

A detailed architectural rendering of a building's exterior. The facade features a large-scale, white-painted steel grid system. This grid is not uniform; it includes various openings, recesses, and protrusions that create a dynamic, undulating surface. Some sections appear to be fully enclosed, while others are more open, suggesting a perforated or screen-printed design. The perspective is from a low angle, looking up at the building's corner, which emphasizes the scale and complexity of the grid structure.

MEBD Spring 2016

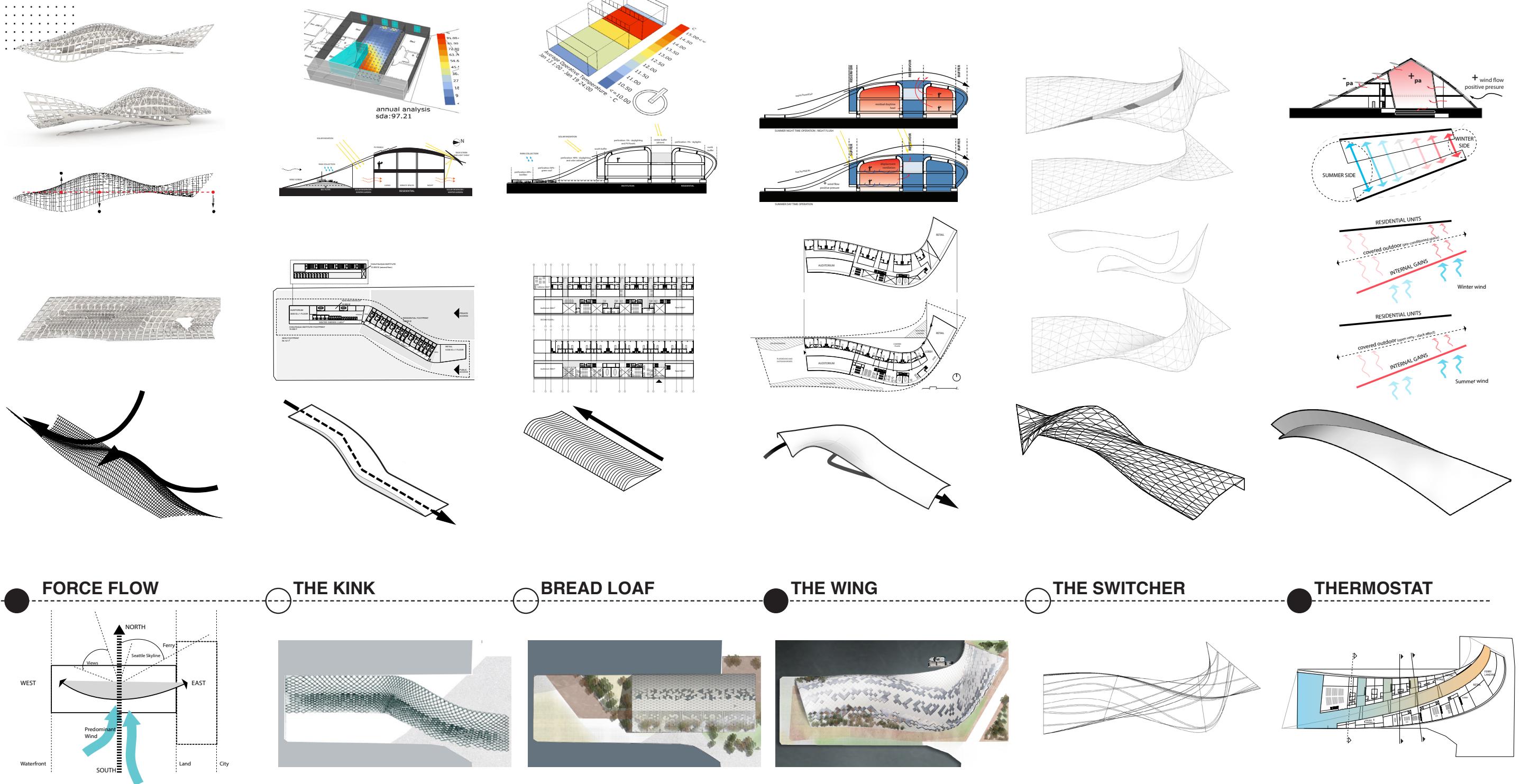
Design Studio

Benghi

Oskierko-Jeznacki

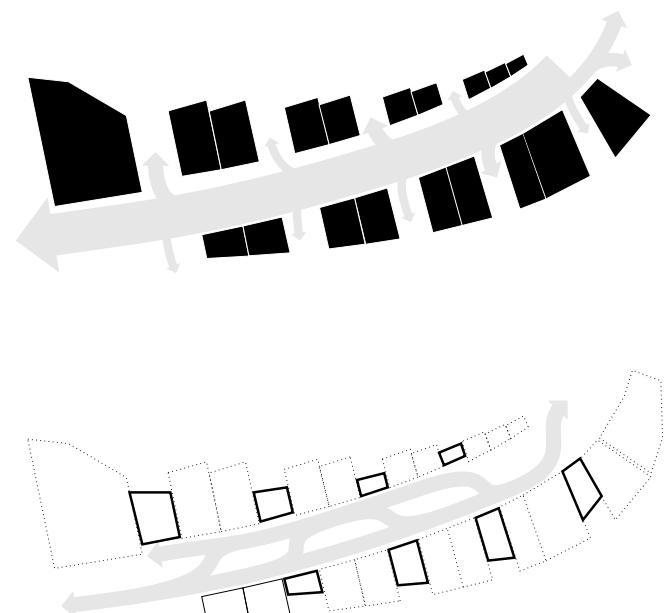
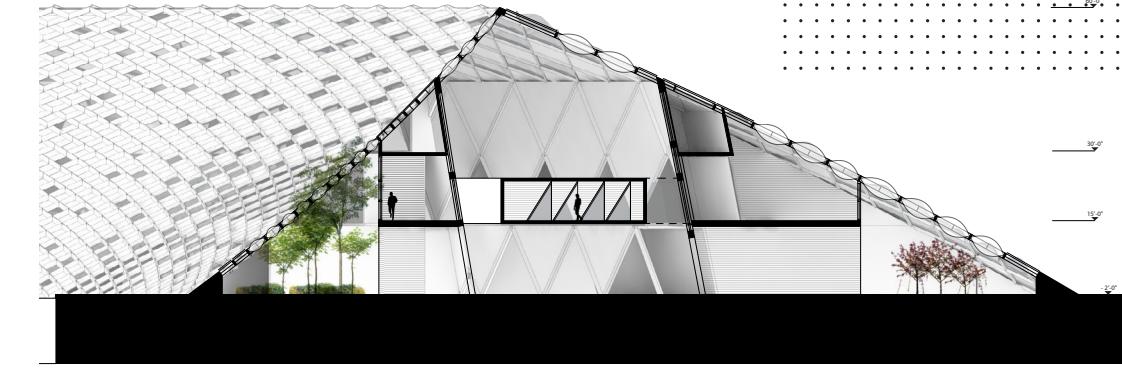
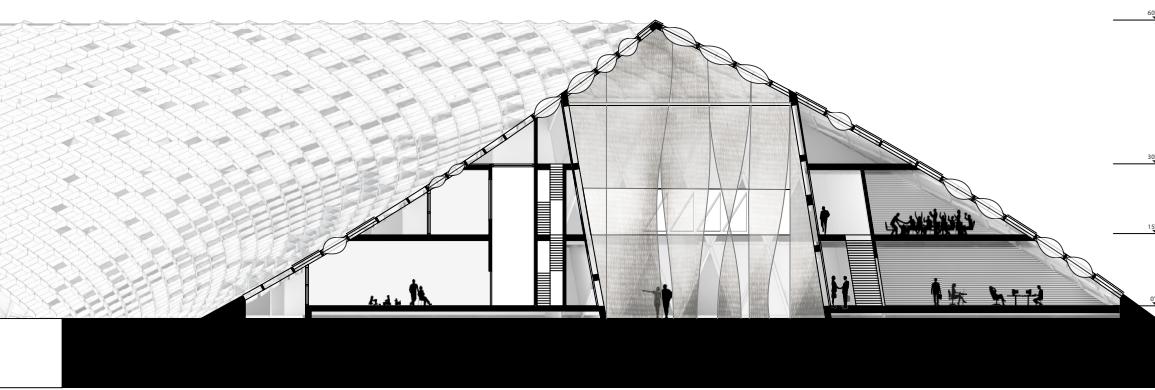
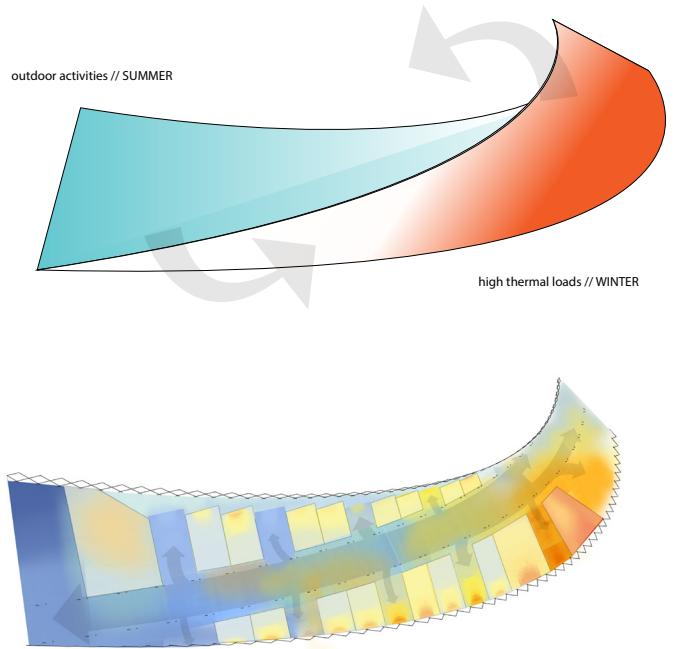
Static Variability

