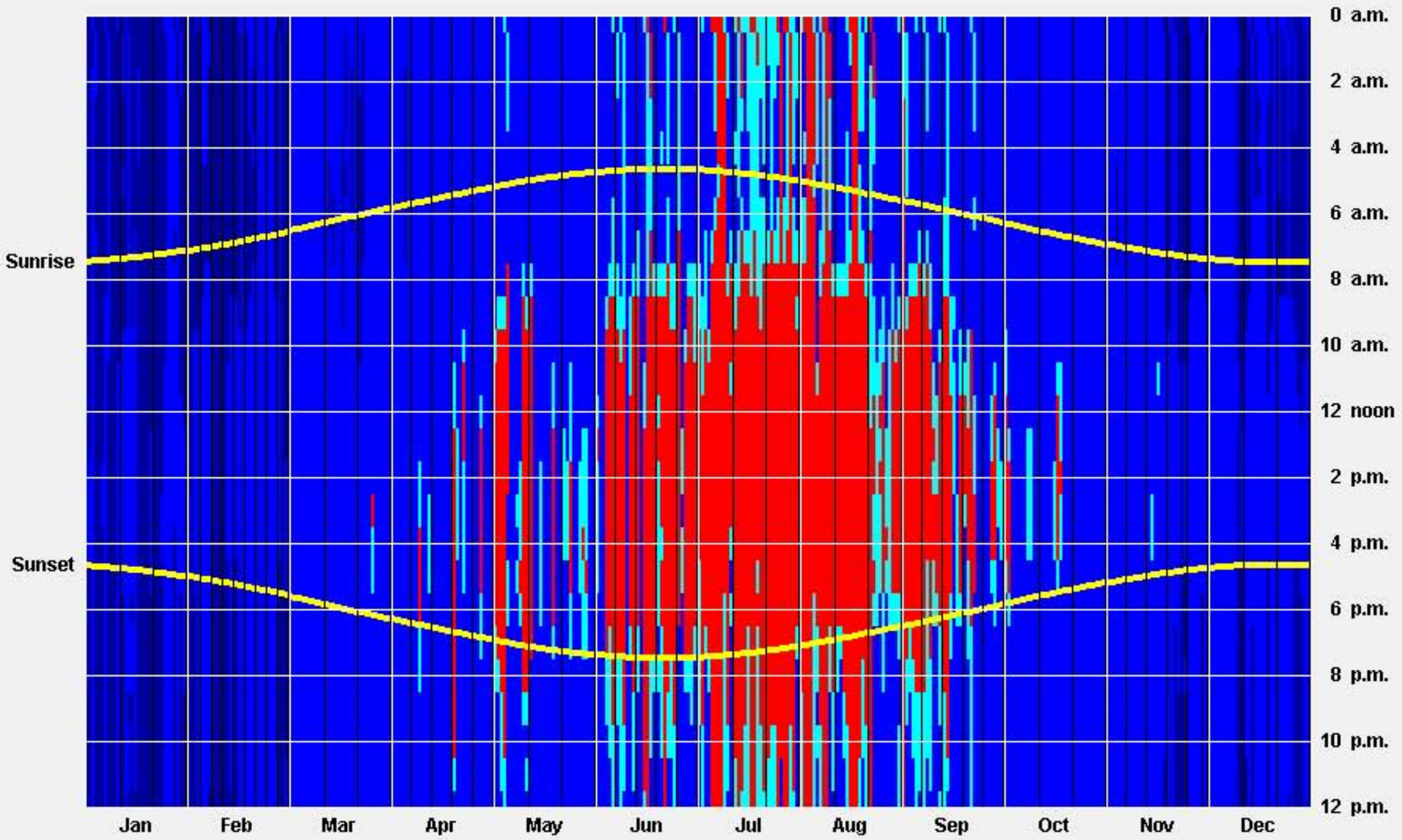
TIMETABLE PLOT

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

DRY BULB TEMP
(degrees F)

12%	< 32	
64%	32	- 70
8%	70	- 75
16%	75	- 100
0%	> 100	



PLOT:

DRY BULB TEMP

Monthly Avg Daily

Select colored squares on LEGEND to change plot colors (see Help).

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SUN SHADING CHART

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

- WARM/HOT > 75°F
  (SHADE NEEDED)
  357 Hours Exposed
  0 Hours Shaded
- COMFORT > 70°F
  (SHADE HELPS)
  150 Hours Exposed
  0 Hours Shaded
- COOL/COLD < 70°F
  (SUN NEEDED)
  2003 Hours Exposed
  0 Hours Shaded

PLOT MONTHS:

WINTER SPRING

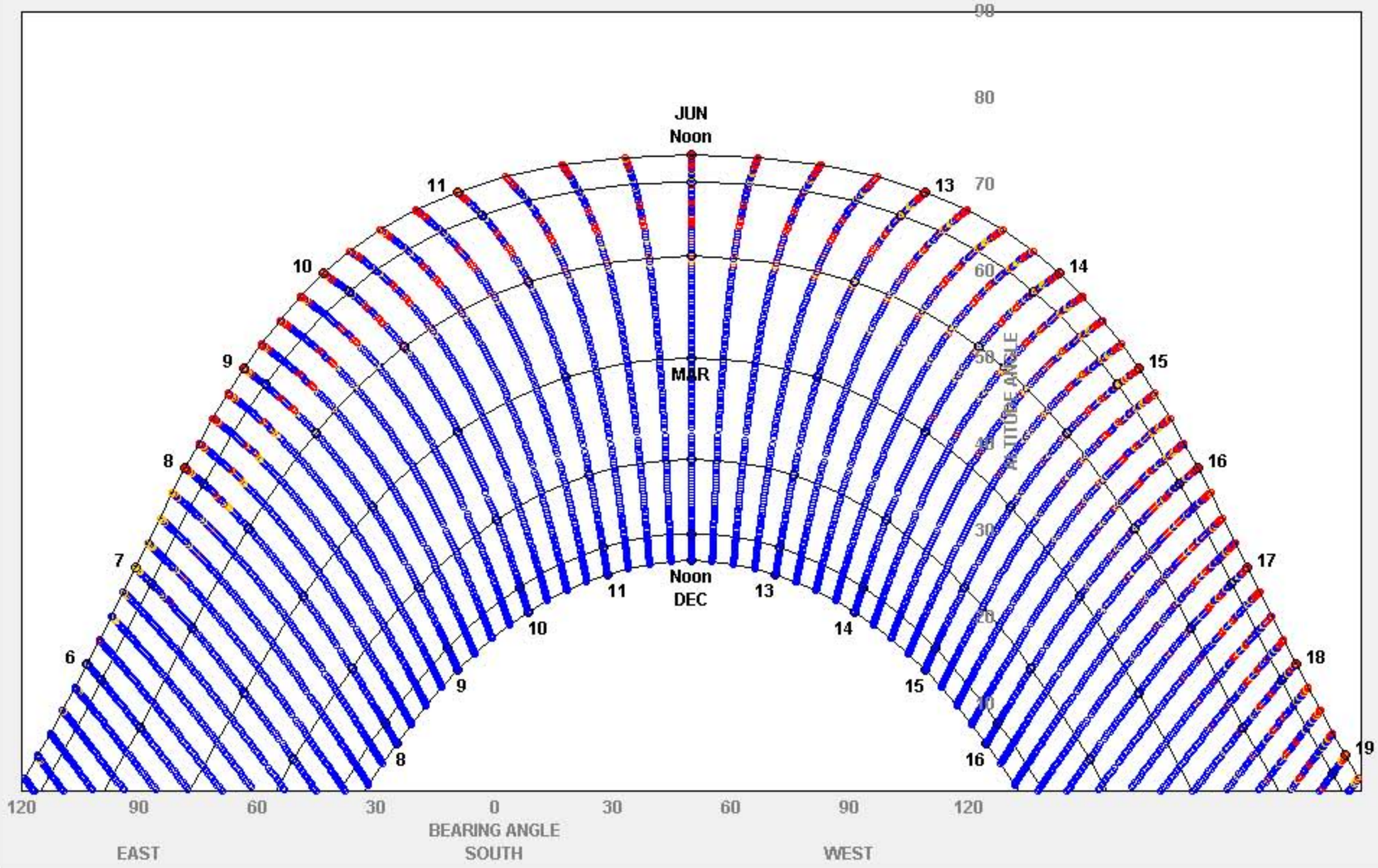
(•) December 21 to June 21

SUMMER FALL

( ) June 21 to December 21

[ ] Display Grid
[ ] Display Shading Calculator
[ ] Display Obstruction Elevation

Input Obstructions



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SUN CHART

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

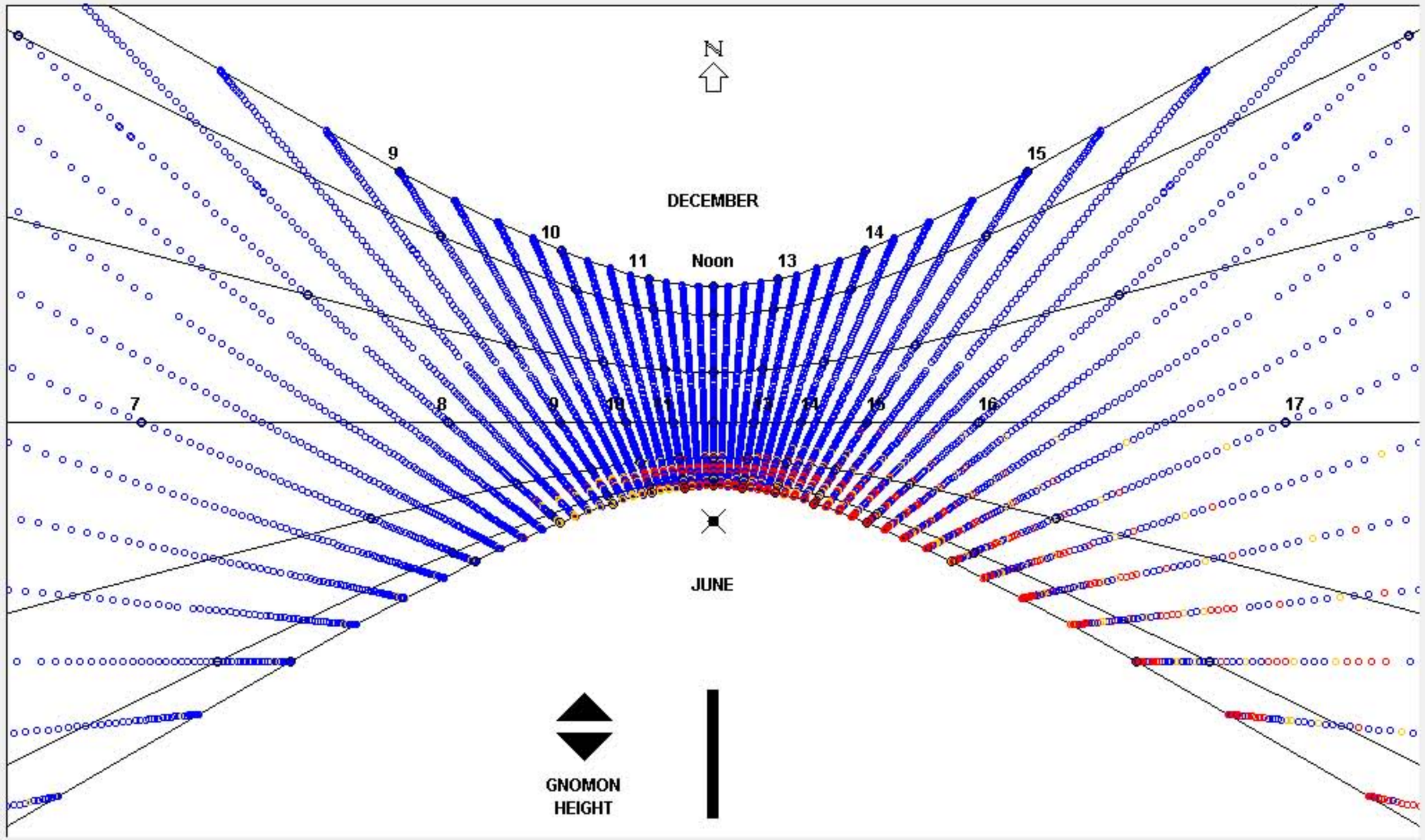
- WARM/HOT > 75°F (SHADE NEEDED)
- COMFORT > 70°F (SHADE HELPS)
- COOL/COLD < 70°F (SUN NEEDED)

GNOMON POSITION

PLOT MONTHS:

WINTER SPRING
- (•) December 21 to June 21

SUMMER FALL
- ( ) June 21 to December 21



Click on arrows to increase or decrease gnomon height.

