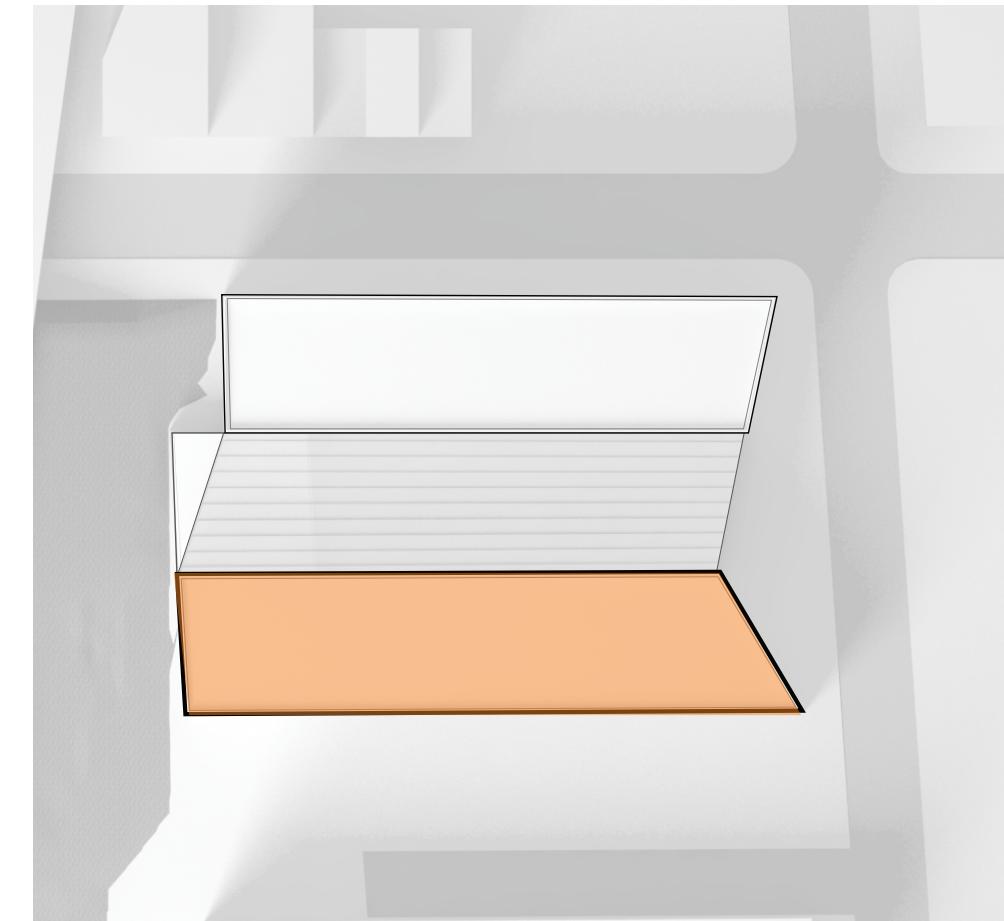
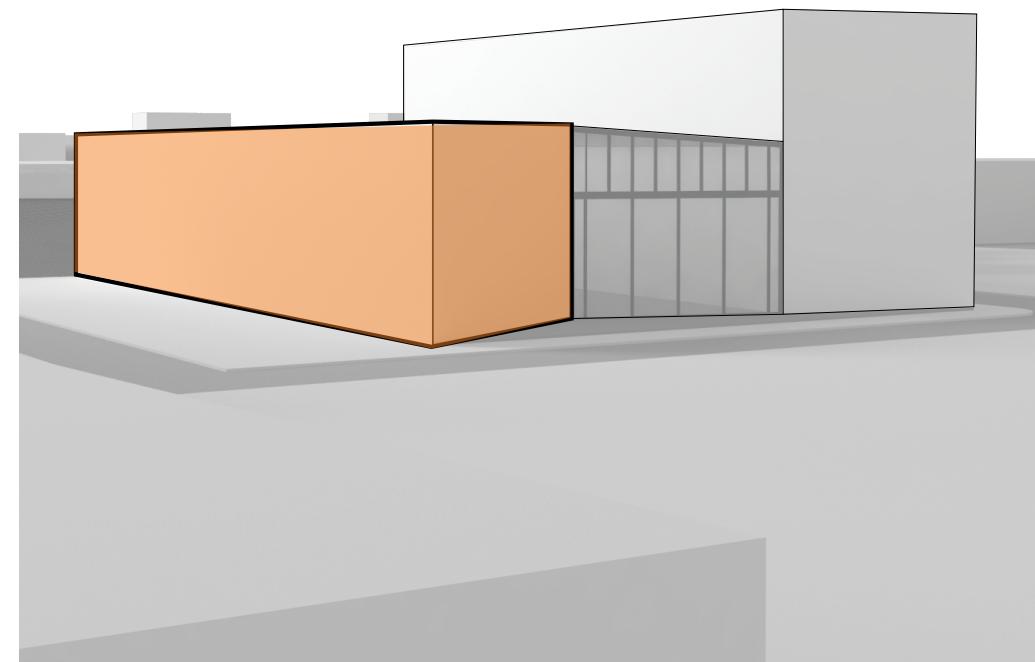


SUNROOM AS PASSIVE CONDITIONING STRATEGY

DESIGN OBJECTIVE

To figure out how we can use passive solar strategies to condition and achieve maximum thermal comfort in a 20,000 square foot office building in Philadelphia.

We want to prove sunrooms are an effective strategy for passive conditioning in Philadelphia while amalgamating into the design narrative of the building seamlessly.



WORKFLOW

PHASE 1

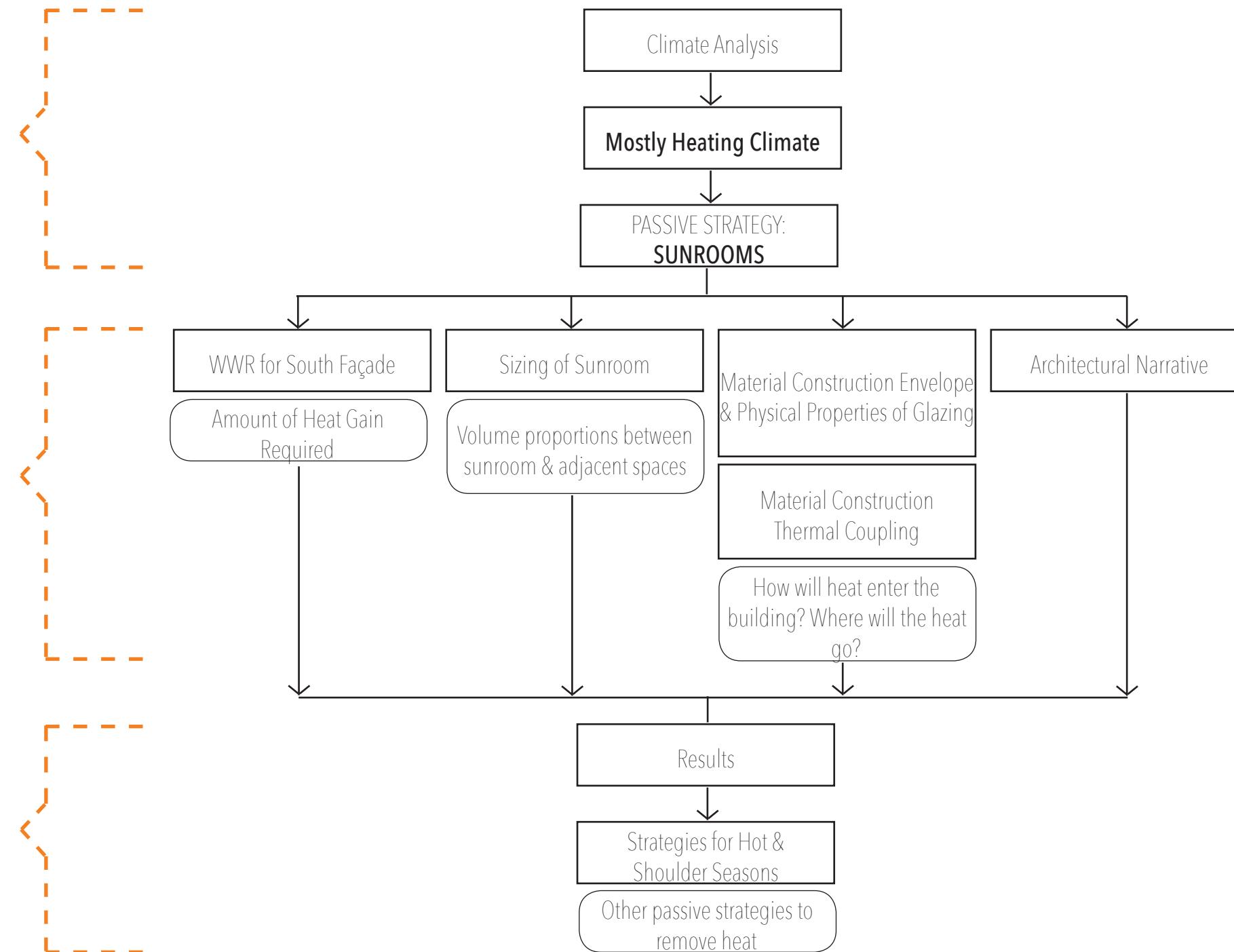
Our climate analysis of Philadelphia revealed that we have significantly more cold stress than heat stress and is comfortable the majority of the time. From our research on passive strategies we discovered sunrooms work well in this climate.