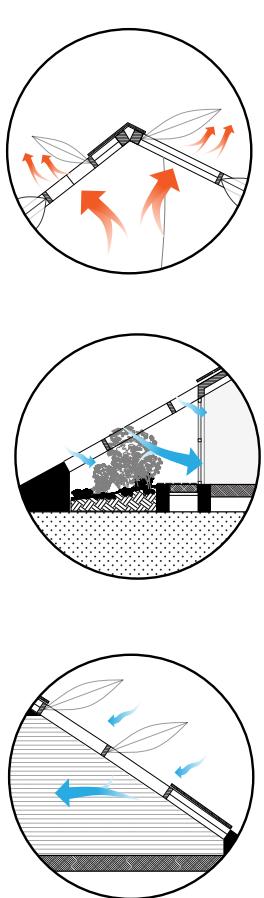
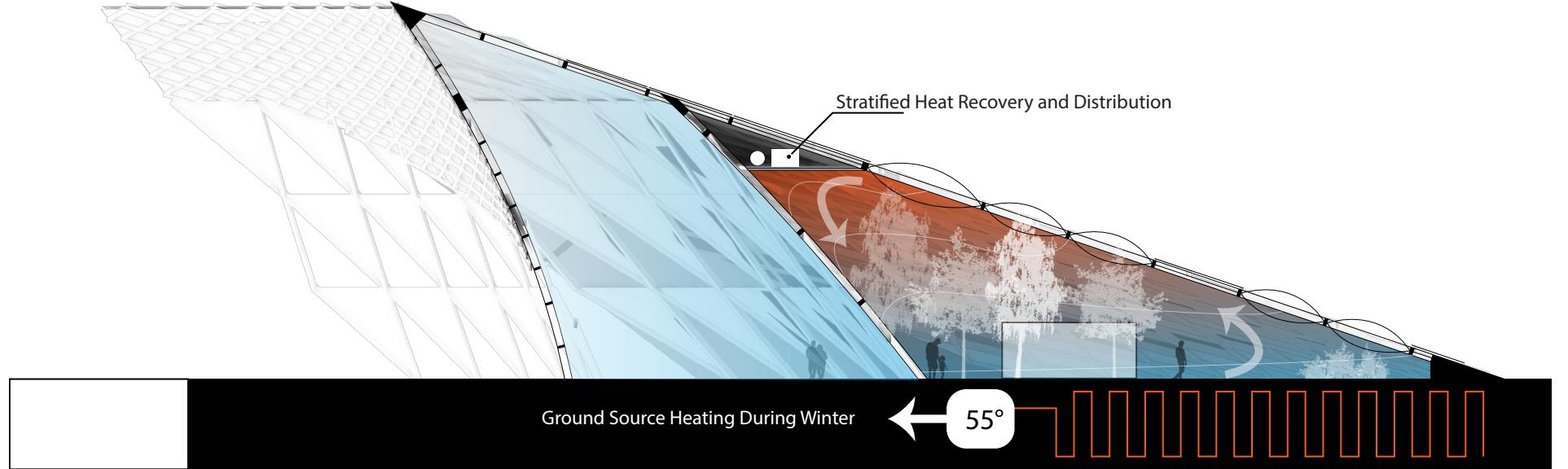
Design Intent and Project Evolution