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RADIATION RANGE

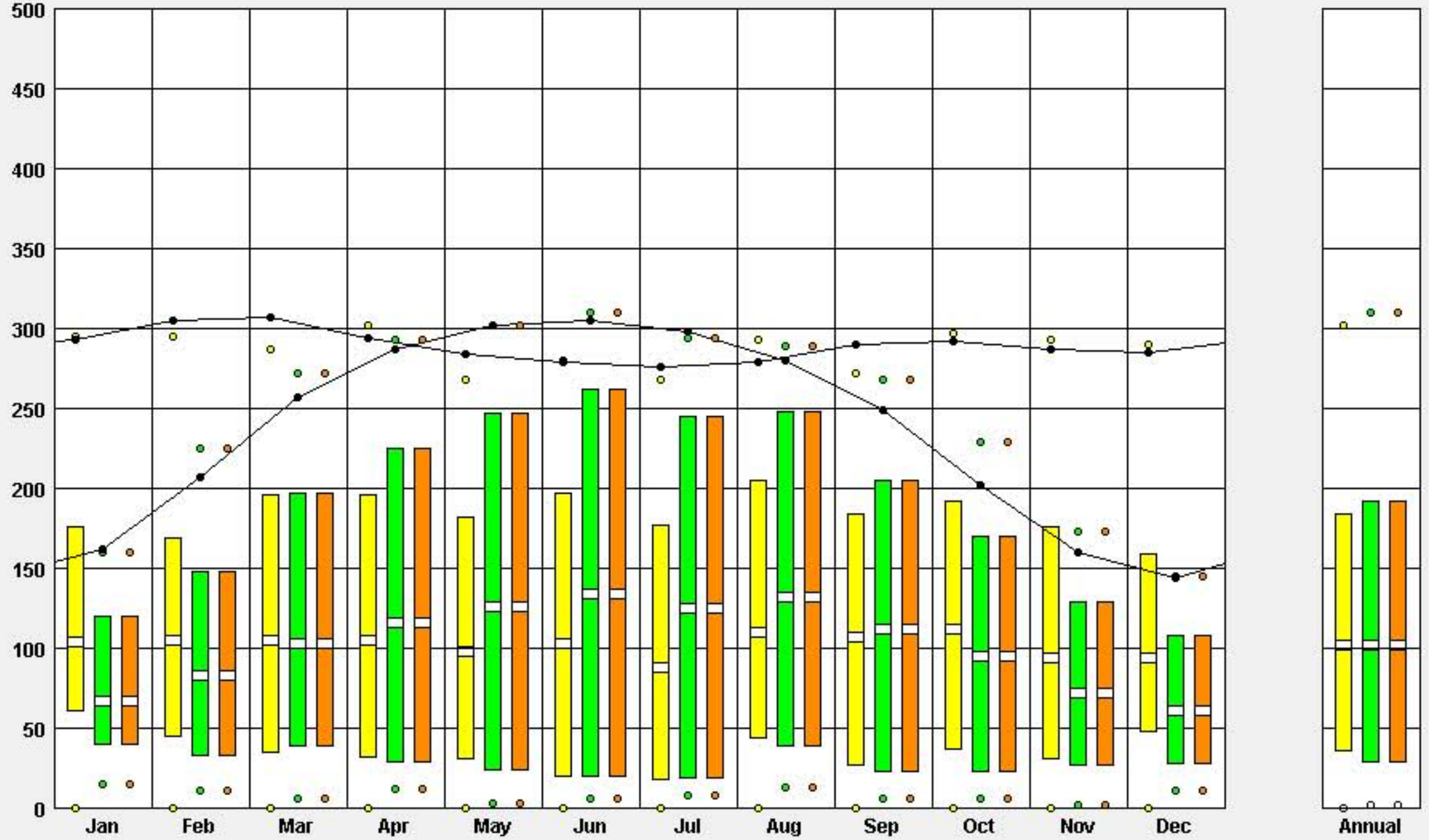
LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

HOURLY AVERAGES
DAYLIT HOURS ONLY

RECORDED HIGH - ○
AVERAGE HIGH -
MEAN -
AVERAGE LOW -
RECORDED LOW - ○

RECORDED:
DIRECT NORMAL
GLOBAL HORIZONTAL
TOTAL SURFACE
(Btu/sq.ft per hour)
THEORETICAL:



Tilted Surface Radiation Input:

0.0 Tilt degrees from H...
(Vertical = 90°)
0.0 Bearing degrees fro...
(South = 0°,West ...
20.0 % Ground Reflecta...
(20% = grass)

PLOT:
◉ Hourly Avg ○ Daily Total

Hit ENTER to replot if you change Tilted Surface Radiation parameters.

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PSYCHROMETRIC CHART
California Energy Code

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

COMFORT INDOORS
89% COMFORTABLE
11% NOT COMFORTABLE

PLOT: COMFORT INDOORS

◉ Hourly ○ Daily Min/Max

◉ All Hours ○ Select Hours
1 a.m. through 12 a.m.

◉ All Months ○ Select Months
JAN through DEC
○ 1 Month JAN Next
○ 1 Day 1 Next
○ 1 Hour 1 a.m. Next