PHASE 2

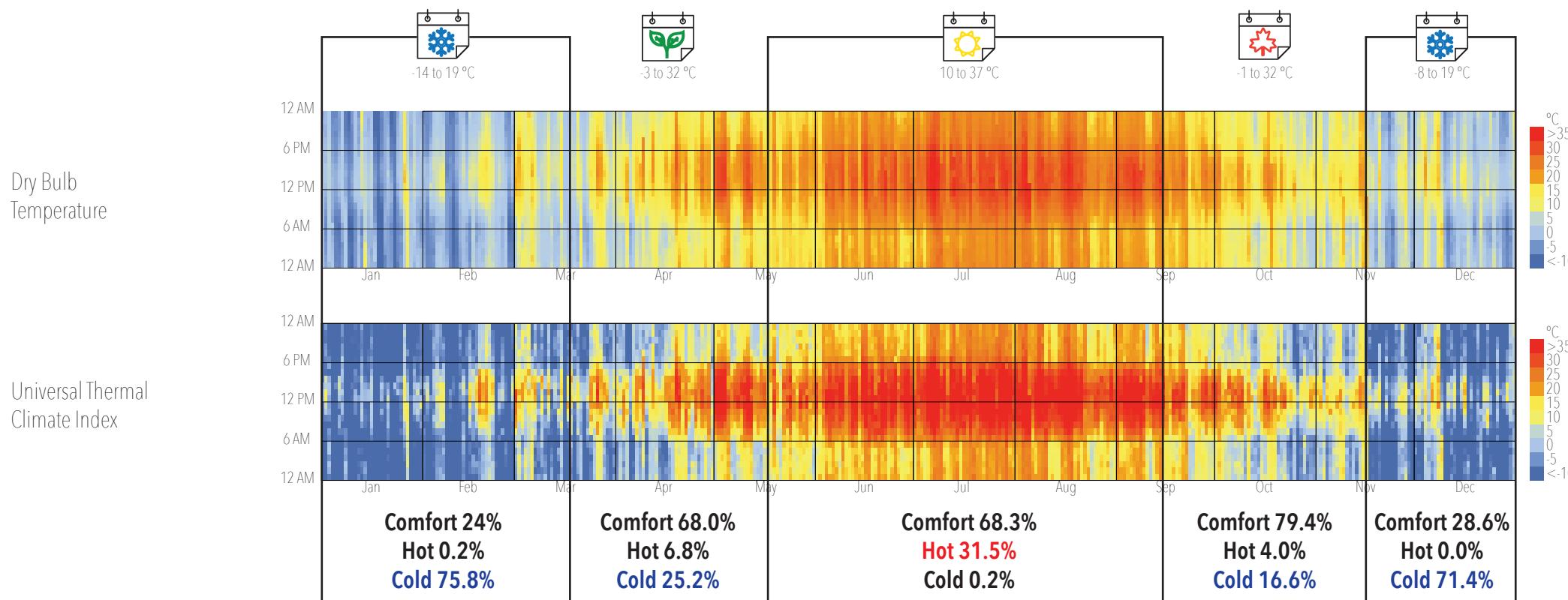
In the second phase of our workflow we will test multiple variables in relationship to sunroom and thermal mass coupling to determine the most comfortable conditions for occupancy. We plan to take that information to make design decisions about the type of activity within the sunrooms that can maximize the utility of the space in accordance with the programming for the building.

PHASE 3

Once we determined our best possible conditions for cold stress we will take the sunroom design and apply passive strategies such as shading and ventilation to achieve maximum comfort for hot and shoulder seasons.

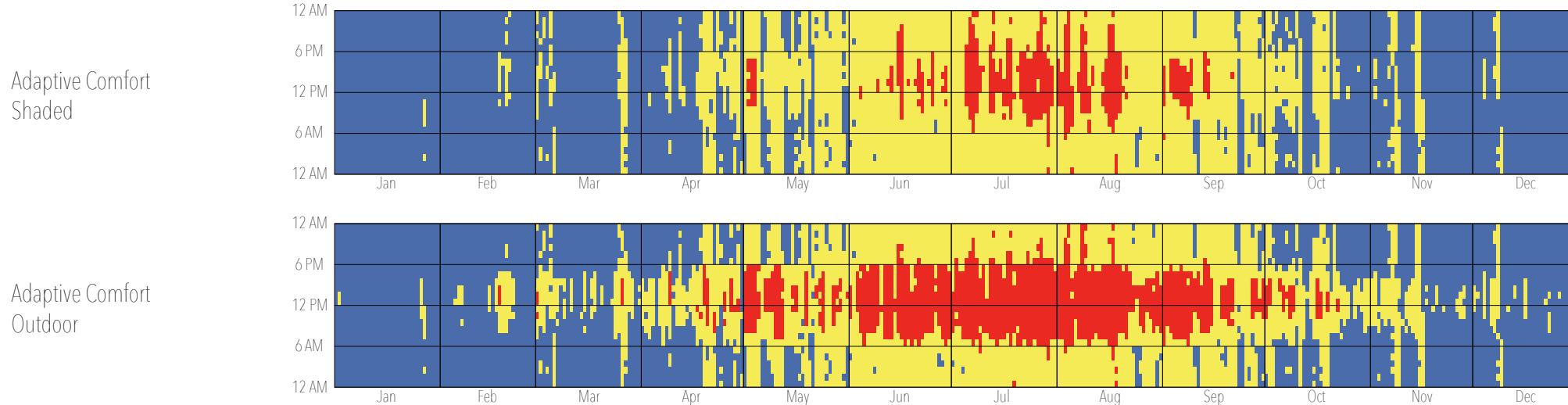


PHASE 1 » CLIMATE ANALYSIS » PHILADELPHIA » MOSTLY HEATING CLIMATE



From the climate analysis we see that Philadelphia is comfortable for most of the year. We also have more cold stress than heat stress throughout the year.

Below we see that during hotter temperatures, adding shading reduces heat stress significantly.



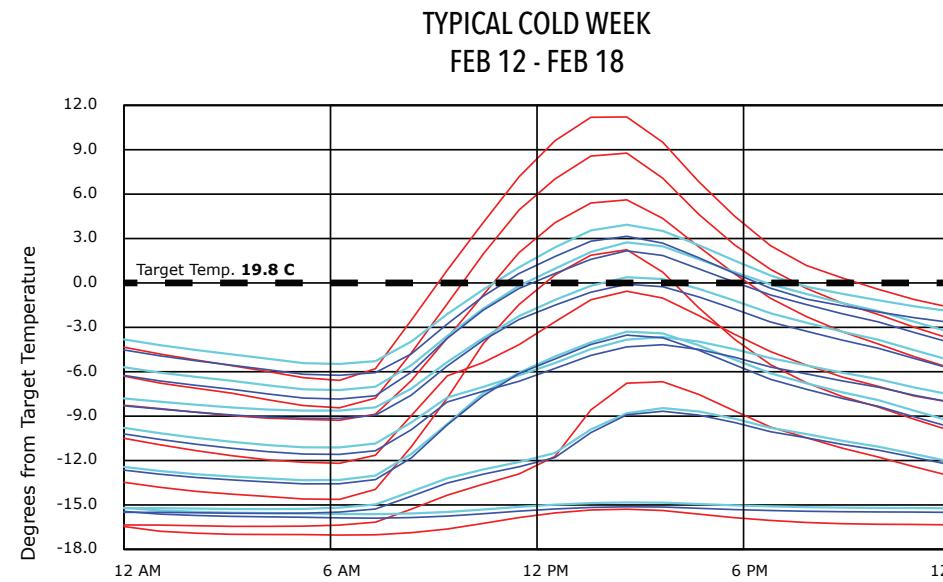
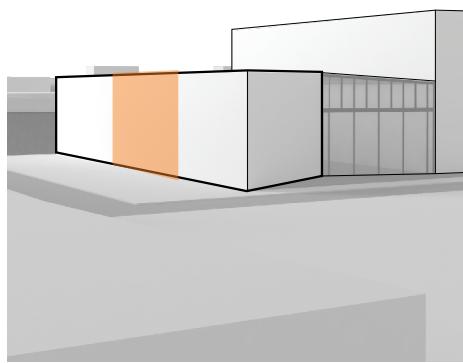
SHADED - % COMFORTABLE

Heat Stress	3.1 %
Comfortable	41.3 %
Cold Stress	34.3 %

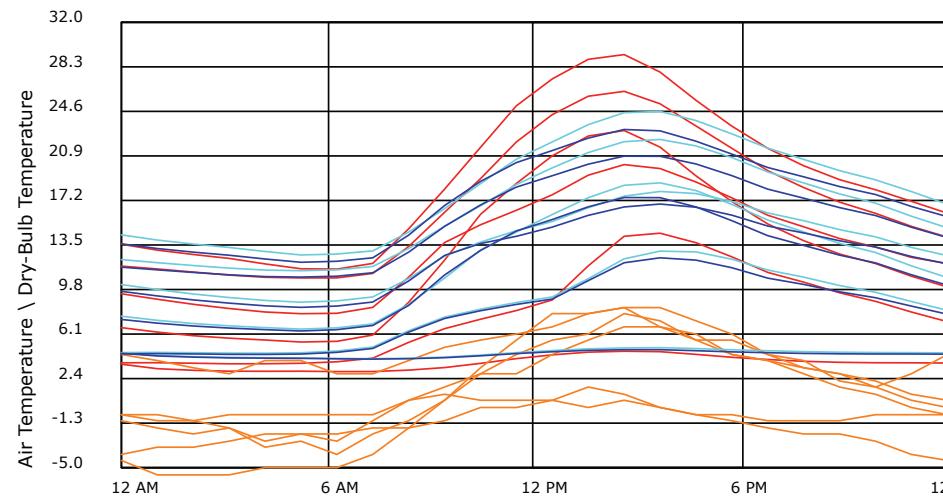
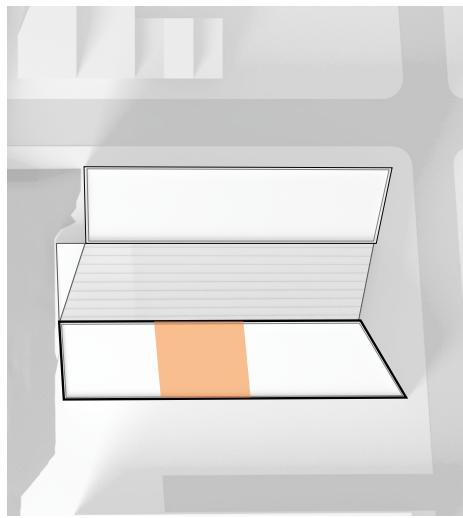
OUTDOOR - % COMFORTABLE