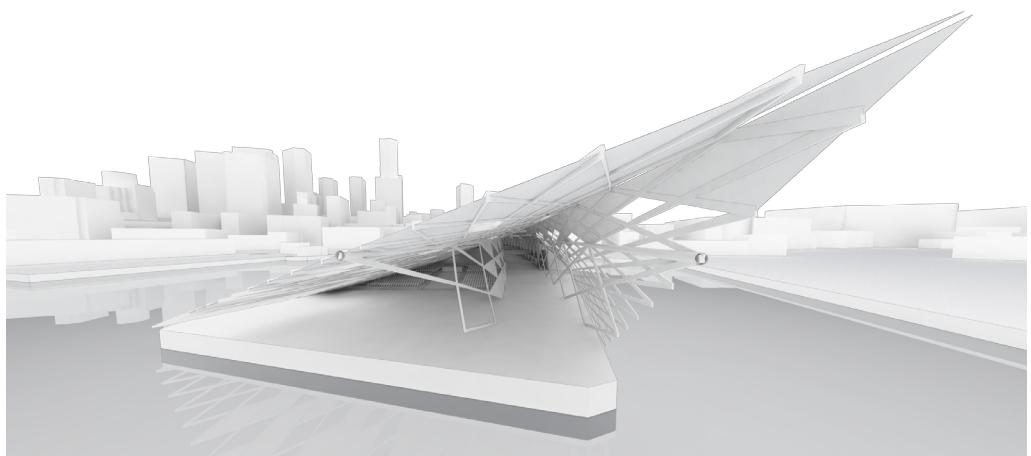
The Seattle Pier

Architectural Design

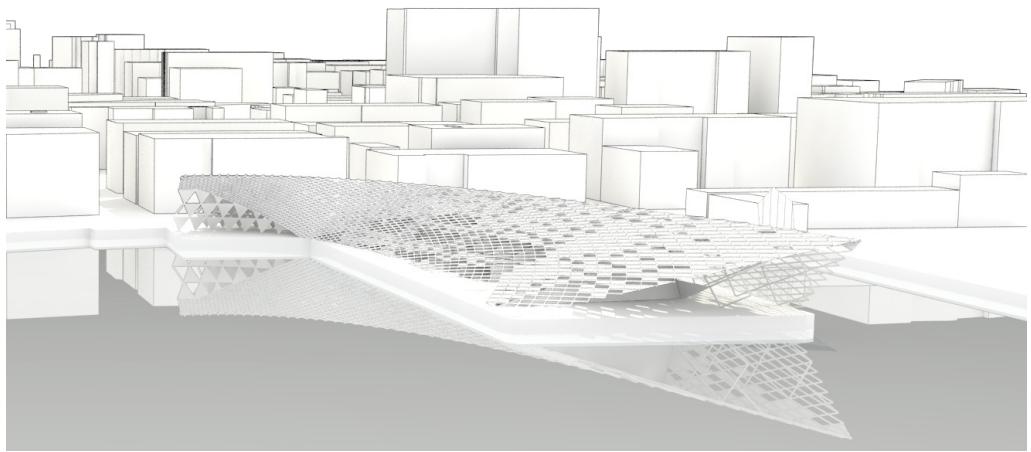




View from the Waterfront / West Side



Bird's Eye View from North West

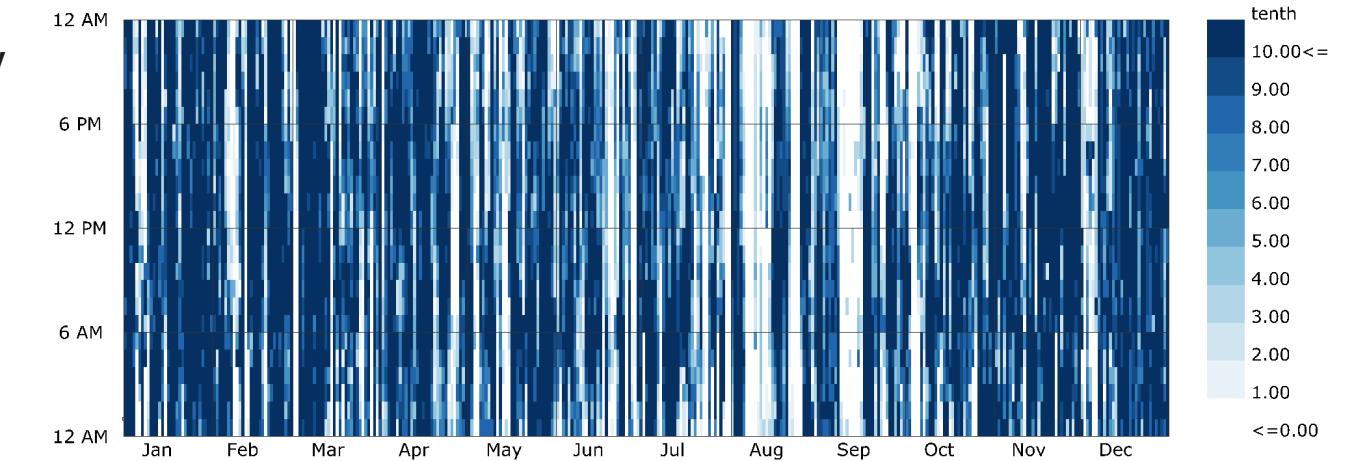


ENVIRONMENTAL ANALYSIS

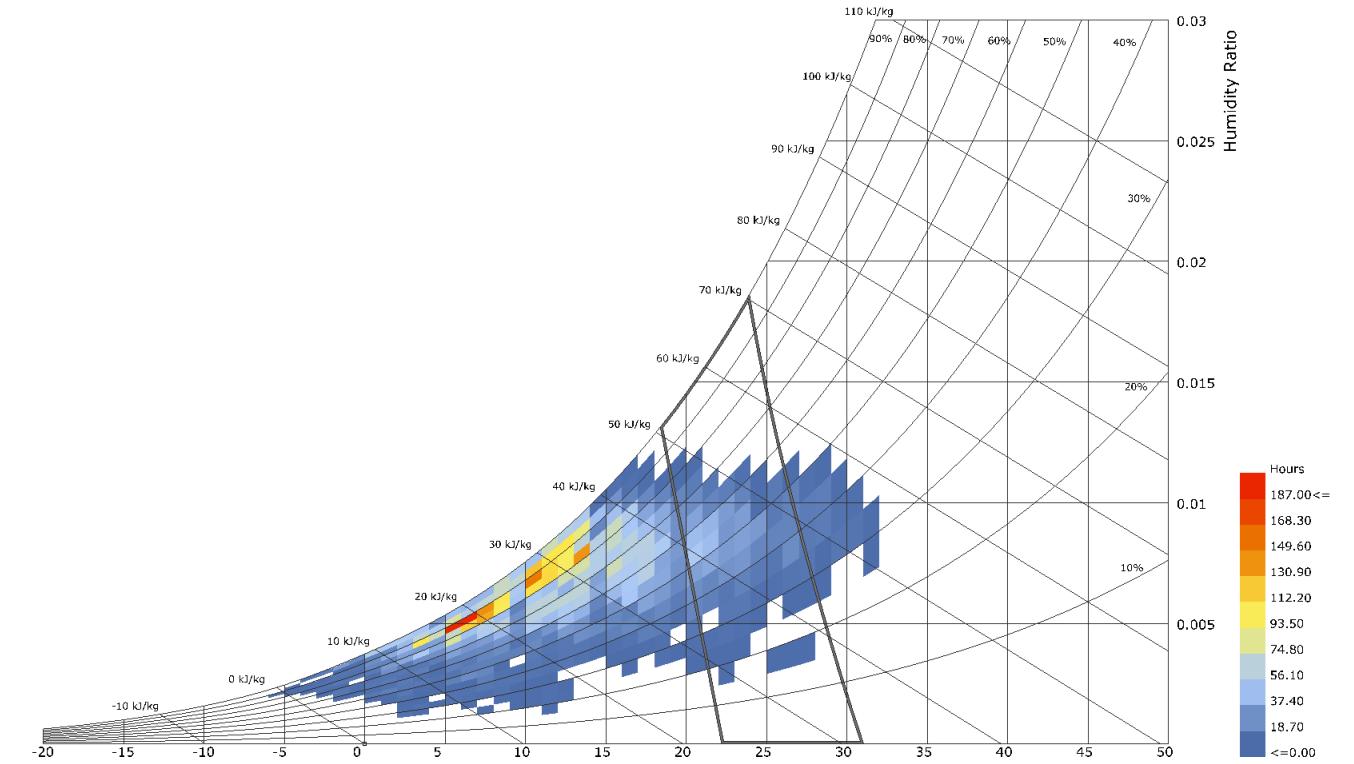
Preliminary Studies

1

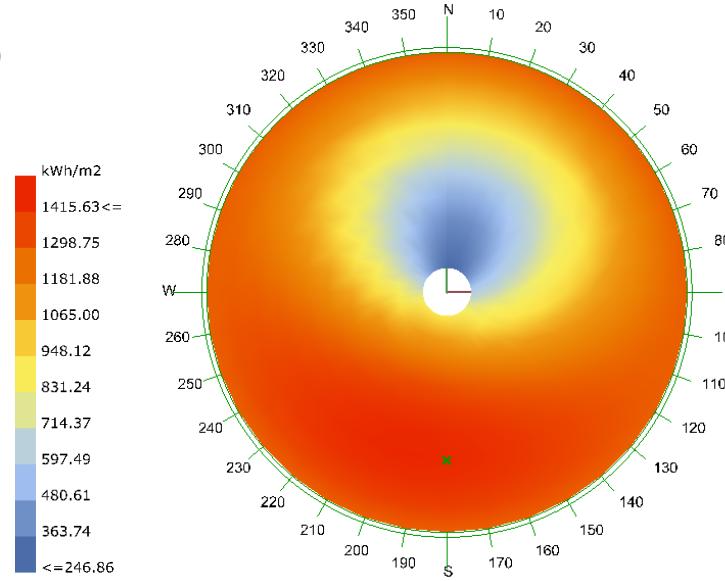
Total Cloud Cover (tenth) - Hourly
1 Jan - 31 Dec



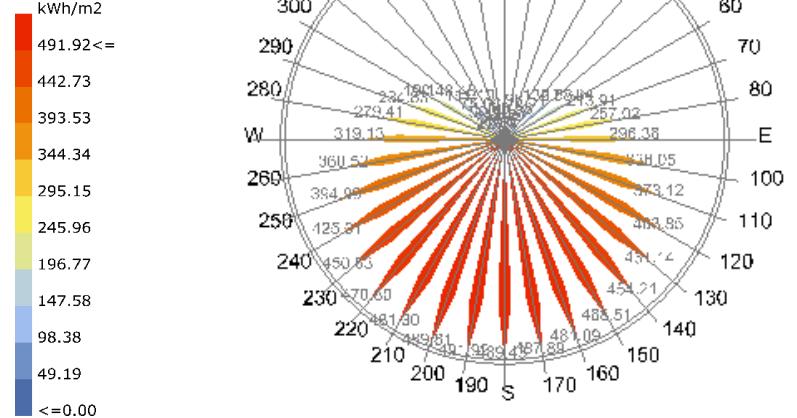
Psychrometric Chart
Seattle Tacoma Intl Airport



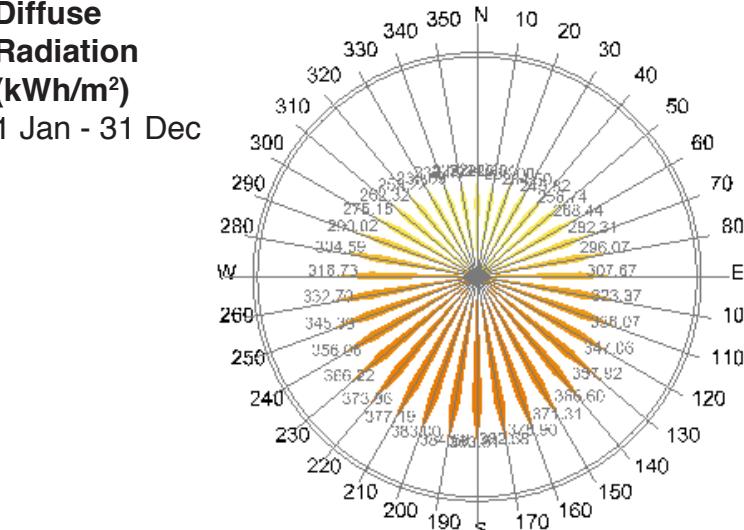
Radiation Calla Lilly (kWh/m²)
1 Jan - 31 Dec



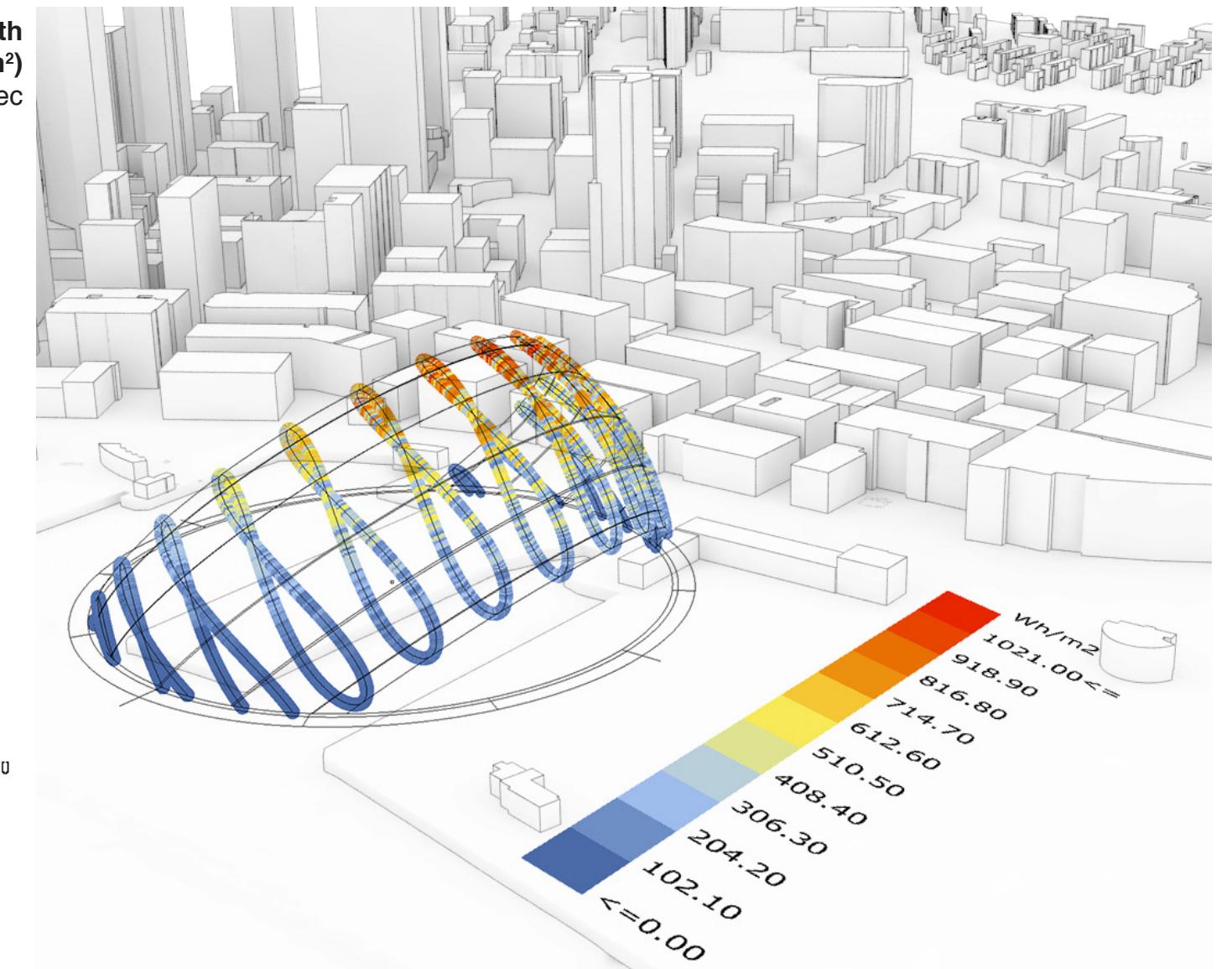
Direct Radiation (kWh/m²)
1 Jan - 31 Dec



Diffuse Radiation (kWh/m²)
1 Jan - 31 Dec



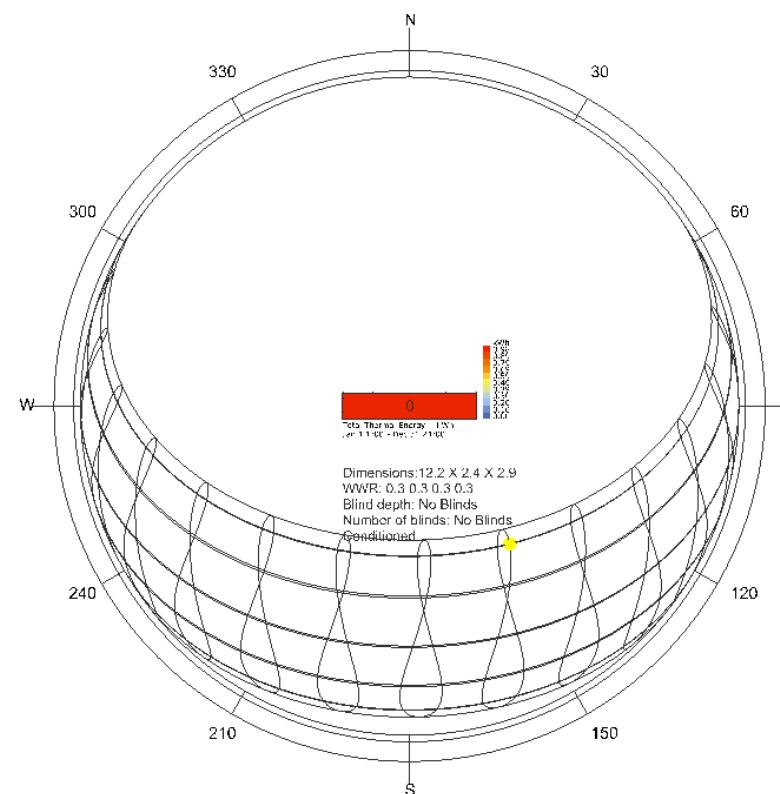
Solar Radiation Sun Path (Wh/m²)
1 Jan - 31 Dec