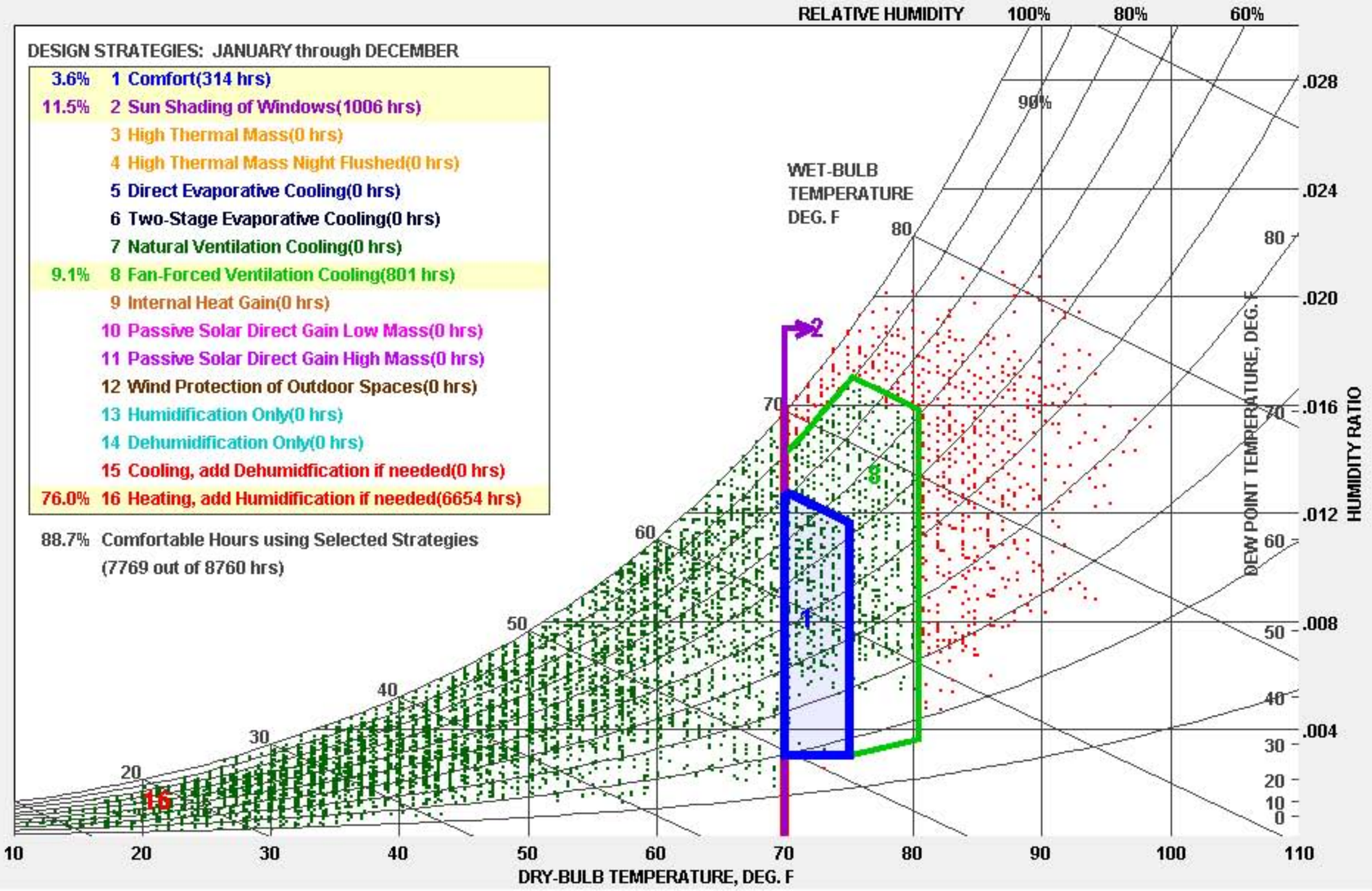
TEMPERATURE RANGE:
◉ 10 to 110 °F ○ Fit to Data

☑ Display Design Strategies
☐ Show Best set of Design Strategies

DESIGN STRATEGIES: JANUARY through DECEMBER

3.6%	1 Comfort(314 hrs)
11.5%	2 Sun Shading of Windows(1006 hrs)
	3 High Thermal Mass(0 hrs)
	4 High Thermal Mass Night Flushed(0 hrs)
	5 Direct Evaporative Cooling(0 hrs)
	6 Two-Stage Evaporative Cooling(0 hrs)
	7 Natural Ventilation Cooling(0 hrs)
9.1%	8 Fan-Forced Ventilation Cooling(801 hrs)
	9 Internal Heat Gain(0 hrs)
	10 Passive Solar Direct Gain Low Mass(0 hrs)
	11 Passive Solar Direct Gain High Mass(0 hrs)
	12 Wind Protection of Outdoor Spaces(0 hrs)
	13 Humidification Only(0 hrs)
	14 Dehumidification Only(0 hrs)
	15 Cooling, add Dehumidfication if needed(0 hrs)
76.0%	16 Heating, add Humidification if needed(6654 hrs)

88.7% Comfortable Hours using Selected Strategies
(7769 out of 8760 hrs)



Click on Design Strategy to select or deselect.

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MONTHLY DIURNAL AVERAGES
California Energy Code

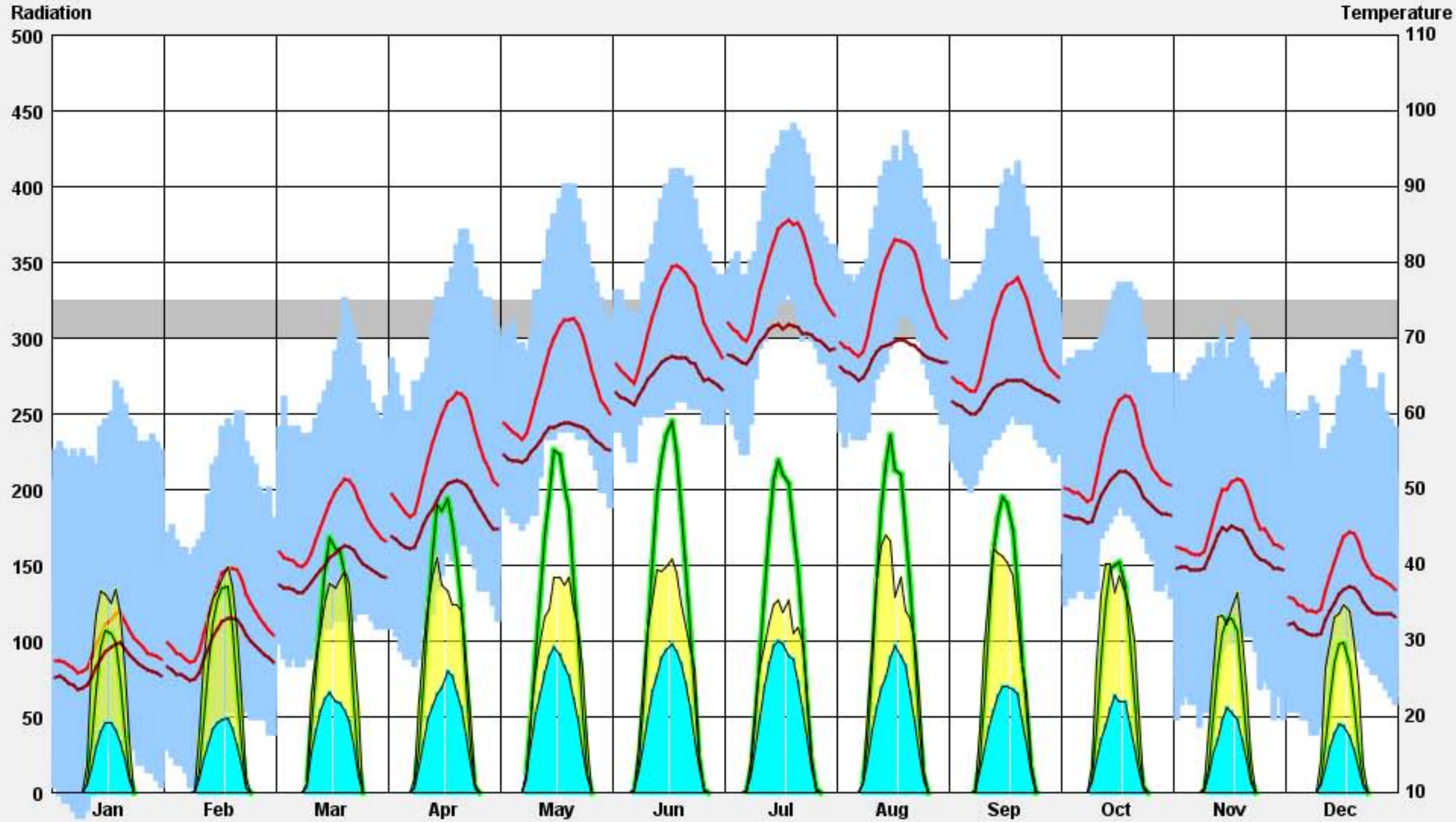
LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