Heat Stress	12.5 %
Comfortable	37.3 %
Cold Stress	31.6 %

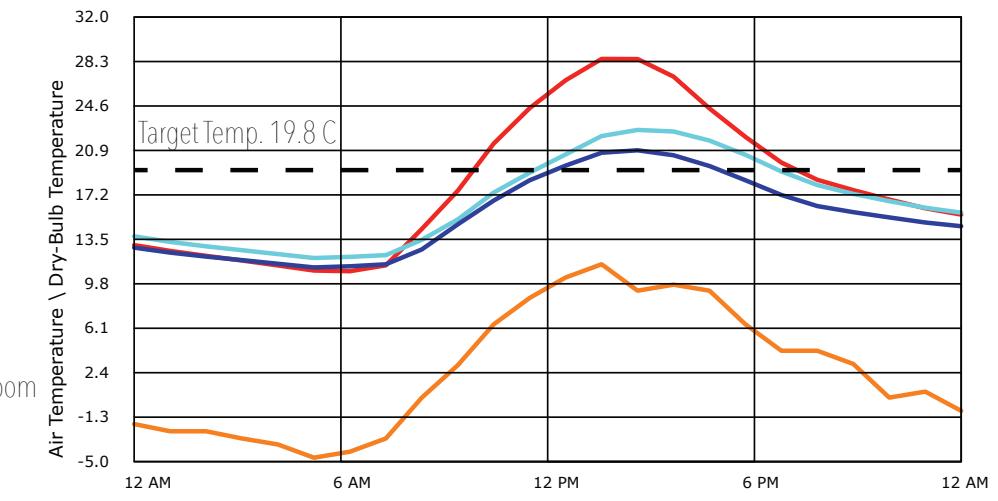
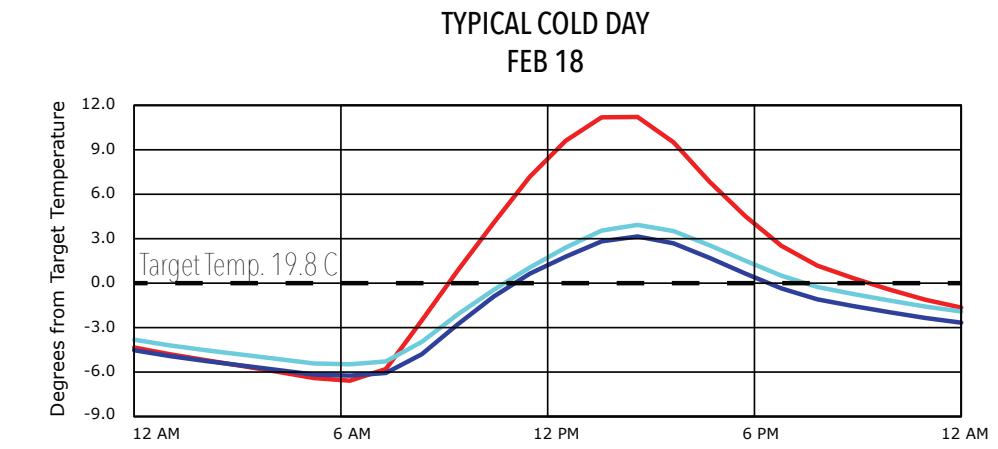
PHASE 2 » PASSIVE STRATEGY » SUNROOM TEMPERATURE



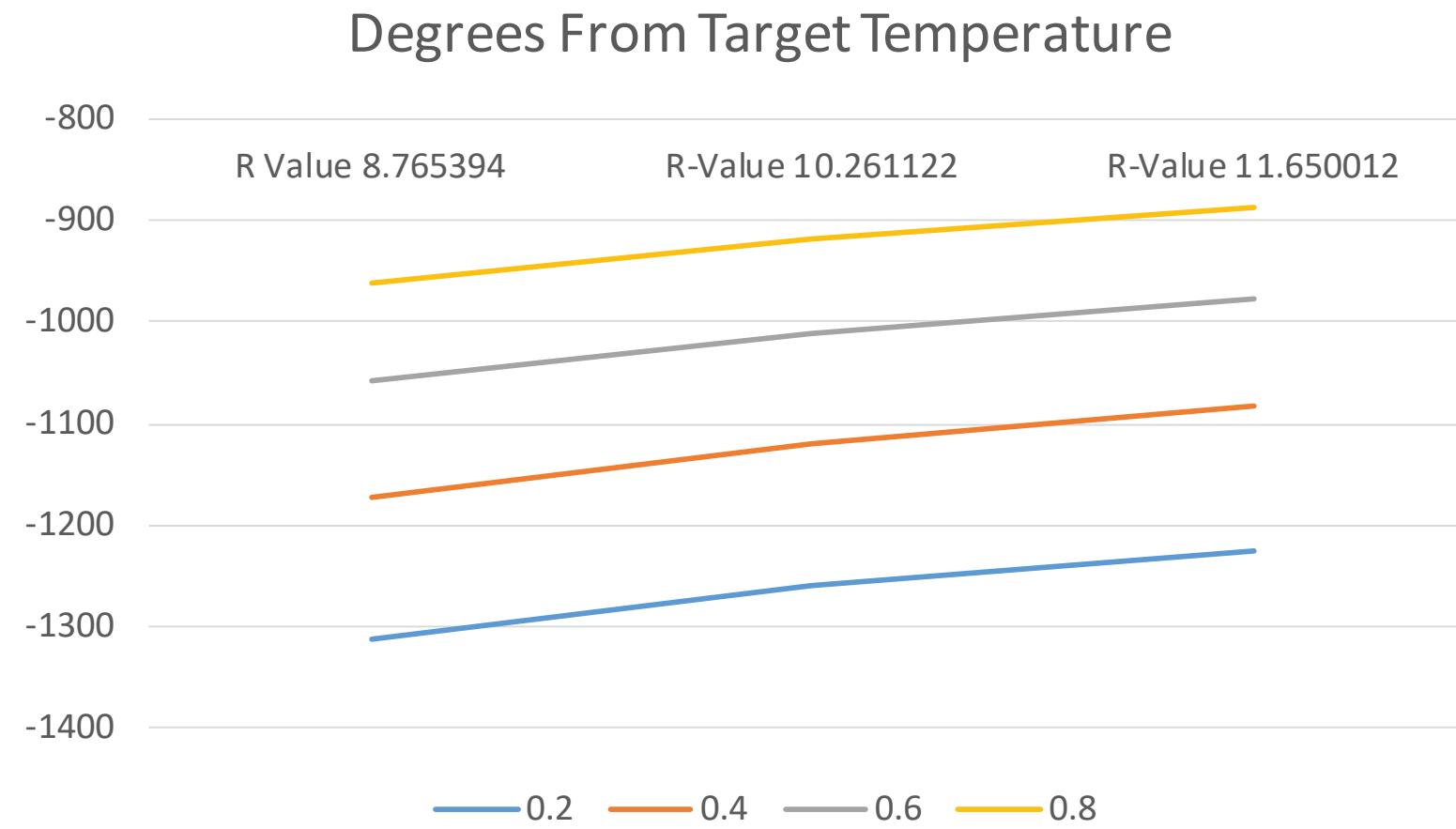
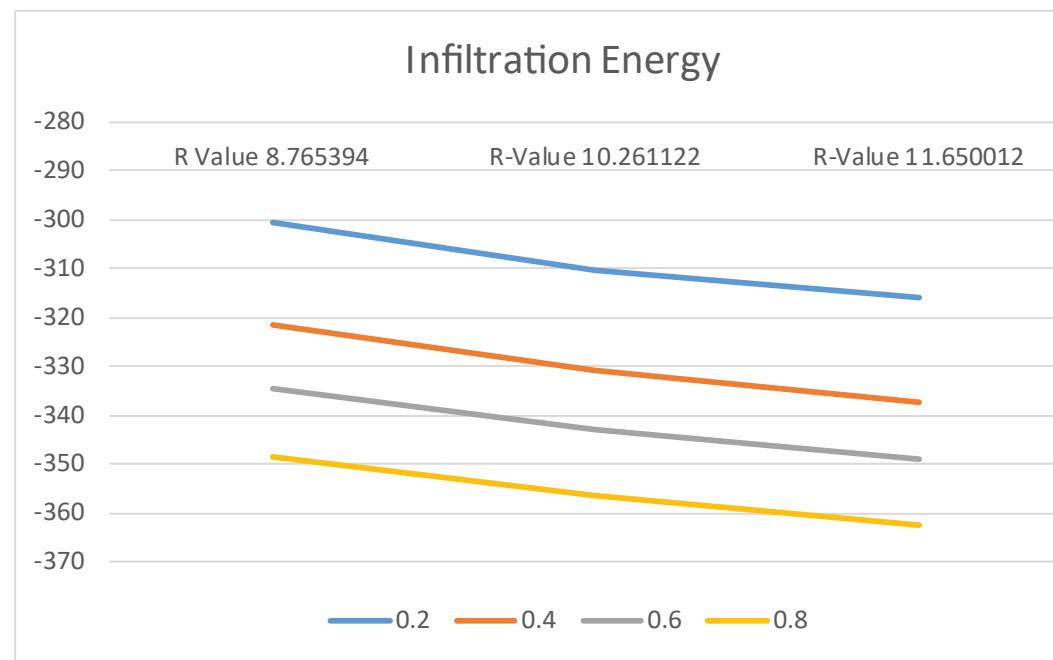
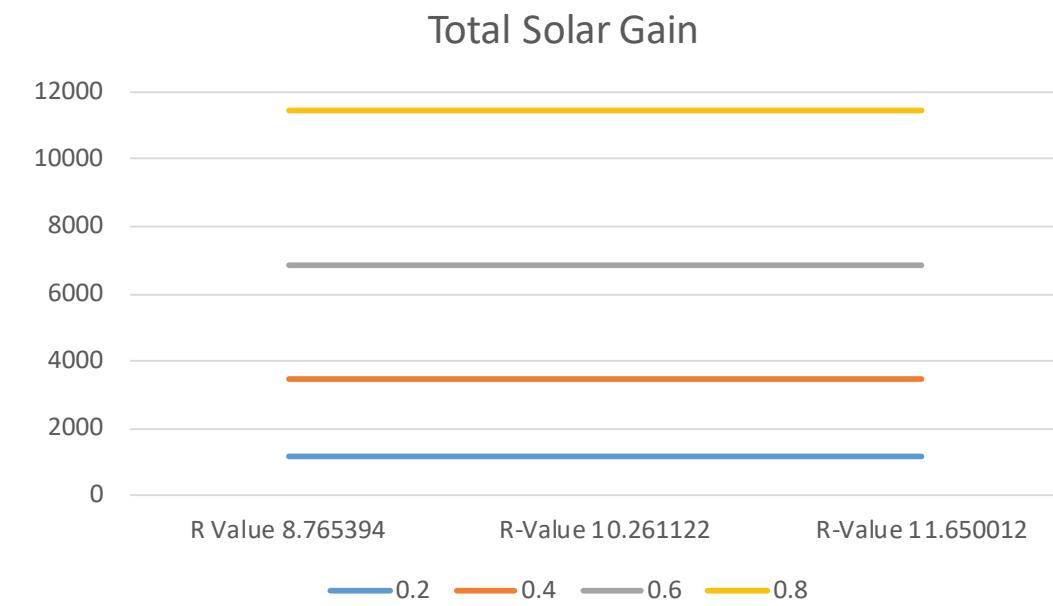
■ SunRoom
■ Occupied Room Adjacent to Sunroom
■ Occupied Room