Comfort Analysis

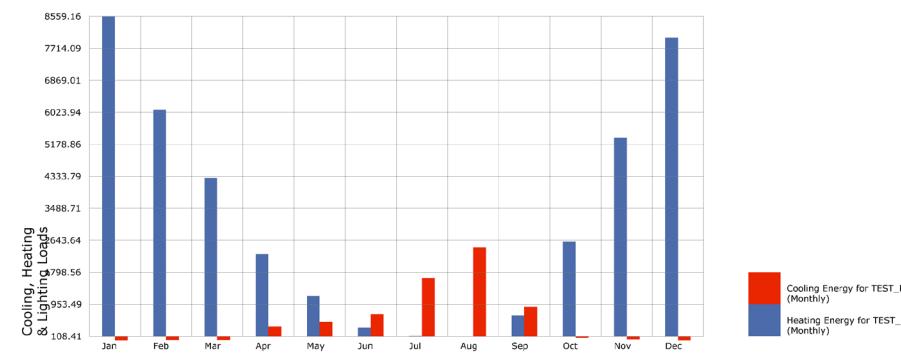
Preliminary Testing

"Shoe-Box" loads analysis

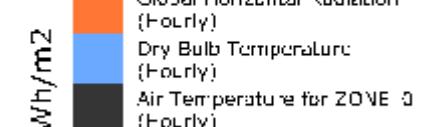
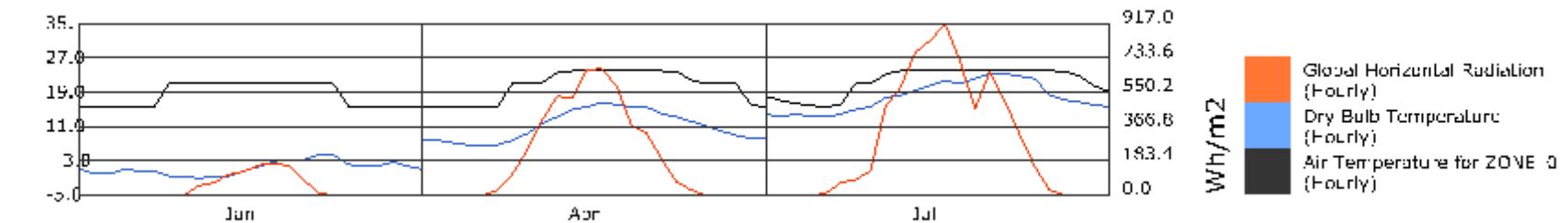
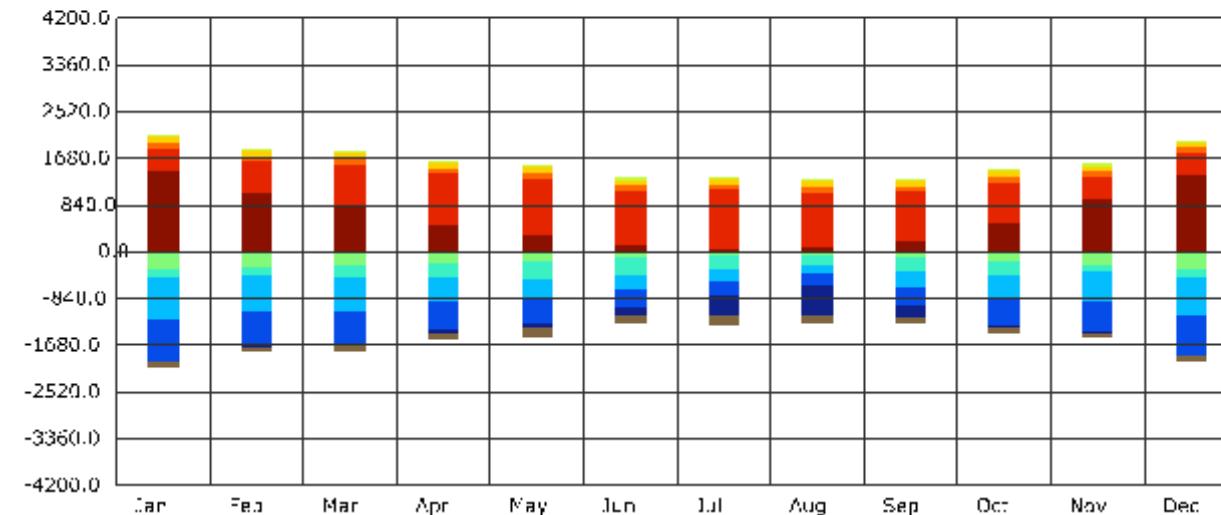


Cooling and Heating Energy Loads

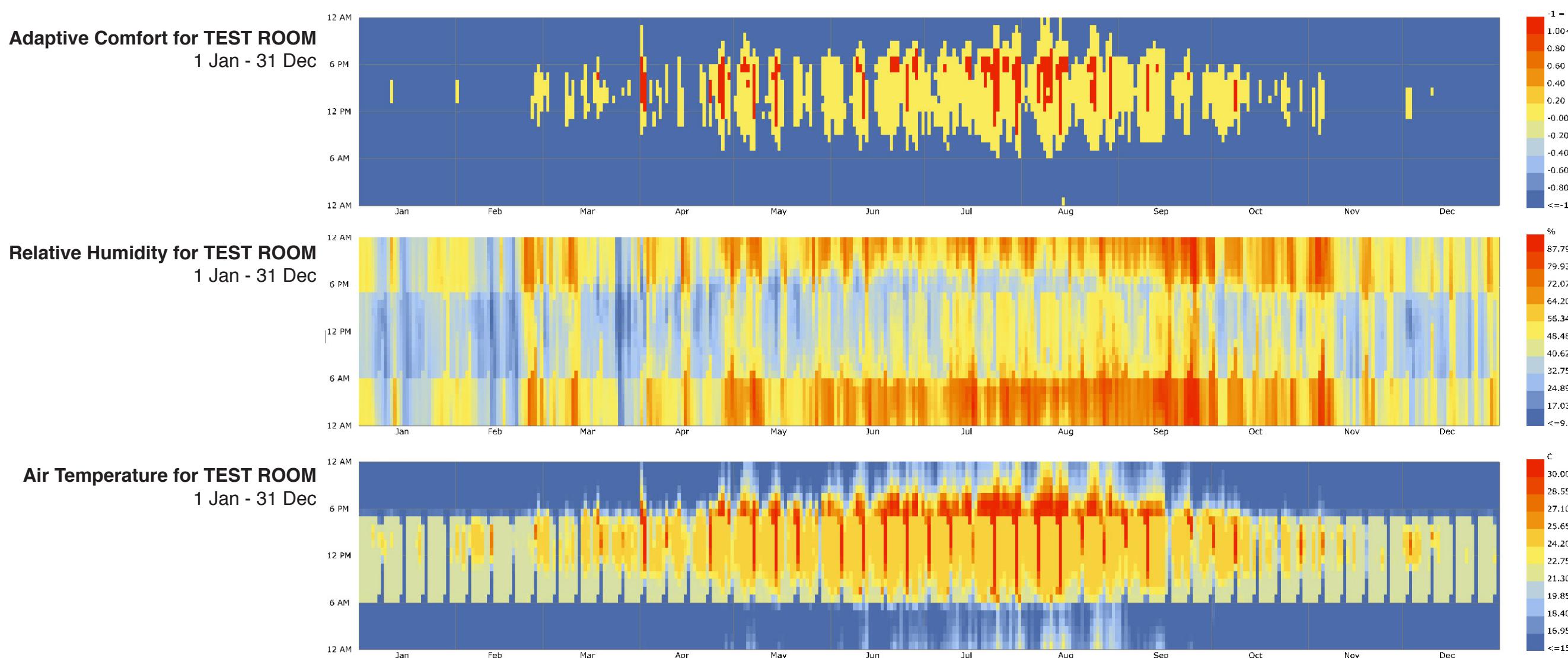
Fully glazed "Test Box"