HOURLY AVERAGES

TEMPERATURE: (degrees F)
- DRY BULB MEAN
- WET BULB MEAN
- DRY BULB (all hours)
- COMFORT ZONE

RADIATION: (Btu/sq.ft)
- GLOBAL HORIZ
- DIRECT NORMAL
- DIFFUSE



☑ Display Dry Bulb ... (all hours)

TEMPERATURE RANGE:
- ◉ 10 to 110 °F
- ○ Fit to Data

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ILLUMINATION RANGE

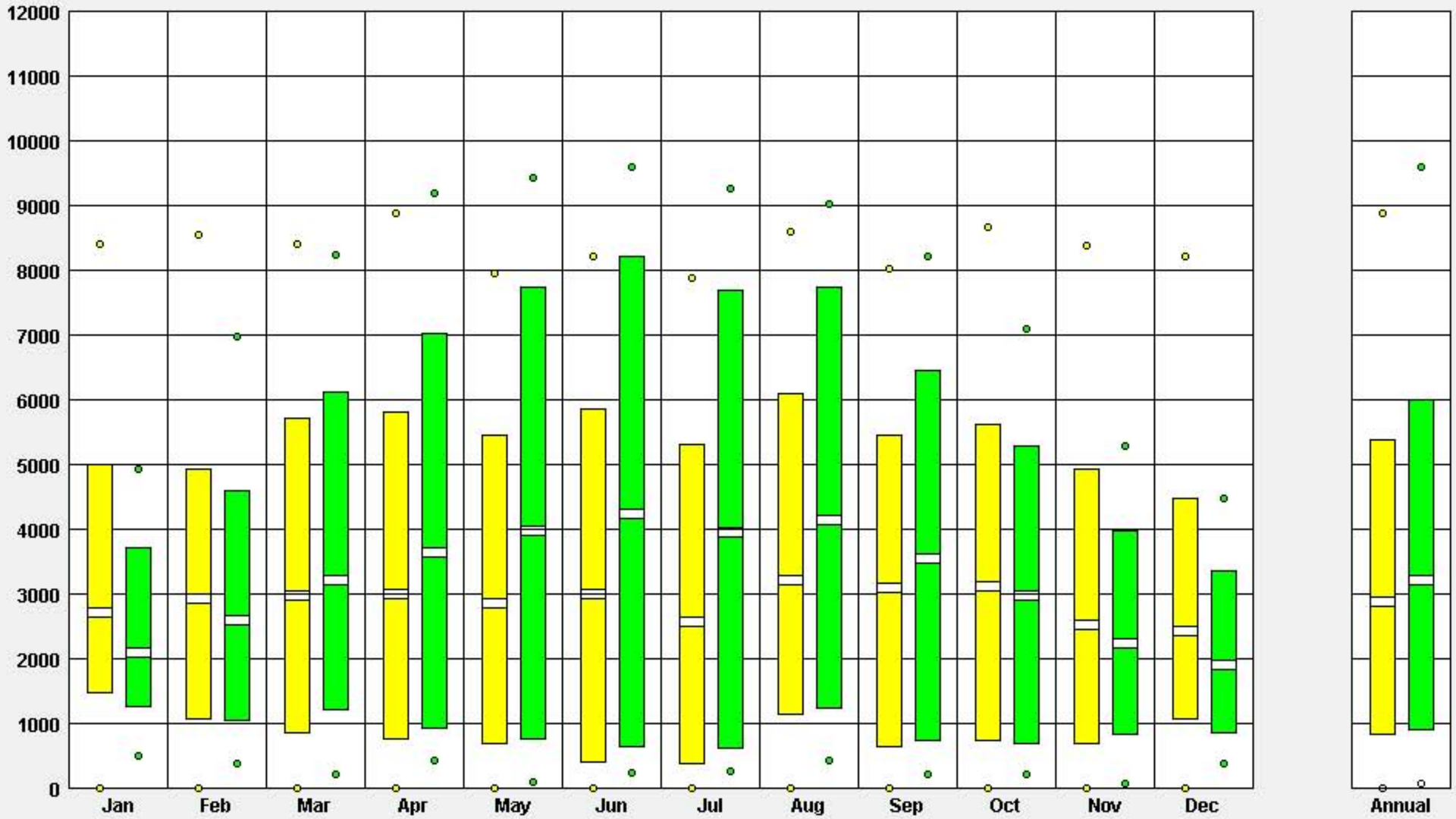
LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

HOURLY ILLUMINATION
DAYLIT HOURS ONLY

RECORDED HIGH -
AVERAGE HIGH -
MEAN -
AVERAGE LOW -
RECORDED LOW -

RECORDED:
DIRECT NORMAL
GLOBAL HORIZONTAL
(footcandles)