■ Air Temp. SunRoom
■ Air Temp. Room Adjacent to Sunroom
■ Air Temp. Occupied Room
■ Dry Bulb Temperature

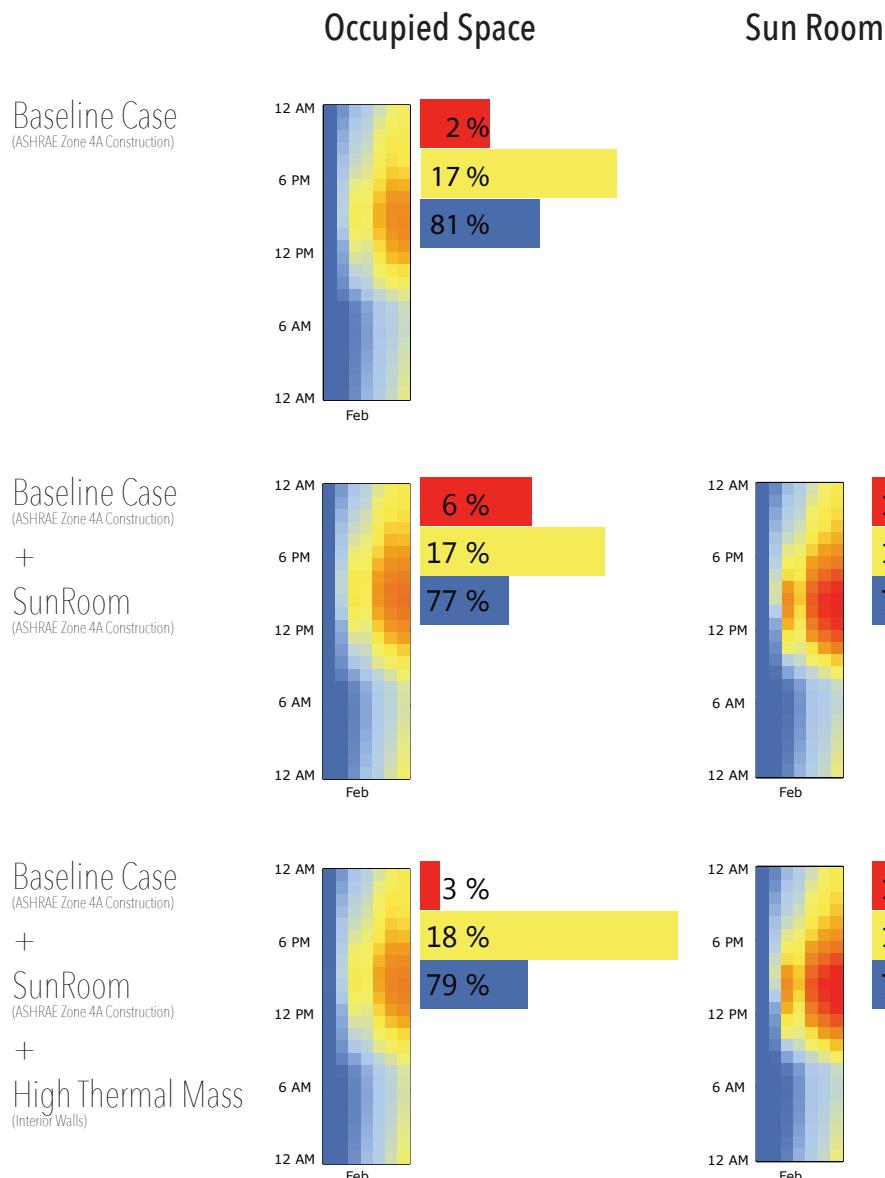


PHASE 2 » PASSIVE STRATEGY » EFFECT OF CONSTRUCTION & HEAT GAIN

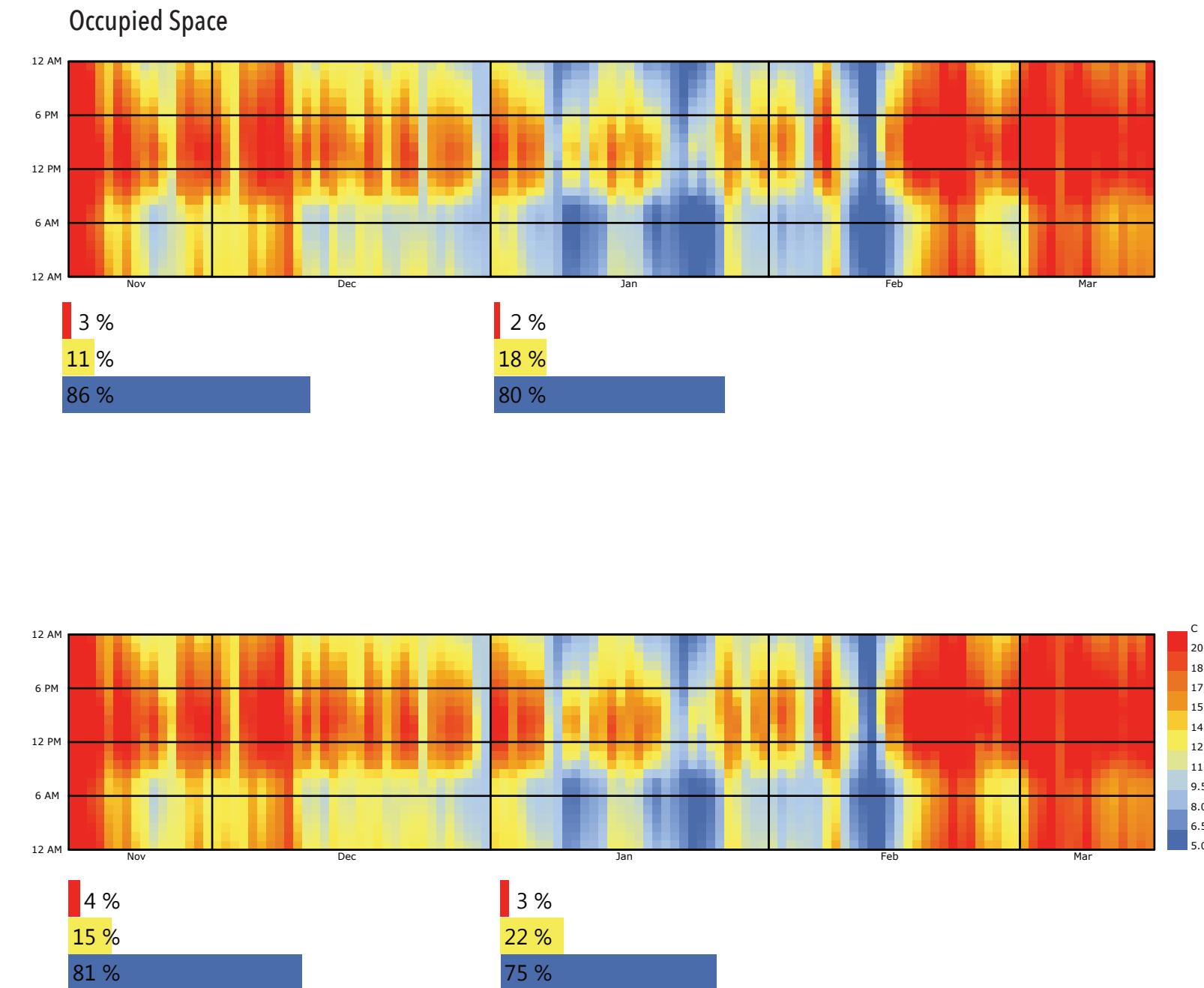


PHASE 2 » PASSIVE STRATEGY » SUNROOMS » TYPICAL COLD WEEK COMFORT

TYPICAL COLD WEEK
FEB 12 - FEB 18



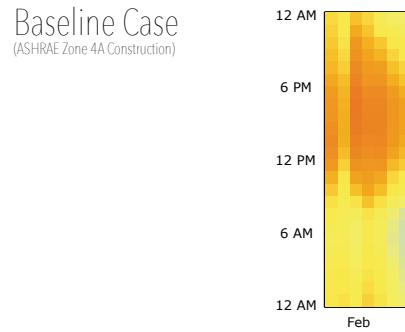
WINTER
NOV 15 - MAR 15



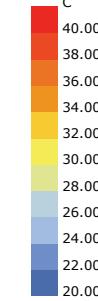
PHASE 2 » PASSIVE STRATEGY » TYPICAL HOT WEEK COMFORT