Cooling Load: 50.12 kWh/m²
Heating Load: 239.67 kWh/m²
Total Load: 289.80 kWh/m²



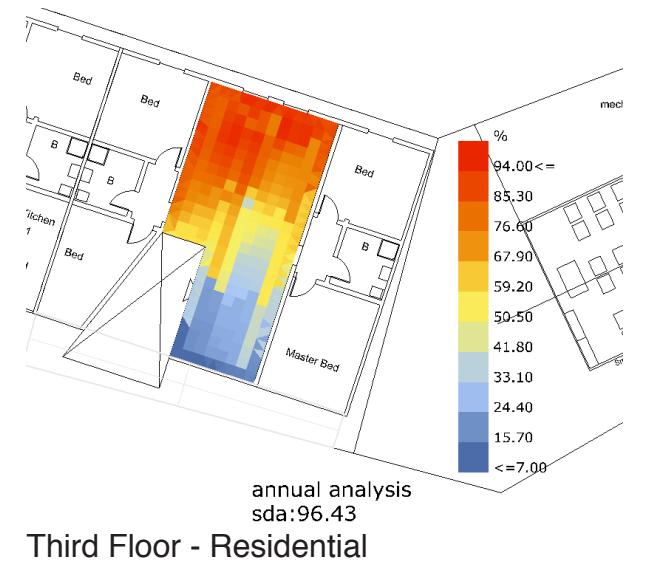
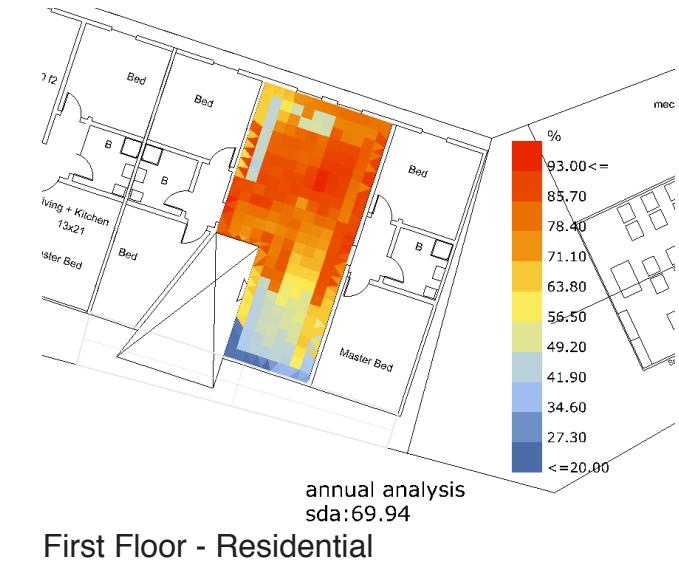
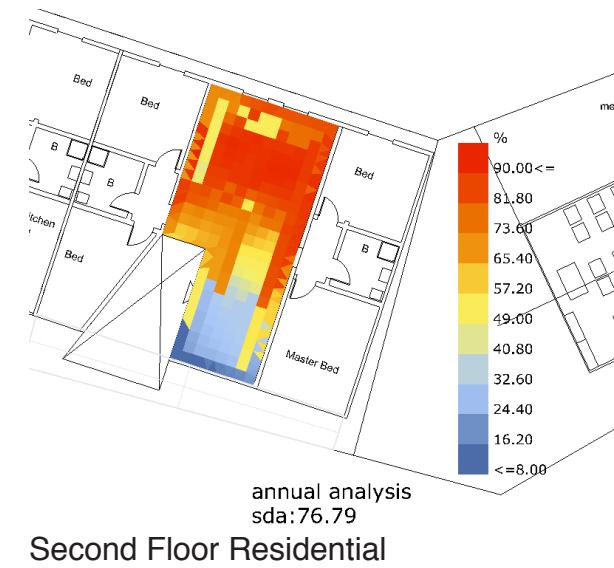
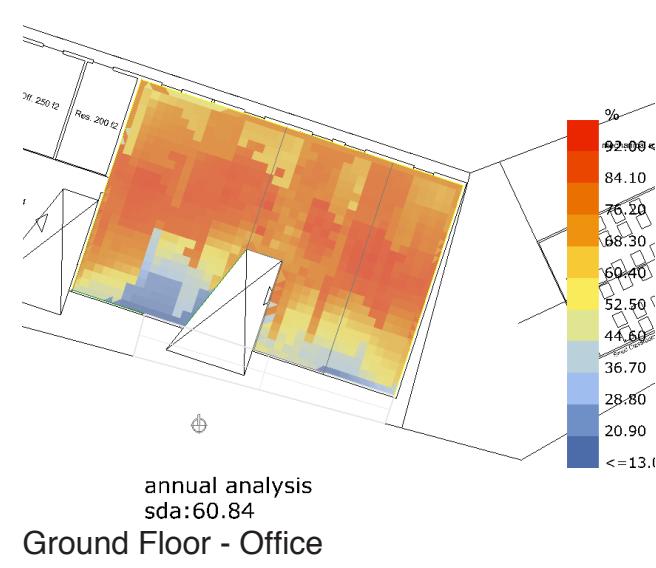
Winter Garden Comfort Exploration



Daylight Simulation

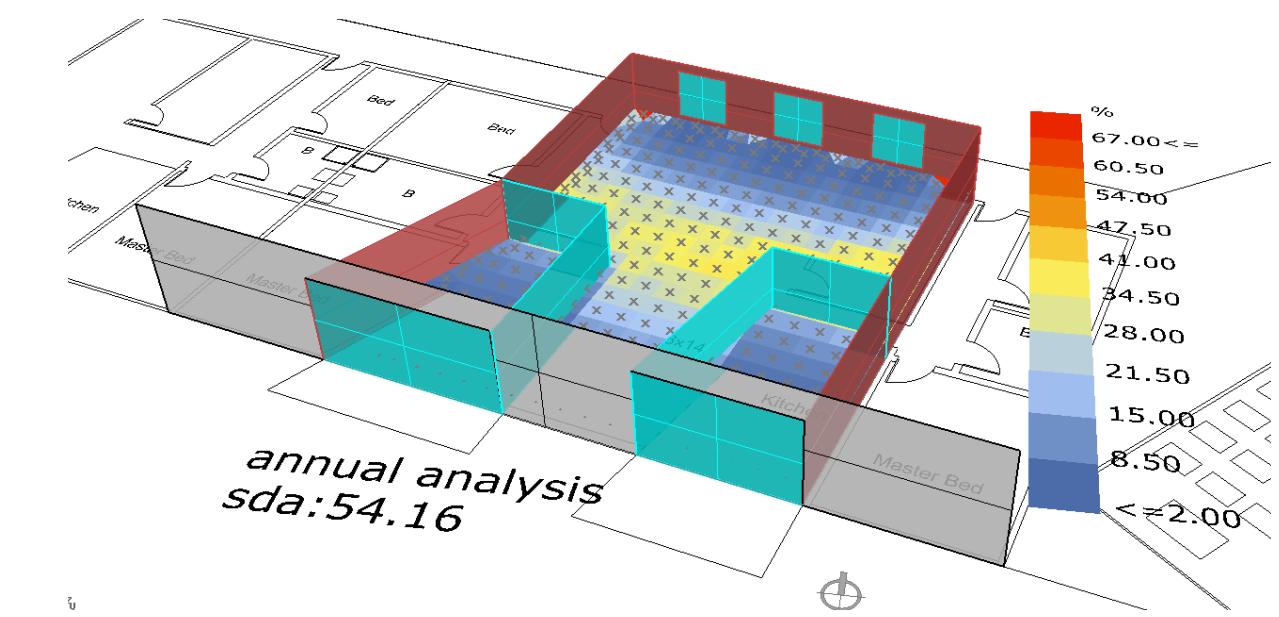
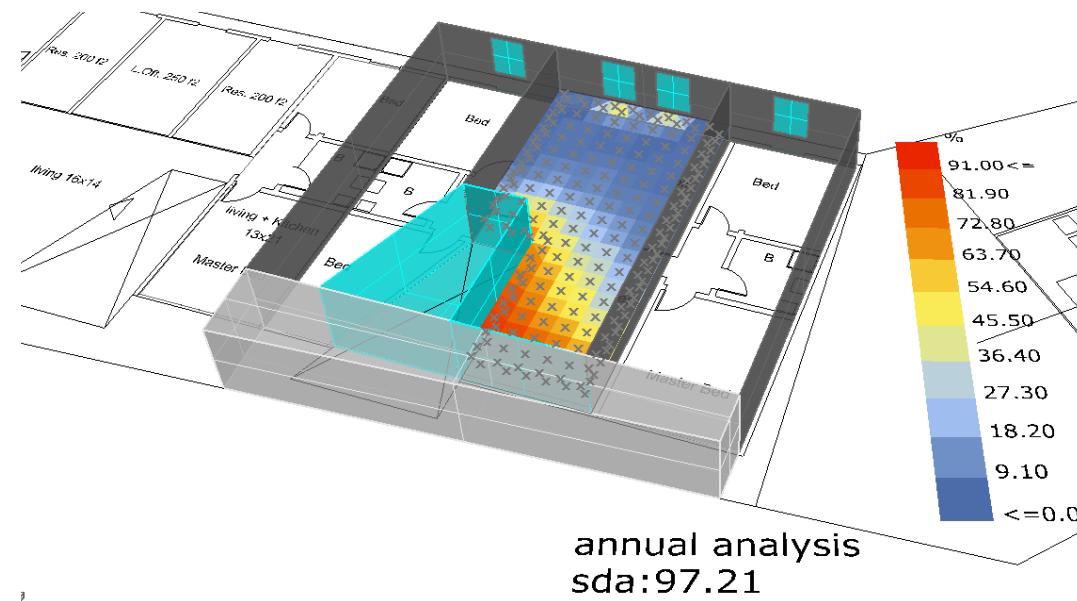
Spatial Daylight Autonomy