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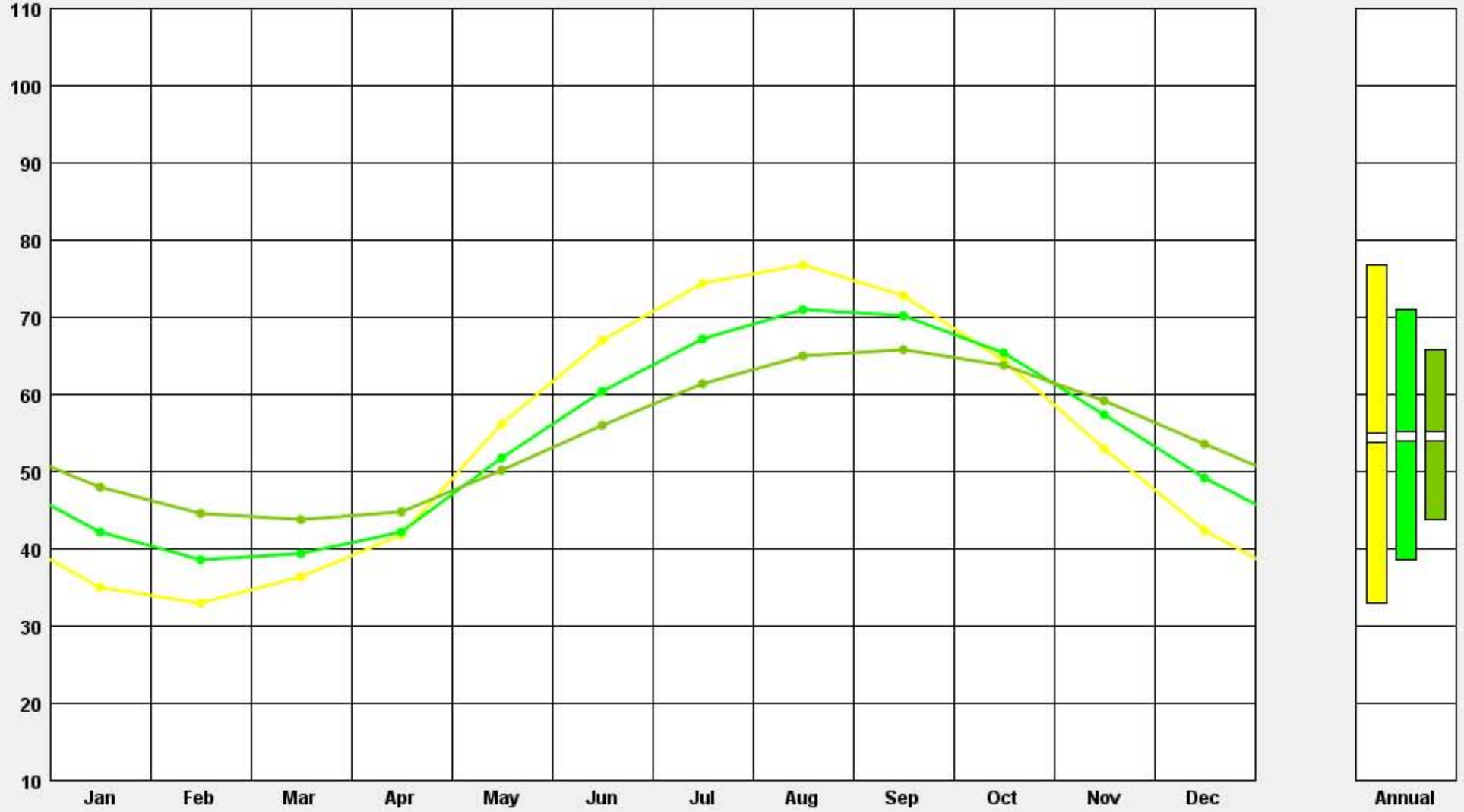
GROUND TEMPERATURE (MONTHLY AVERAGE)

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

DEPTH
(feet)
1.64
6.56
13.12
(Surface is freshly mown grass.)



TEMPERATURE RANGE:
(•) 10 to 110 °F
( ) Fit to Data

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WIND WHEEL

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

TEMPERATURE (Deg. F)
- < 32
- 32 - 70
- 70 - 75
- 75 - 100
- > 100

RELATIVE HUMIDITY (%)
- <30
- 30-70
- >70

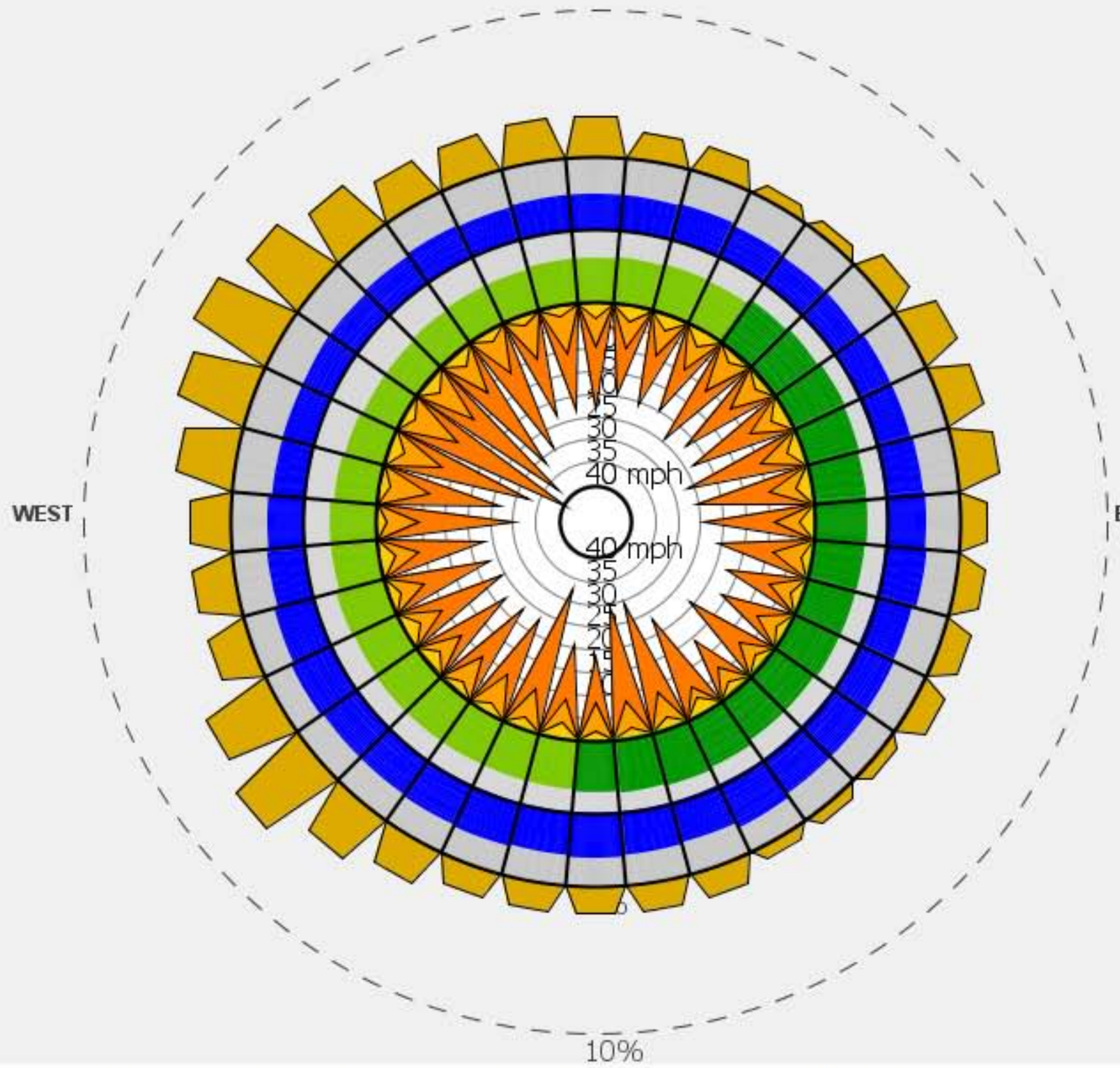
All Hours / Selected Hours
1 a.m. through midnight