TYPICAL HOT WEEK
AUG 19 - AUG 25

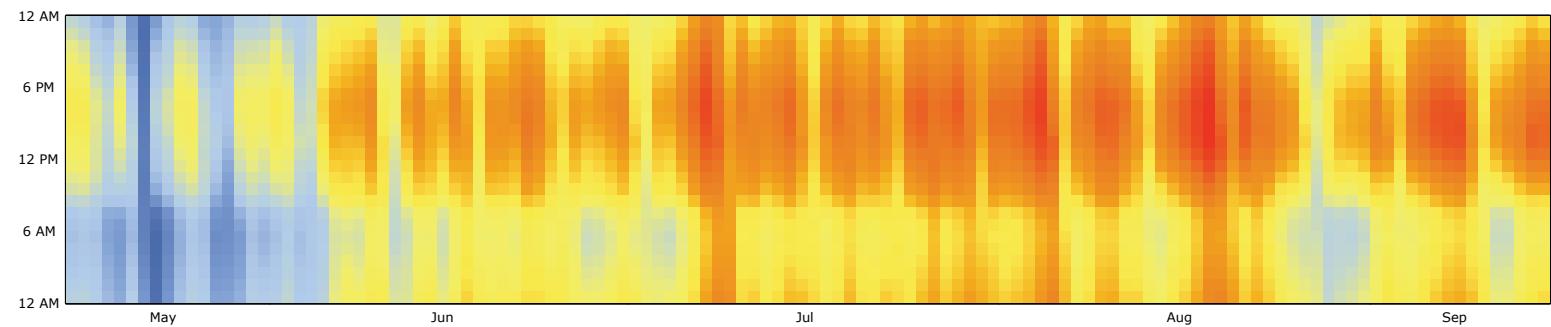
Occupied Space



Sun Room



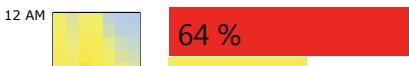
Occupied Space



Baseline Case
(ASHRAE Zone 4A Construction)

+
SunRoom
(ASHRAE Zone 4A Construction)

+
Shading Louvers



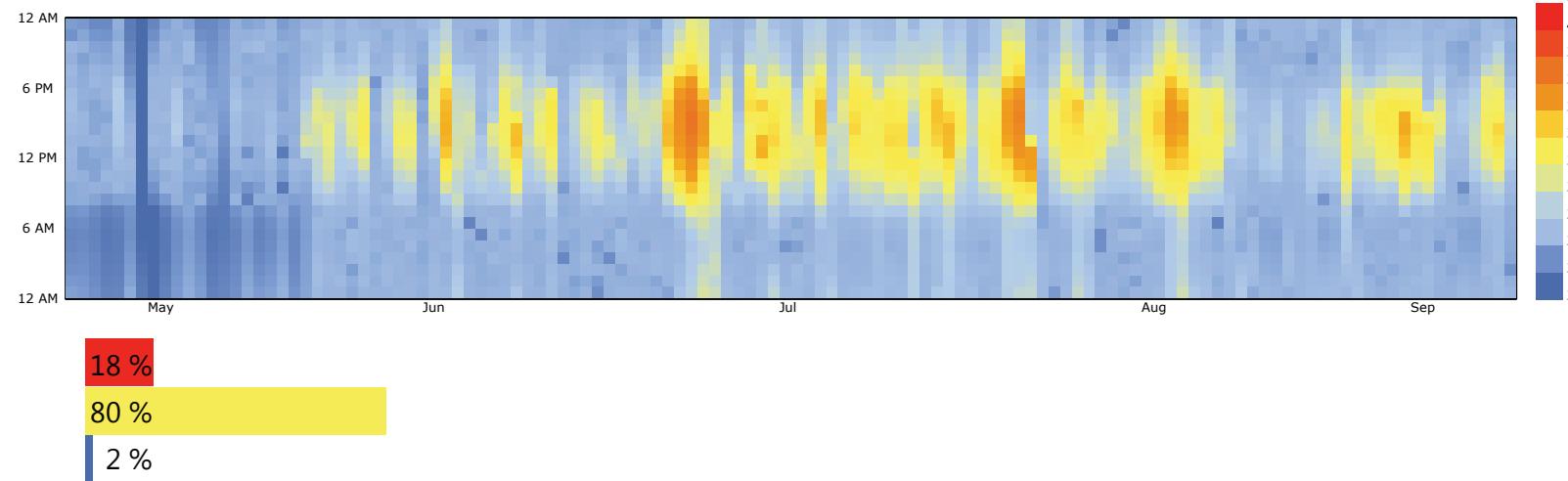
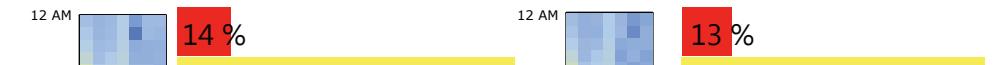
Baseline Case
(ASHRAE Zone 4A Construction)

+
SunRoom
(ASHRAE Zone 4A Construction)

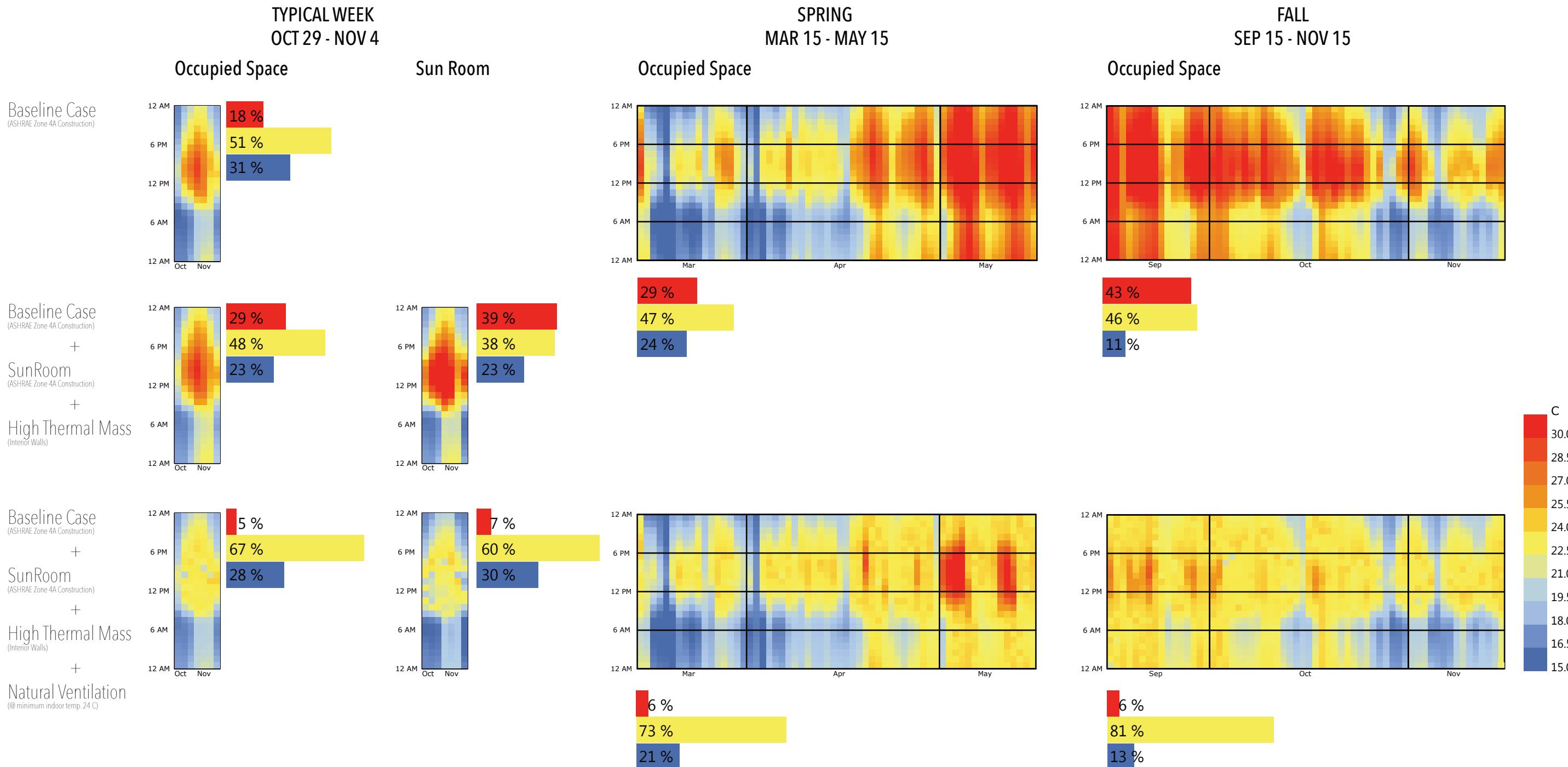
+
Shading Louvers

+
High Thermal Mass
(Interior Walls)