Floor by floor sDA testing

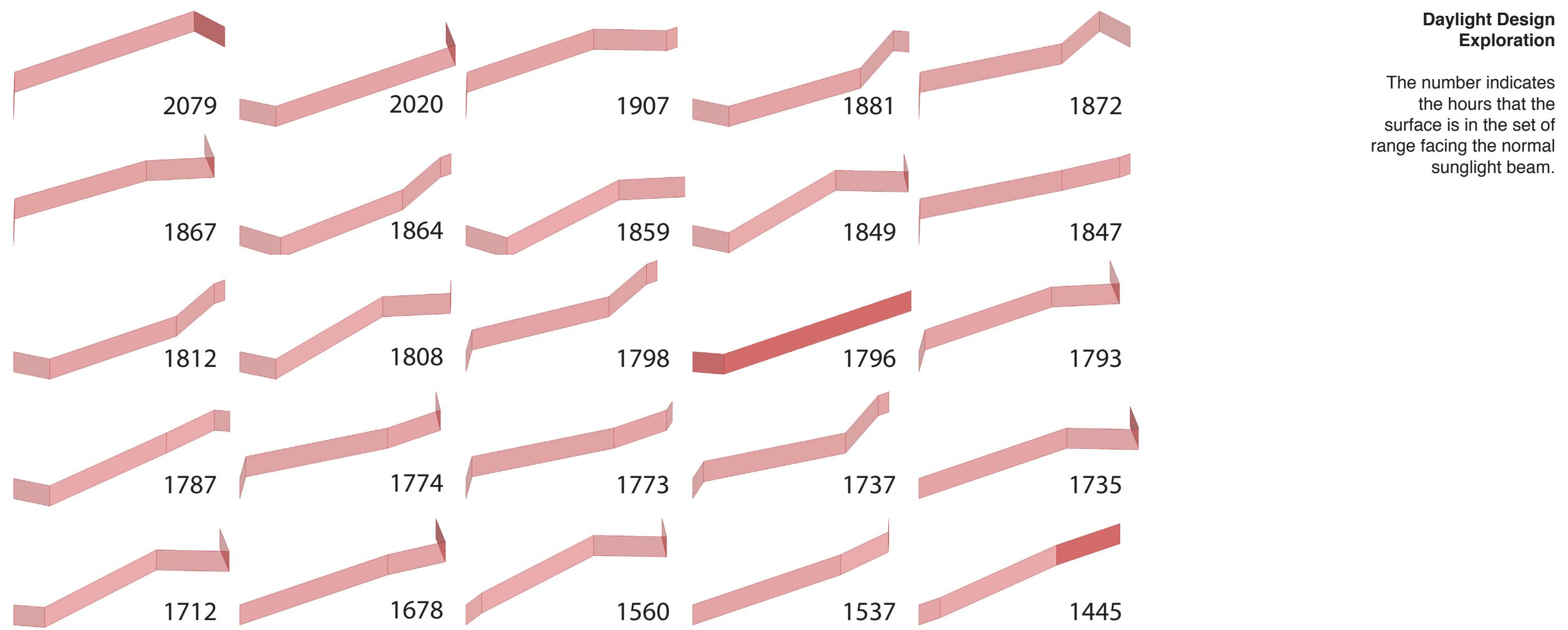


Spatial Daylight Autonomy

3D model prospective view of the first floor



Programmatic Form Finding



ENVIRONMENTAL ANALYSIS

Mid-term review

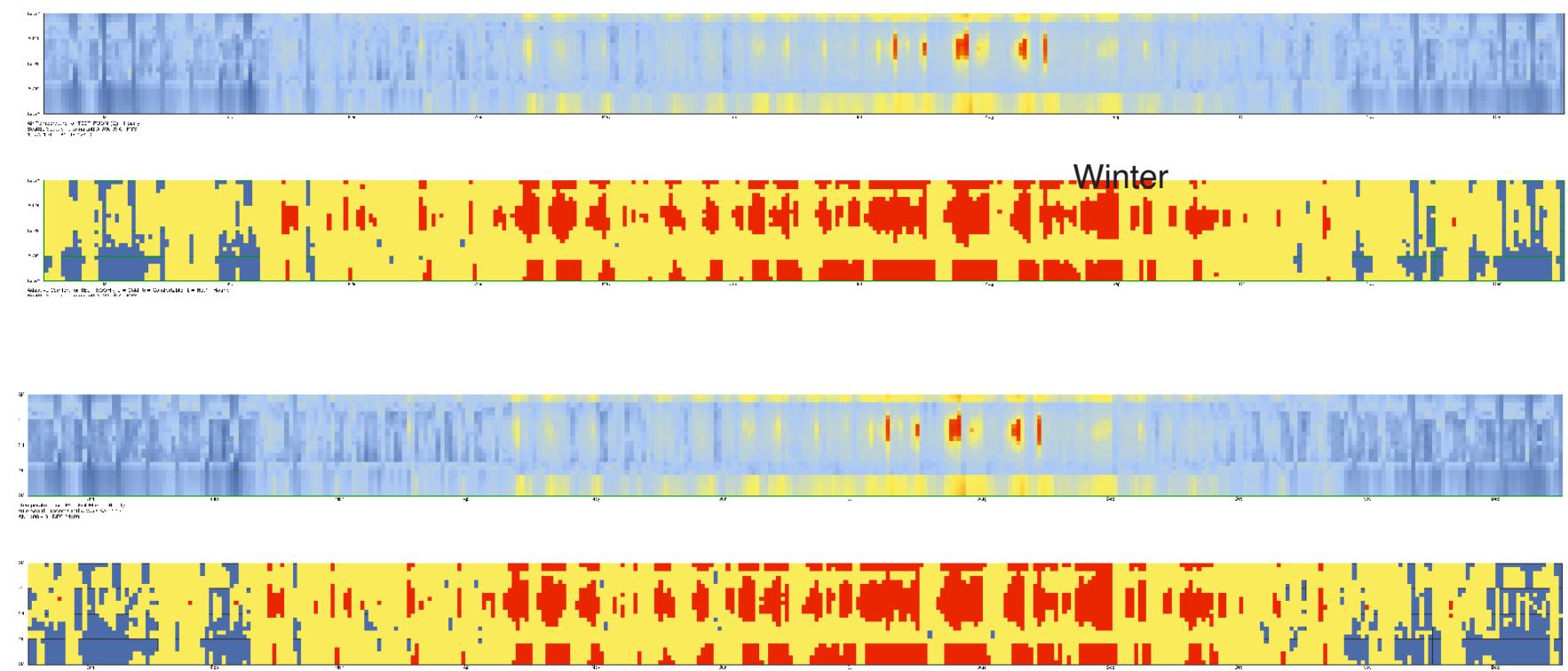
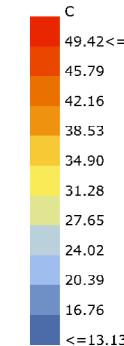
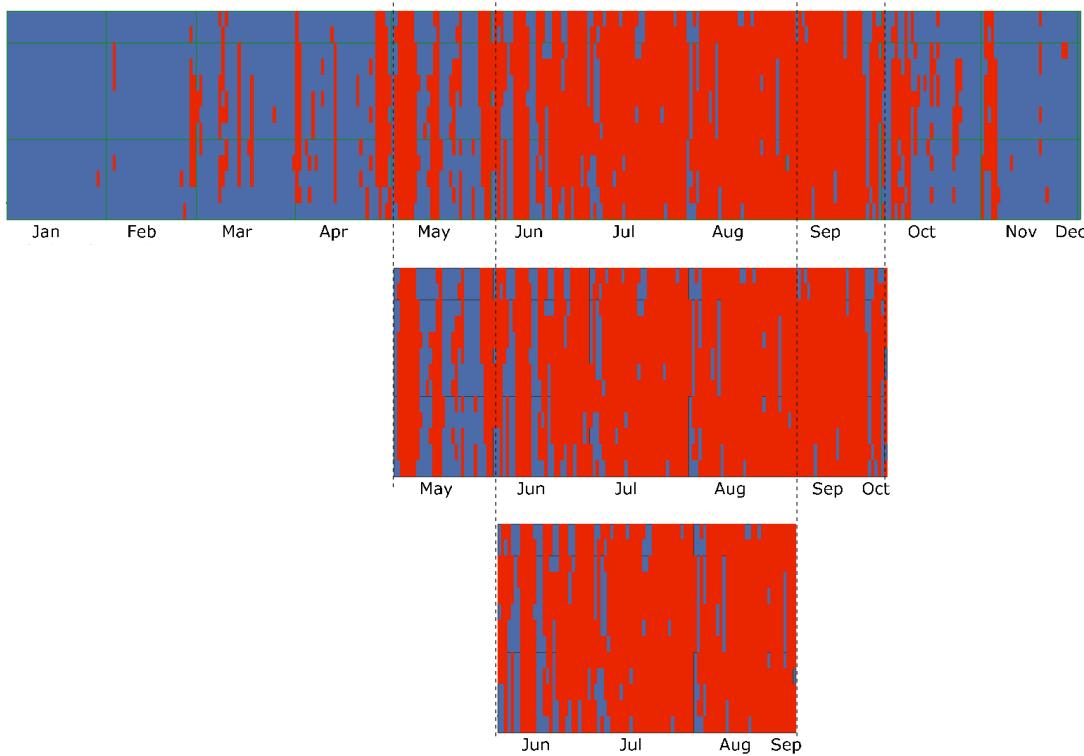
2

Outdoor Comfort

between 8am and 8pm
annual - 43%

between 8am and 8pm
May-October - 77%

June-September - 83%

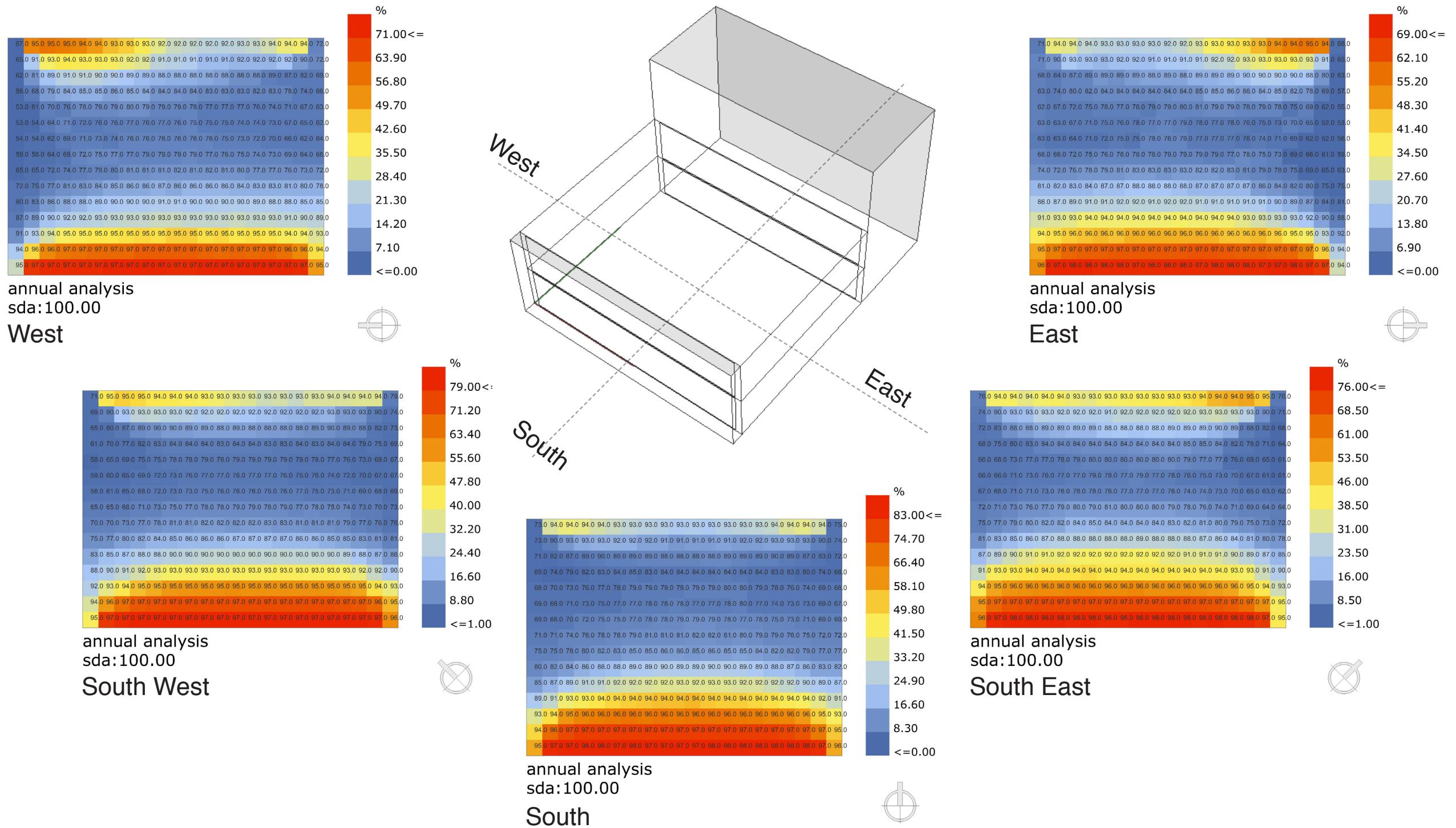


Adaptive Comfort

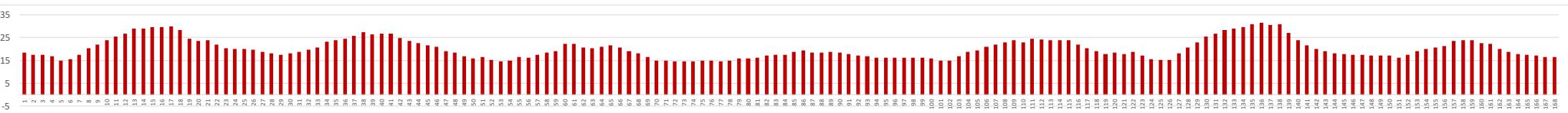
Residential case study
- adaptive comfort 72%
(with natural ventilation)

Office case study -
adaptive comfort 67%
(with natural ventilation)

Daylight Orientation Exploration



Typical Week Assessment



Heating Design Temp.