All Months / Selected Months
JAN through DEC

One Month JAN Next Month

One Day 1 Next Day

Animate
Monthly / Daily / Hourly
Start / Pause / Stop



Start "Animation" to see monthly plots or select the "One Month" option and cycle through months by clicking "Next Month".

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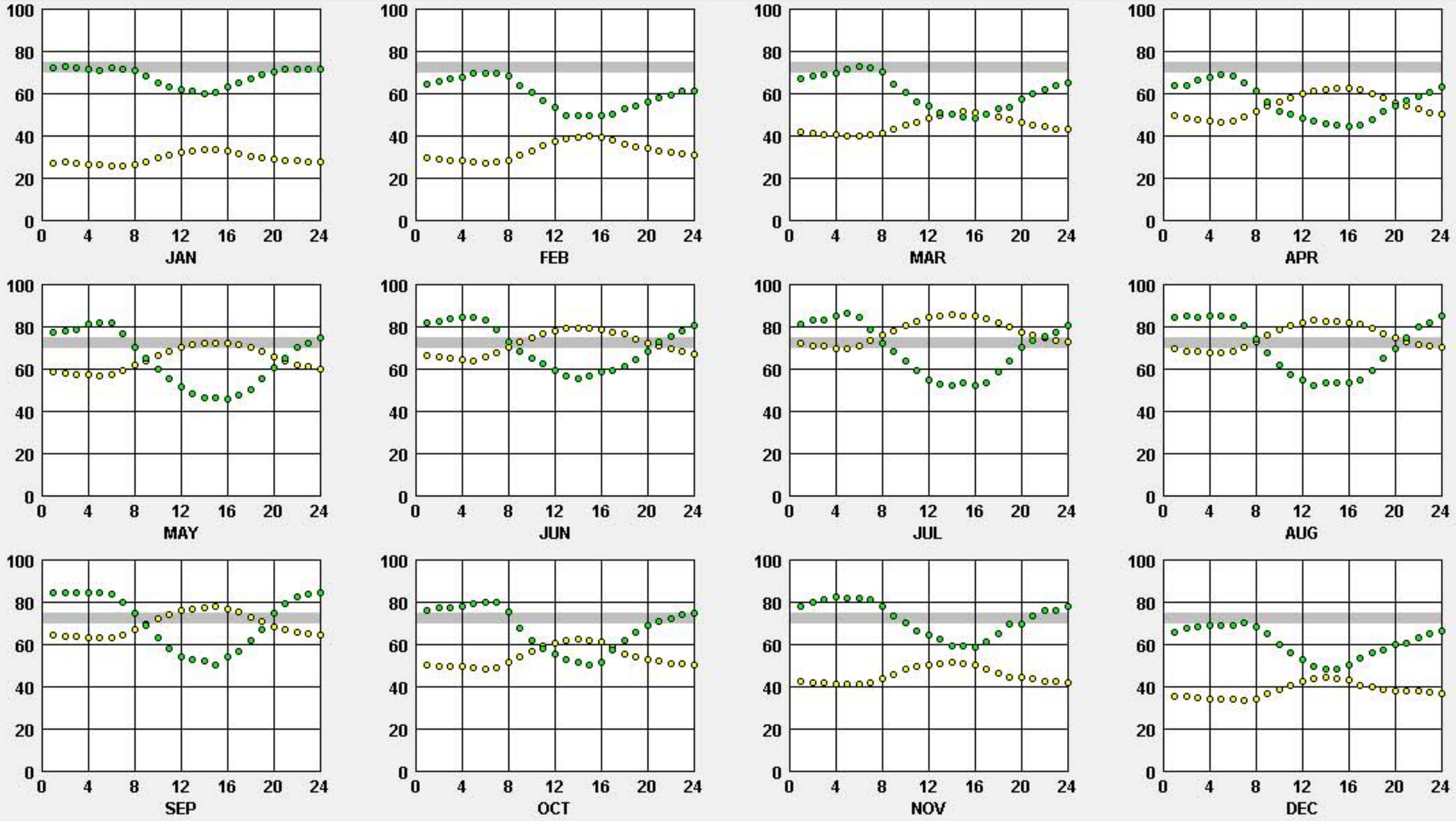
DRY BULB X RELATIVE HUMIDITY