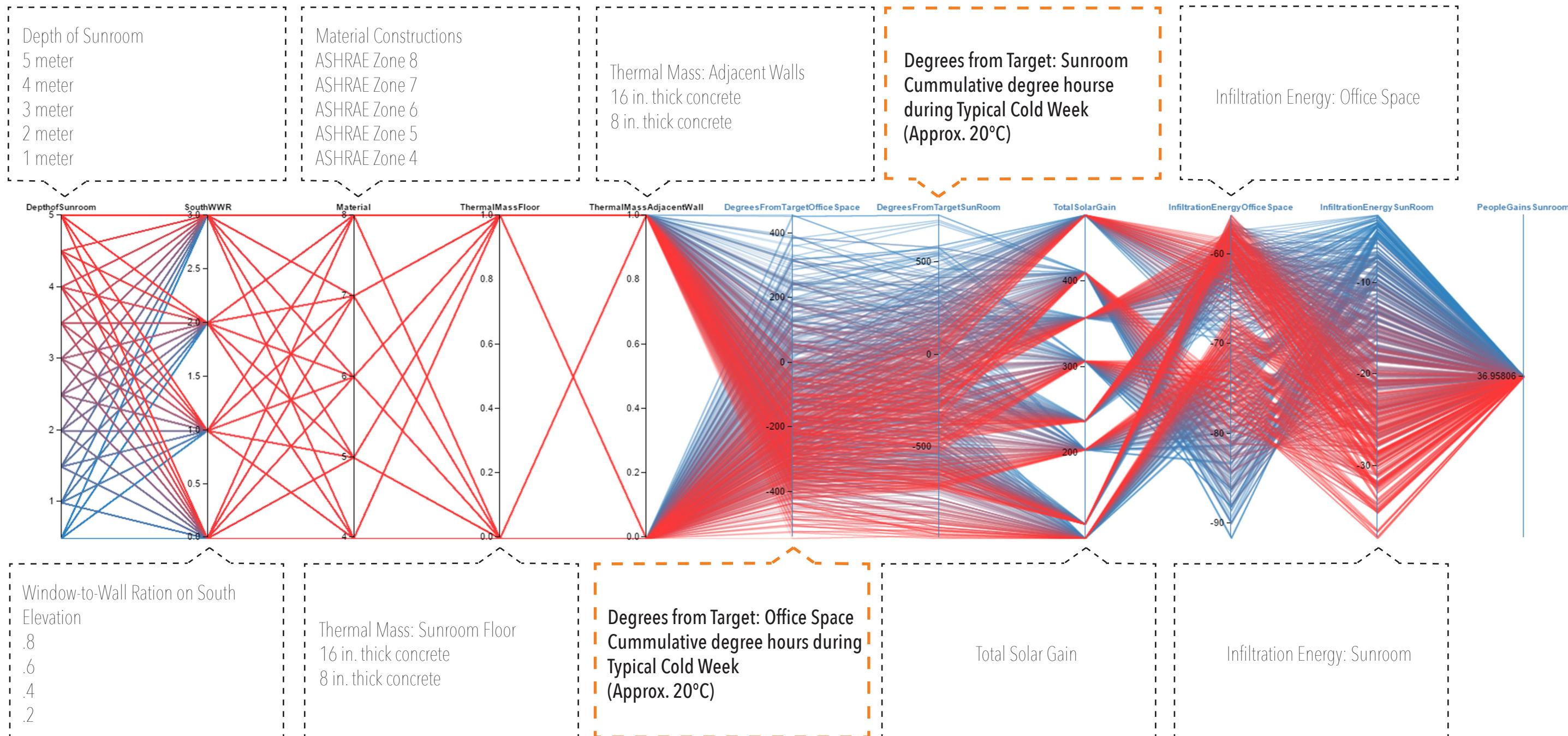
+
Night Purging



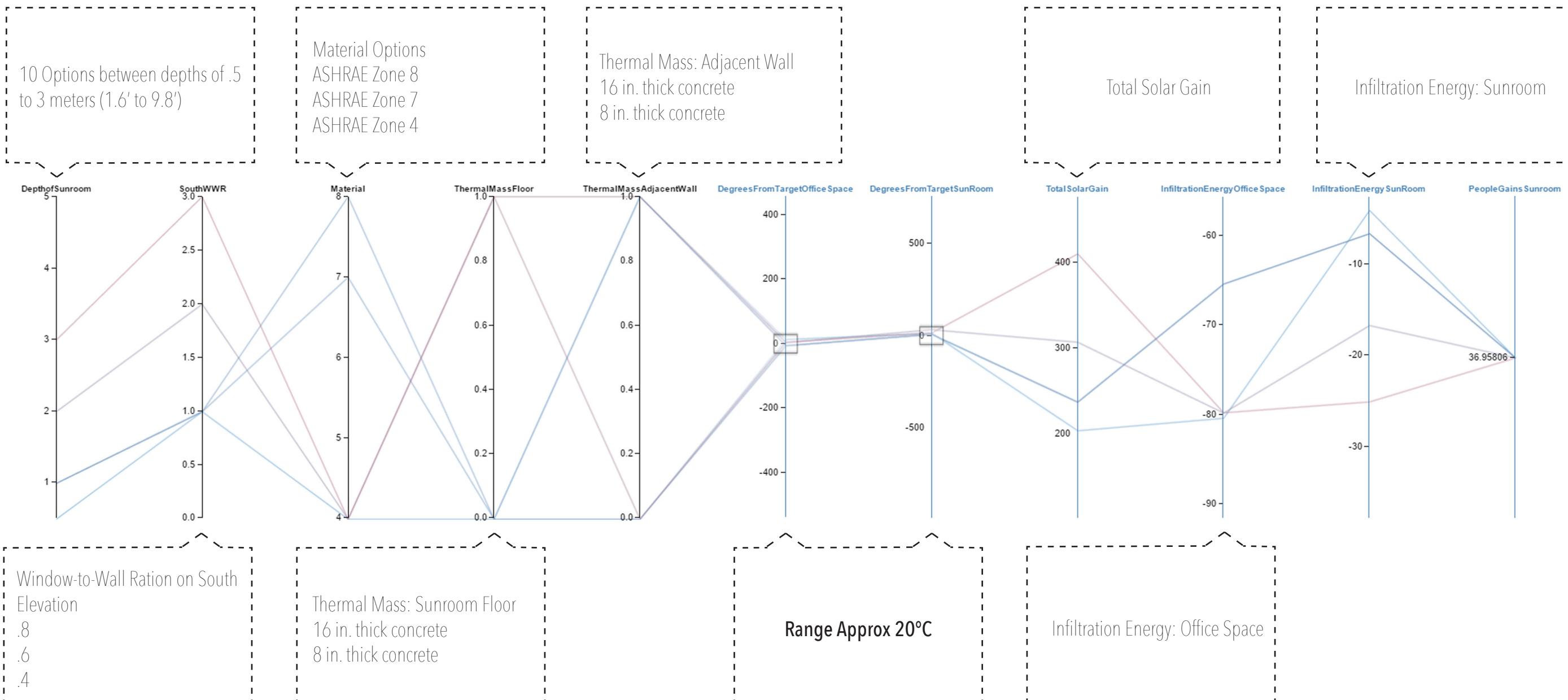
PHASE 2 » PASSIVE STRATEGY » TYPICAL WEEK COMFORT



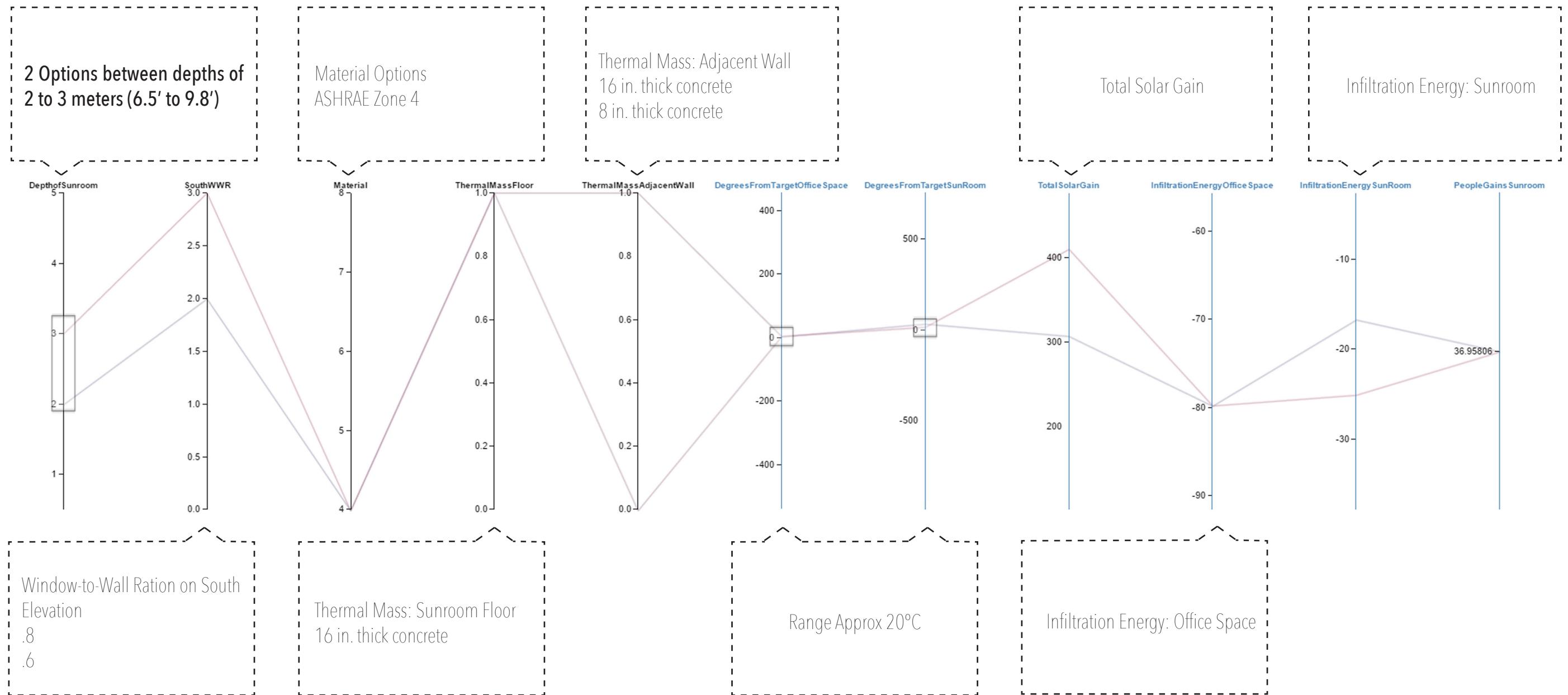