-4.2°C

Cooling Design Temp.

29.4°C

Hottest Week is in August, between the 24th and 30th.

Typical **hot week** is in July, between the 13th to the 19th.

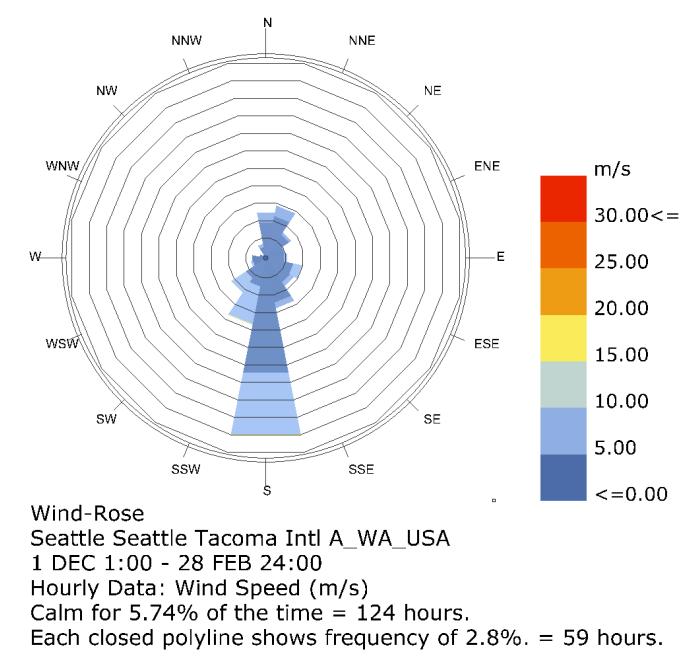
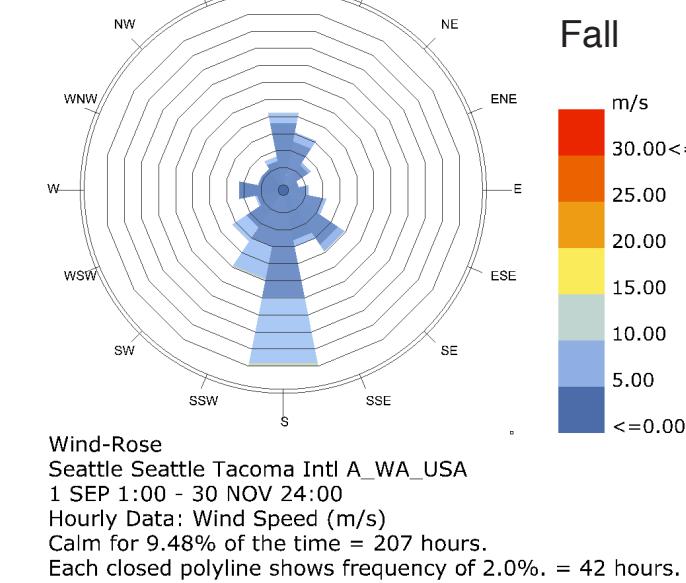
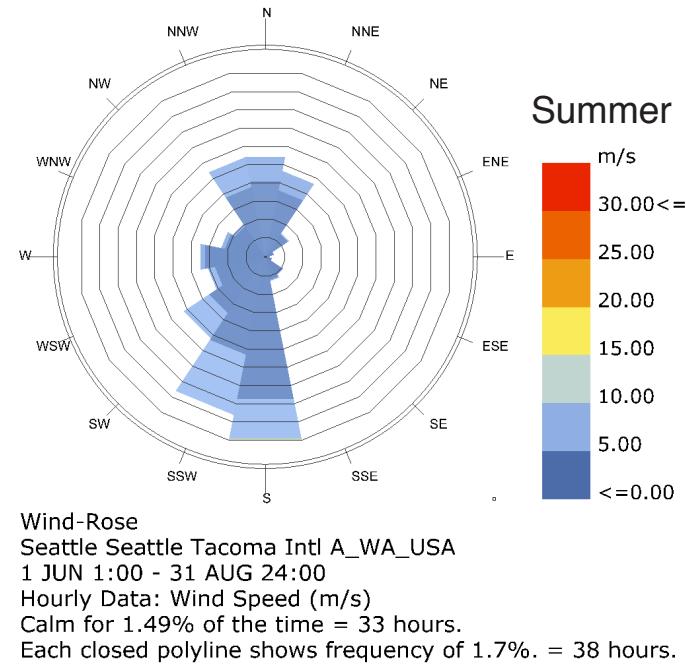
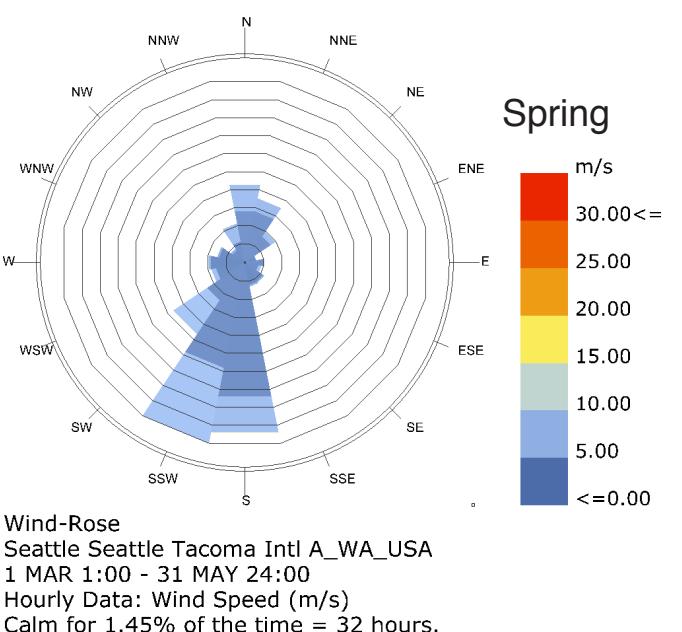
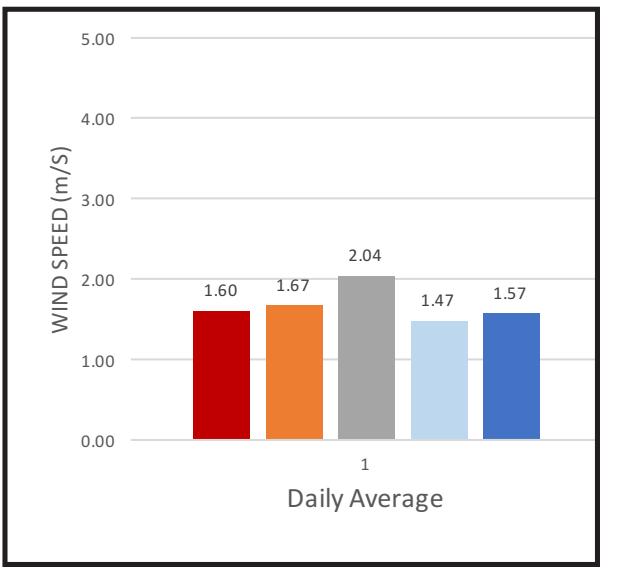
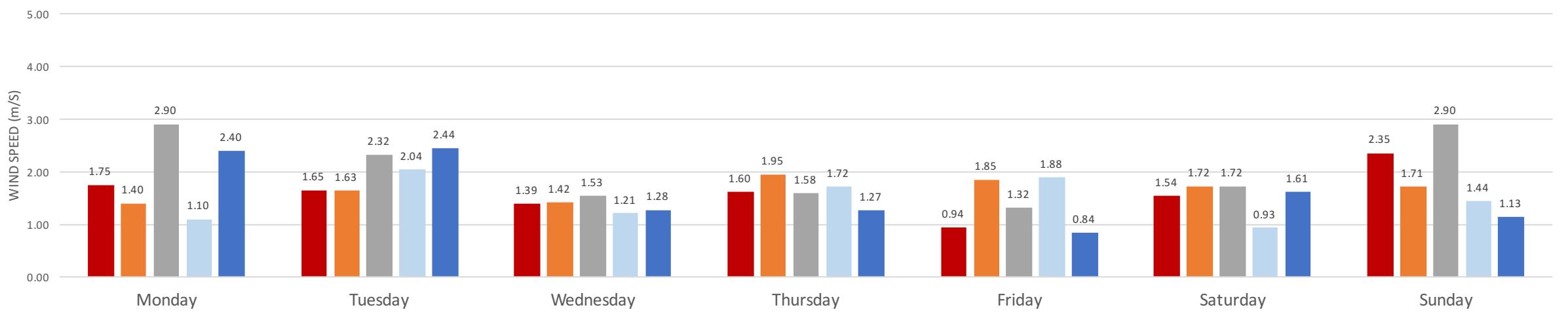
Typical **week** is in October, between the 20th and the 26th.

Typical **cold week** is in February, between the 3rd and the 9th.

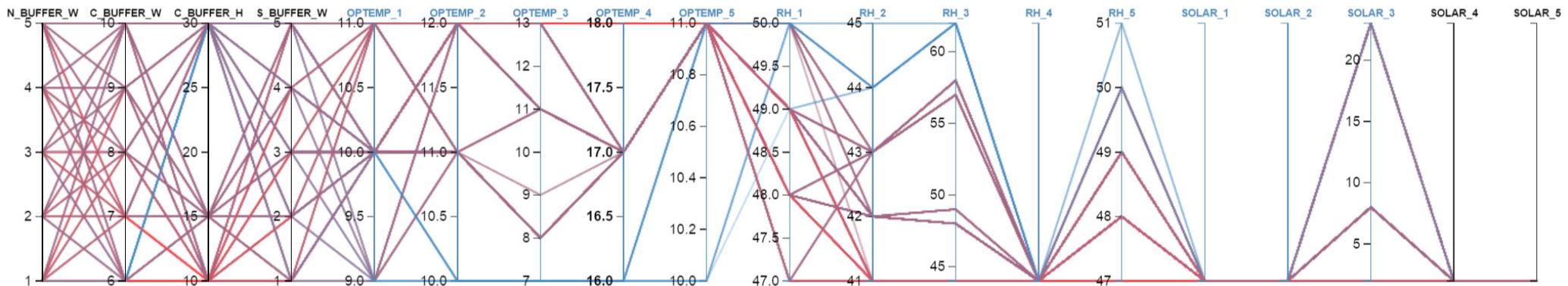
Extreme cold is in January, between the 13th and the 19th.