California Energy Code

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

Dry Bulb
Humidity
Comfort Zone



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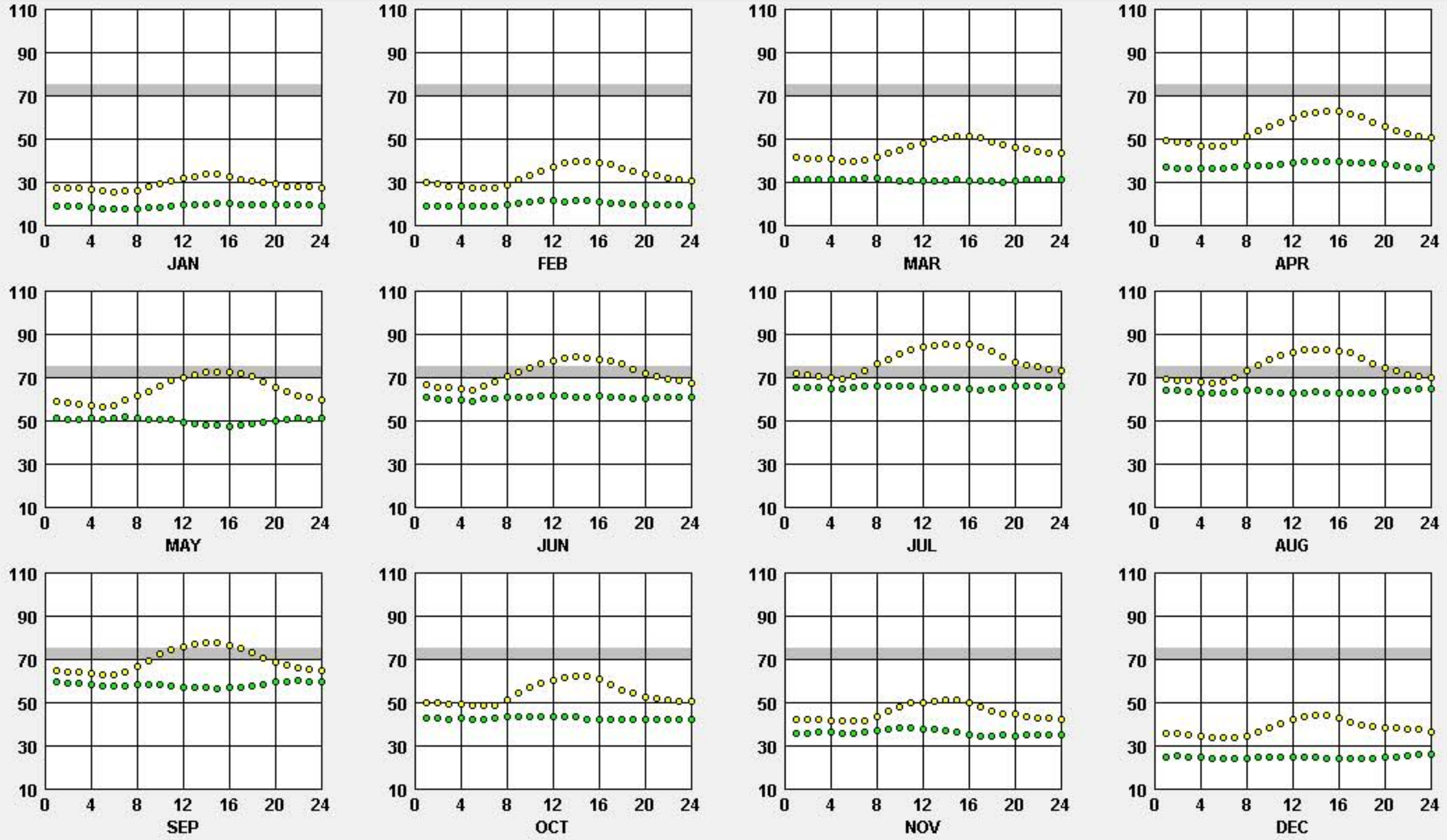
DRY BULB X DEW POINT
California Energy Code

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

Dry Bulb
Dew Point
Comfort Zone



TEMPERATURE RANGE:
(•) 10 to 110 °F
( ) Fit to Data

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DESIGN GUIDELINES (for the Full Year)
California Energy Code
User Modified Design Strategies, User Modified Criteria

LOCATION: **Philadelphia International Ap, PA, USA**
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

Assuming only the Design Strategies that were selected on the Psychrometric Chart, 88.7% of the hours will be Comfortable.
This list of Residential Design guidelines applies specifically to this particular climate, starting with the most important first. Click on a Guideline to see a sketch of how this Design Guideline shapes building design (see Help).

19	For passive solar heating face most of the glass area south to maximize winter sun exposure, but design overhangs to fully shade in summer
20	Provide double pane high performance glazing (Low-E) on west, north, and east, but clear on south for maximum passive solar gain
3	Lower the indoor comfort temperature at night to reduce heating energy consumption (lower thermostat heating setback) (see comfort low criteria)
18	Keep the building small (right-sized) because excessive floor area wastes heating and cooling energy
15	High Efficiency furnace (at least Energy Star) should prove cost effective
4	Extra insulation (super insulation) might prove cost effective, and will increase occupant comfort by keeping indoor temperatures more uniform
13	Steep pitched roof, with a vented attic over a well insulated ceiling, works well in cold climates (sheds rain and snow, and helps prevent ice dams)
2	If a basement is used it must be at least 18 inches below frost line and insulated on the exterior (foam) or on the interior (fiberglass in furred wall)
16	Trees (neither conifer or deciduous) should not be planted in front of passive solar windows, but are OK beyond 45 degrees from each corner
14	Locate garages or storage areas on the side of the building facing the coldest wind to help insulate
67	Traditional passive homes in cold clear climates had snug floorplan with central heat source, south facing windows, and roof pitched for wind protection
5	Carefully seal building to minimize infiltration and eliminate drafts, especially in windy sites (house wrap, weather stripping, tight windows)
31	Organize floorplan so winter sun penetrates into daytime use spaces with specific functions that coincide with solar orientation
22	Super tight buildings need a fan powered HRV or ERV (Heat or Energy Recovery Ventilator) to ensure indoor air quality while conserving energy
11	Heat gain from lights, people, and equipment greatly reduces heating needs so keep home tight, well insulated (to lower Balance Point temperature)
1	Tiles or slate (even on wood floors) or a stone-faced fireplace provides enough surface mass to store winter daytime solar gain and summer nighttime 'coolth'
6	Exterior wind shields or dense planting can protect entries from cold winter winds (wing walls, wind breaks, fences, exterior structures, or land forms)
8	Sunny wind-protected outdoor spaces can extend living areas in cool weather (seasonal sun rooms, enclosed patios, courtyards, or verandahs)
7	Use vestibule entries (air locks) to minimize infiltration and eliminate drafts, in cold windy sites
12	Insulating blinds, heavy draperies, or operable window shutters will help reduce winter night time heat losses