PHASE 2 » TESTING VARIABLES » TYPICAL COLD WEEK » 800 ITERATIONS



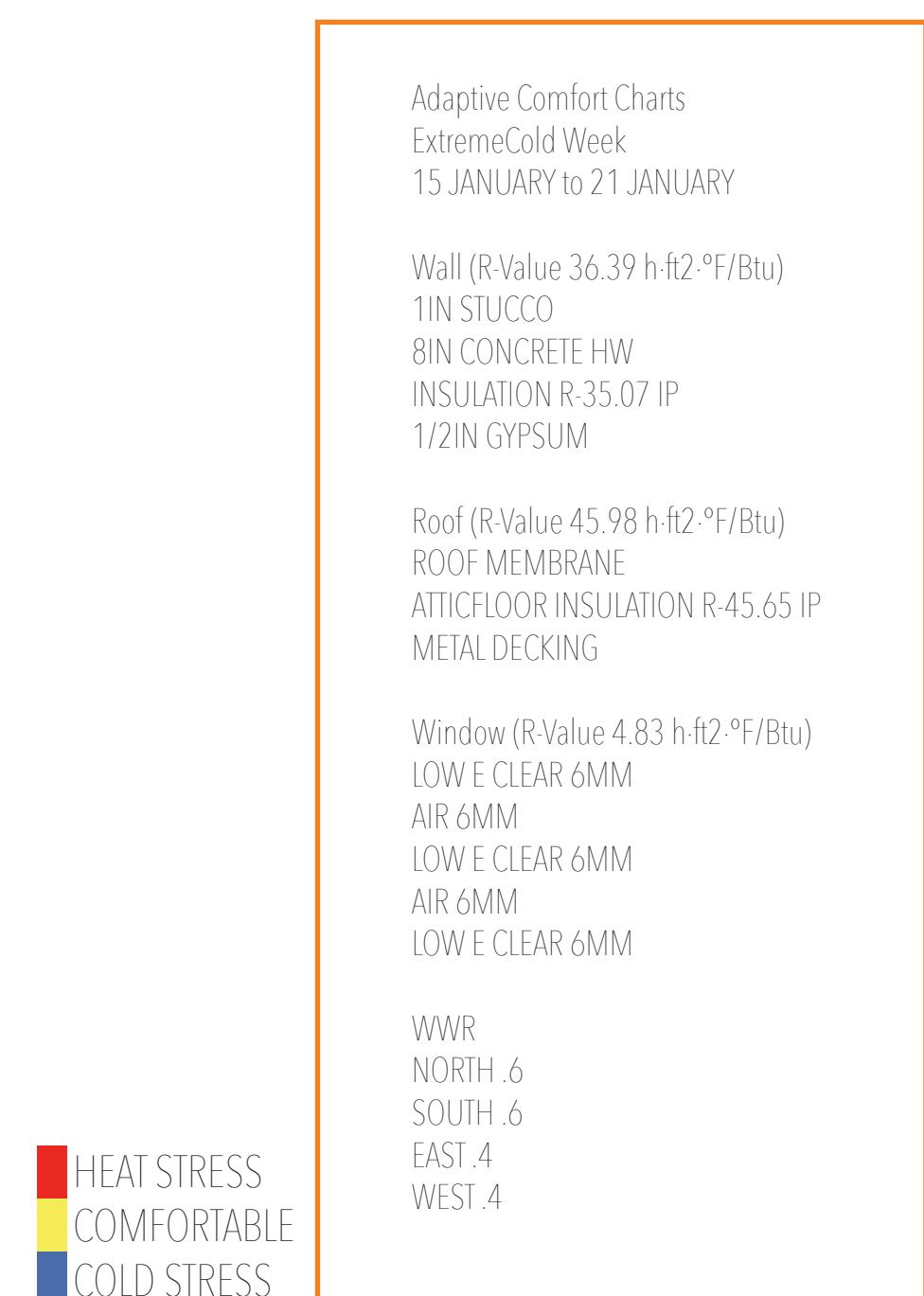
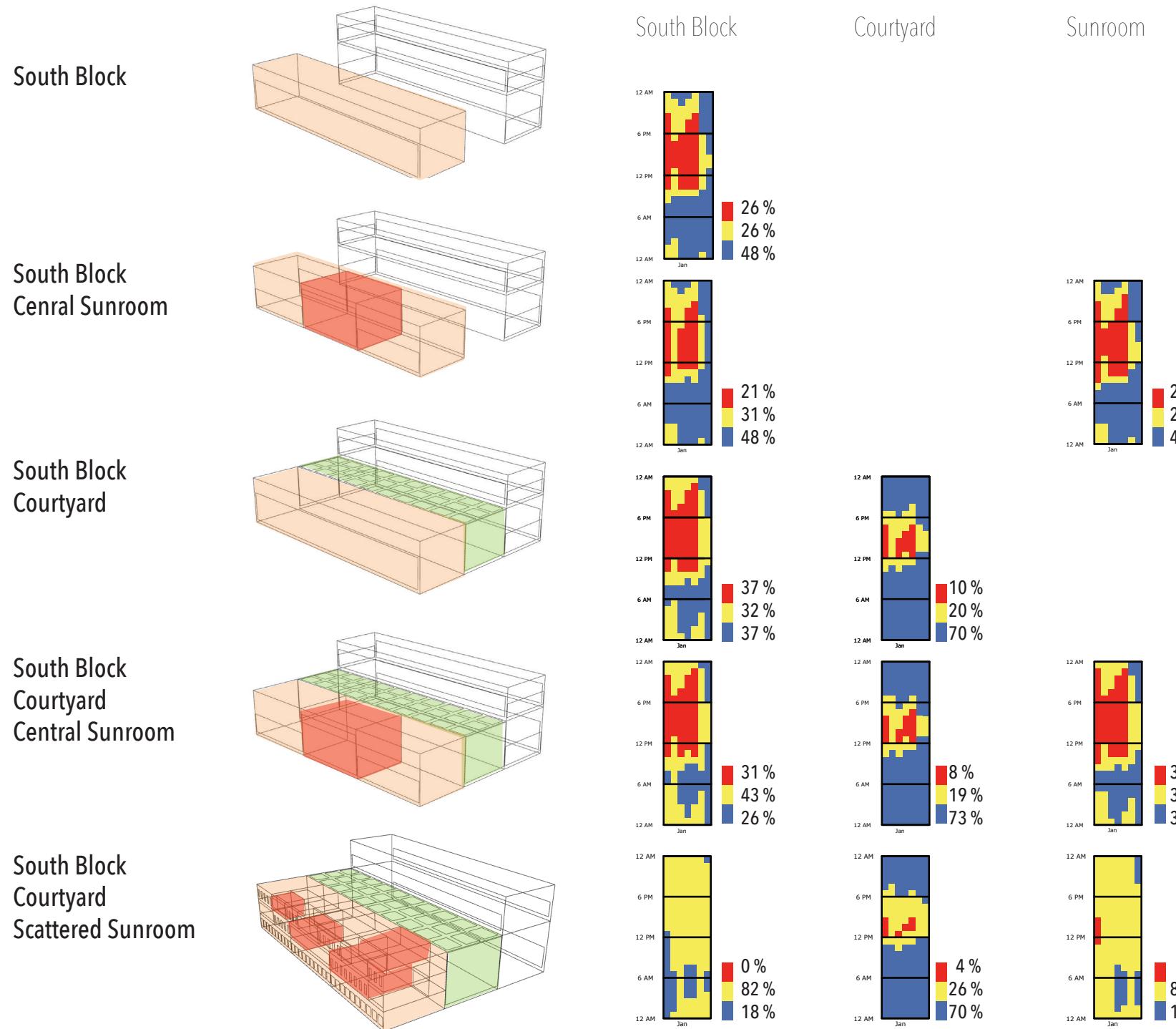
PHASE 2 » TESTING VARIABLES » TYPICAL COLD WEEK



PHASE 2 » TESTING VARIABLES » TYPICAL COLD WEEK



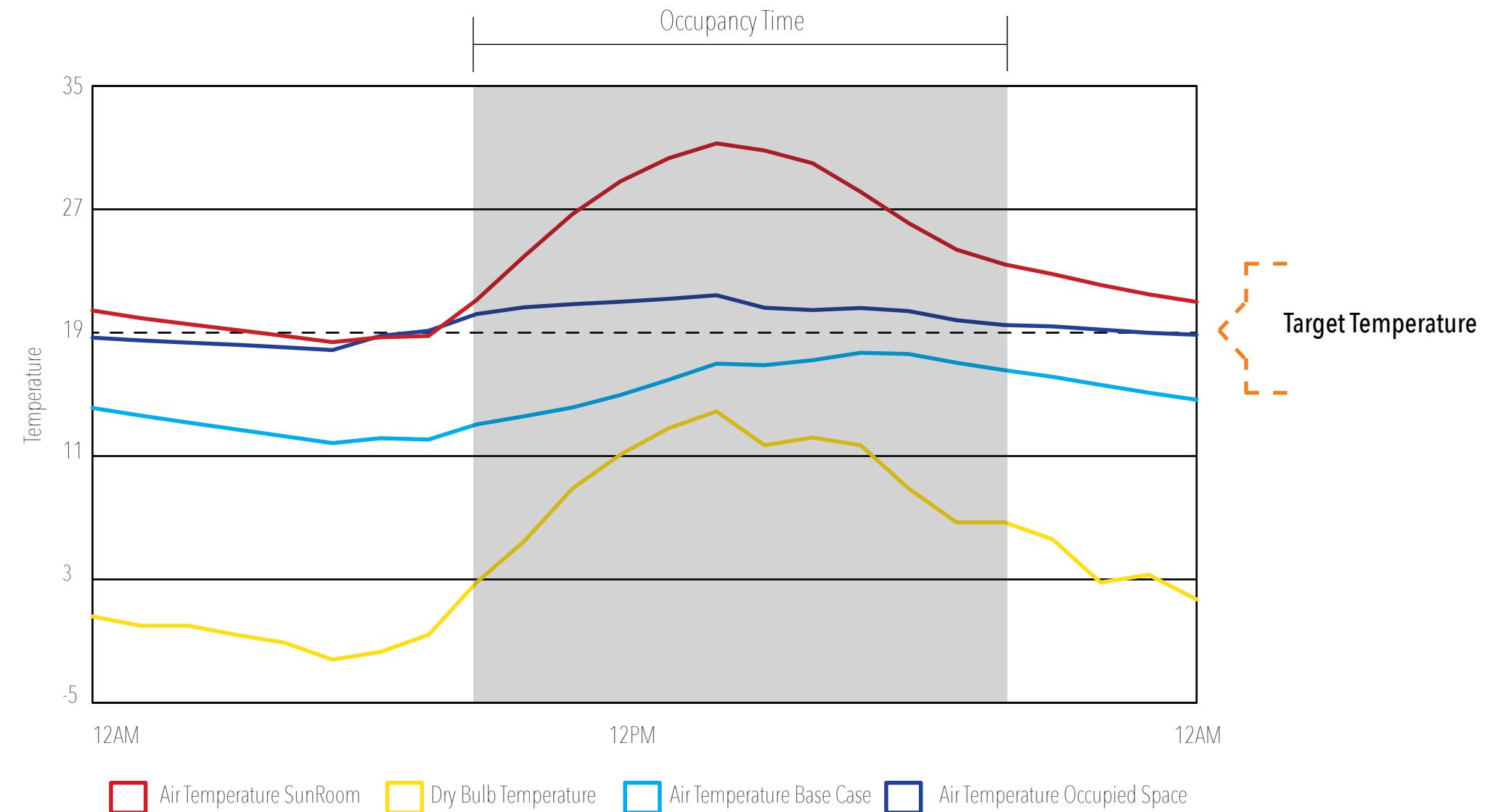
PHASE 2 » COMFORT ANALYSIS » EFFECT OF BUILDING MASSING » EXTREME COLD WEEK



PHASE 2 » SCATTERED SUNROOMS » TEMPERATURE EFFECT » TYPICAL COLD DAY

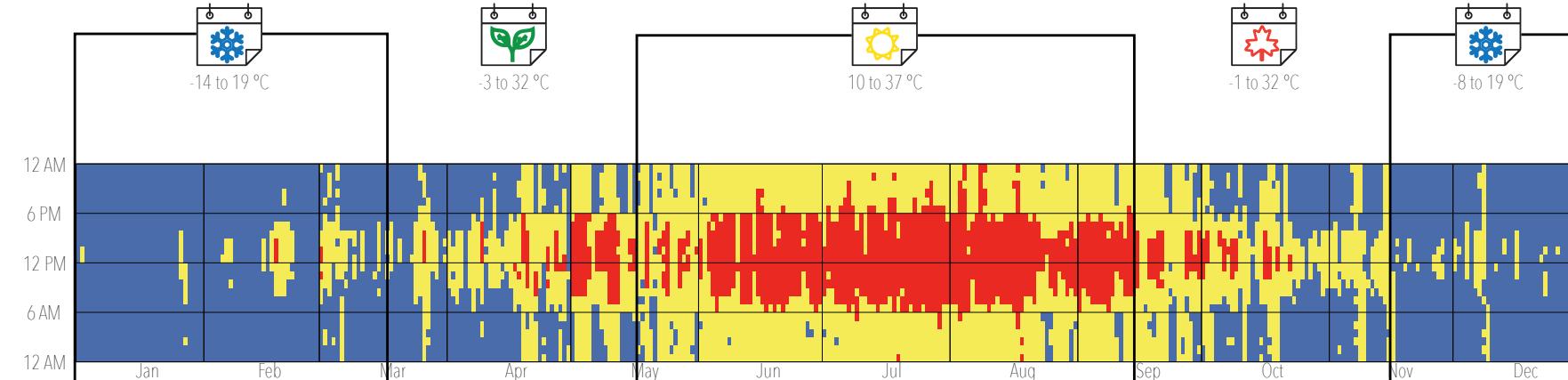
TEMPERATURE STUDY FOR A TYPICAL COLDY DAY with SUNROOM
18TH FEBRUARY

CONSTRUCTION	
Baseline	
Office Room 10m by 10m	
No Windows	
Climate Zone 4 Construction	
1IN Stucco	
8IN CONCRETE HW RefBldg	
Mass Wall Insulation R-7.23 IP	
1/2IN Gypsum	
Fixed Window 3.12/0.40/0.31	
Roof Membrane	
IEAD Roof Insulation R-19.72 IP	
Metal Decking	
Improved Case	
Office Room 10m by 10m Adjacent to 3m Depth Sunroom	
.6 WWR on South Facade of Sunroom	
Climate Zone 6 Construction	
1IN Stucco	
8IN CONCRETE HW RefBldg	
Mass Wall Insulation R-10.11 IP	
1/2IN Gypsum	
Fixed Window 3.12/0.40/0.31	
Roof Membrane	
IEAD Roof Insulation R-19.72 IP	
Metal Decking	
Thermal Mass Adjacent Wall	
16inch Concrete Wall	



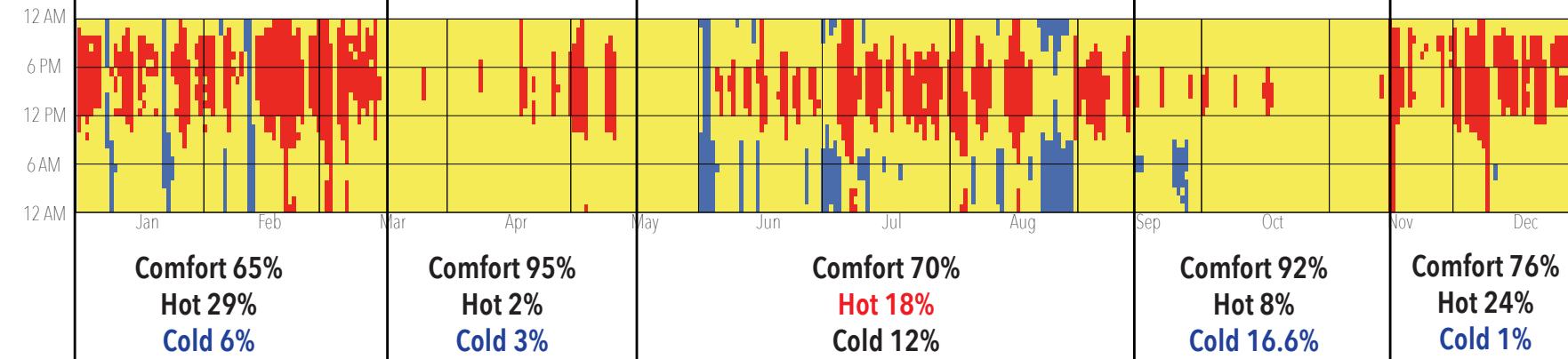
PHASE 2 » SCATTERED SUNROOMS » COMFORT ANALYSIS

Outdoor Adaptive Comfort



Heat Stress 13 %
Comfortable 37 %
 Cold Stress 32 %
 Comfortable 18 %
 Slight Cold/Heat

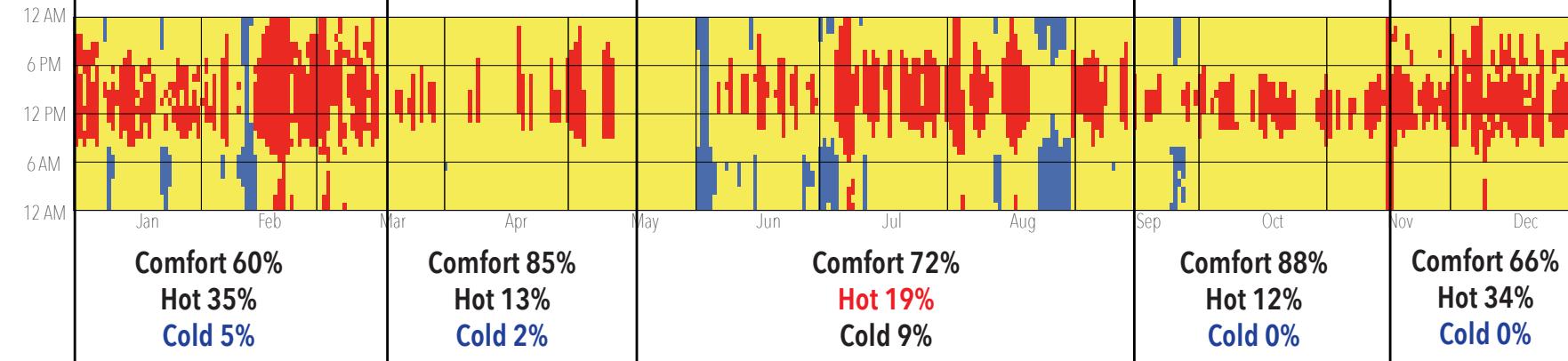
Office Space Adjacent to Sunroom Adaptive Comfort



Heat Stress 8 %
Comfortable 85 %
 Cold Stress 7 %

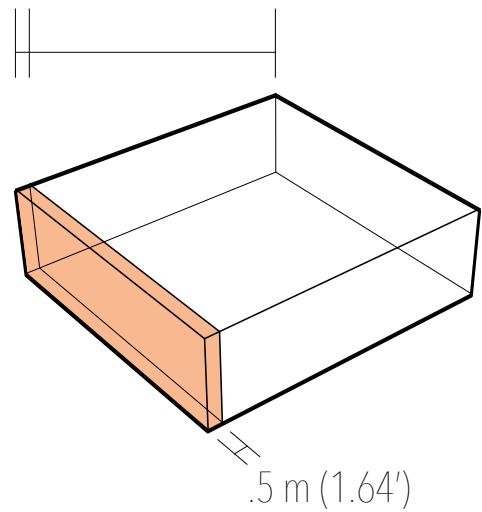
Sunroom heats adjacent spaces passively through thermal mass

Sunroom Adaptive Comfort

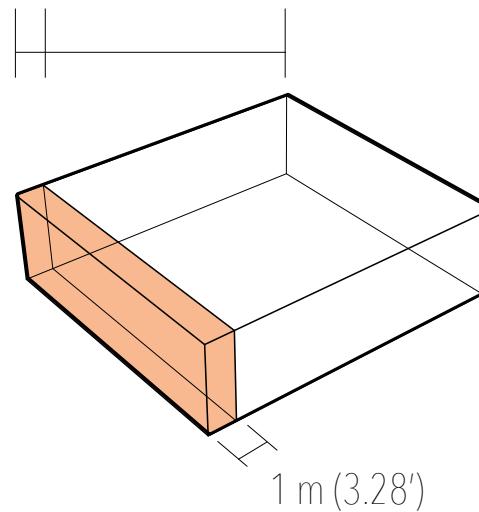


Heat Stress 13 %
Comfortable 81 %
 Cold Stress 6 %

PHASE 2 » ARCHITECTURAL NARRATIVE » PROGRAM



This size sunroom does not provide distinctive, occupiable space



This size sunroom does not provide distinctive, occupiable space