Cooling setpoint 18.3°C
Heating setpoint 23.3°C

Annual HDD, 2675.35
Annual CDD, 36.45



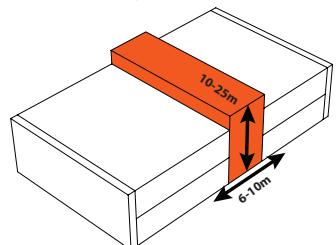
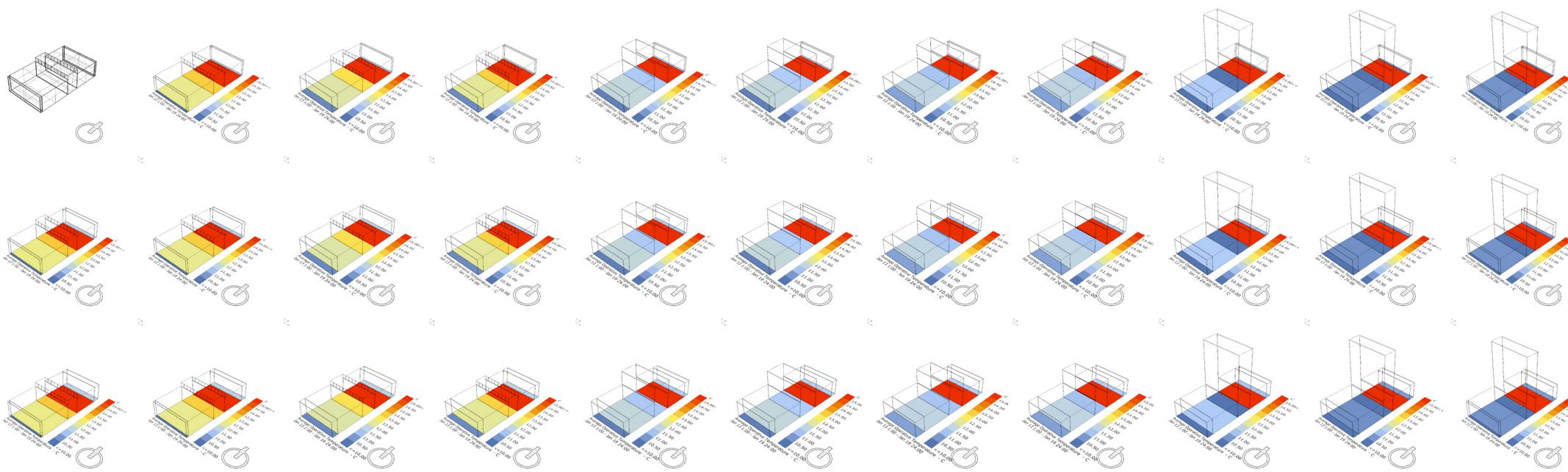
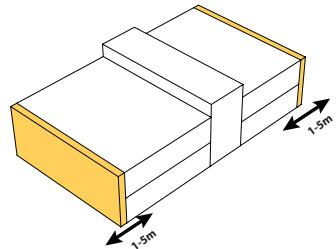
South/north Axis Tuning



In an effort to achieve a prototypical program module, the first step was parametric optimization. Variables investigated are the widths of the three buffer spaces and the height of the center atrium.

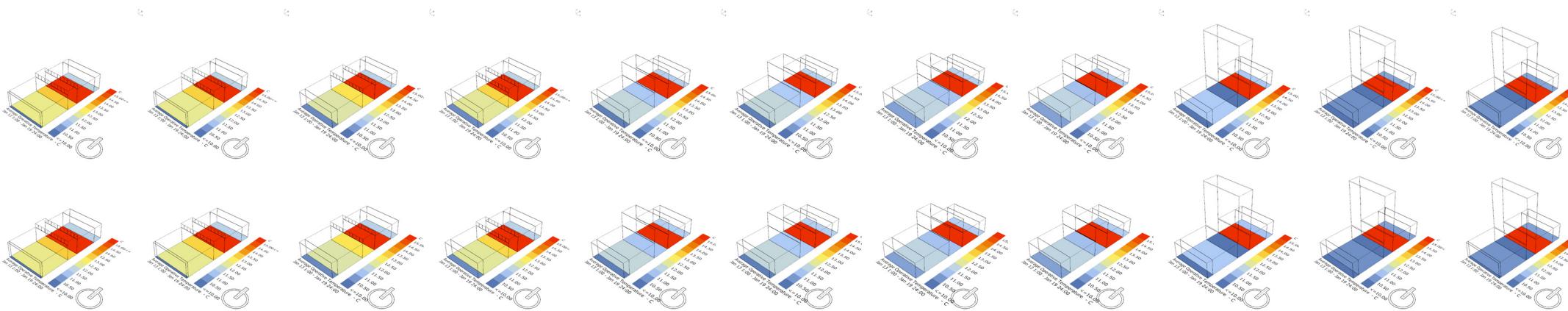
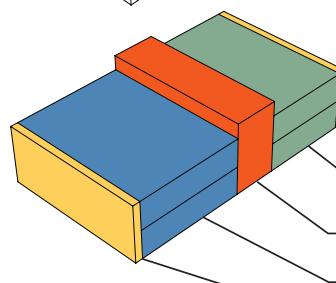
Atrium Height and Width Tuning

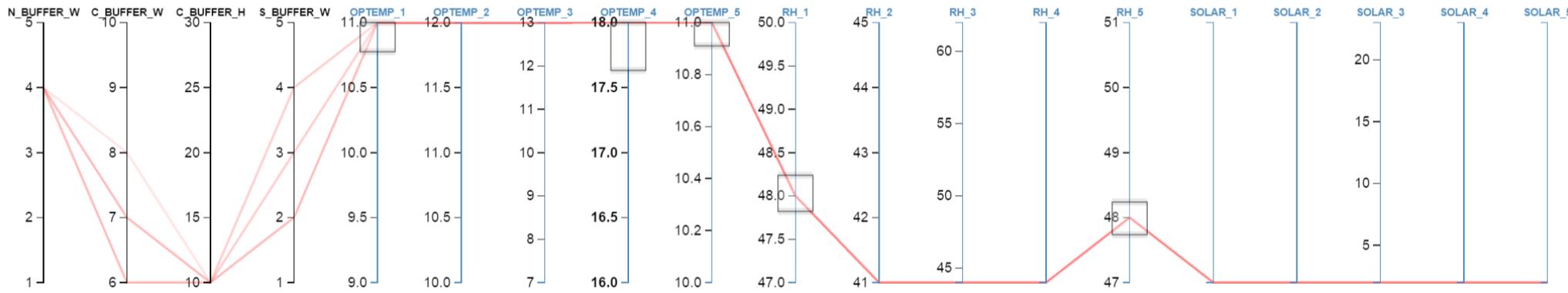
In winter, south buffer performs better at a minimum width; on the contrary the northern buffer width has to be increased to improve residential units insulation.



North and South Buffer Width Optimization

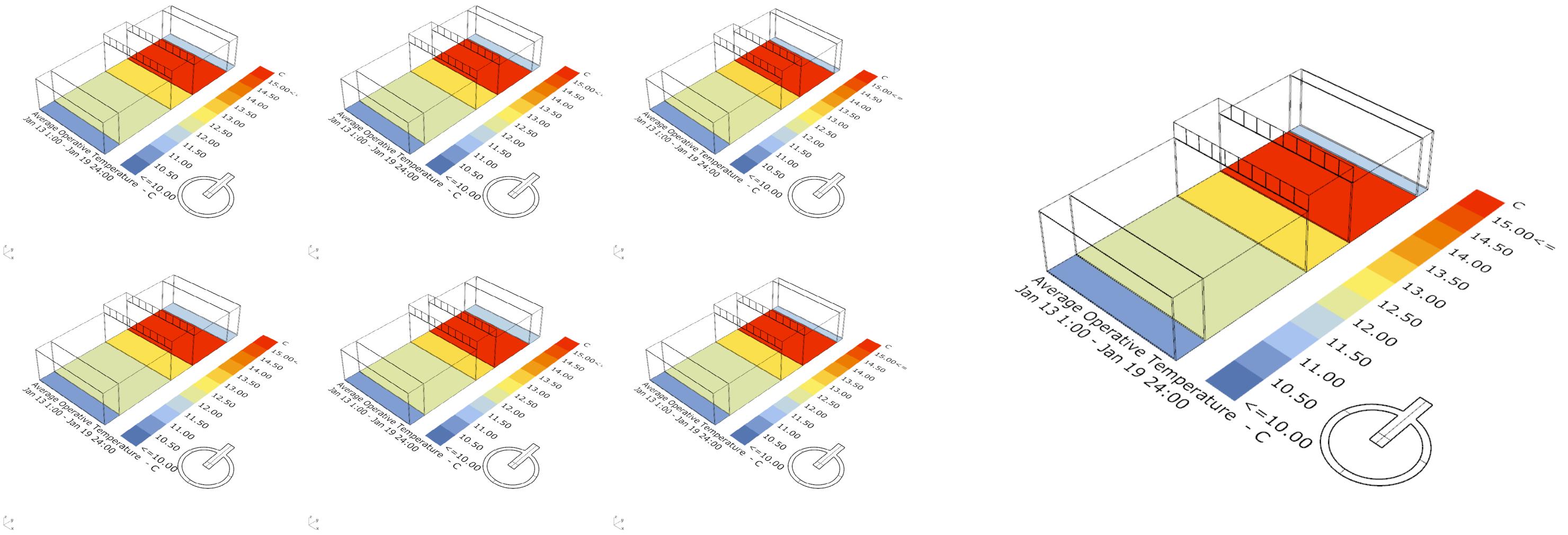
Not taking into account stack-effect, atrium performances are significantly affected by its height: low heights provide higher operative temperatures.





Optimal Winter Comfort Axis Configuration

Optimum configuration reduces RH in the buffer zones while maximizing operative temperature in the permanent occupied zones. Overall the most optimum configuration one that minimizes the construction, while optimizing space.



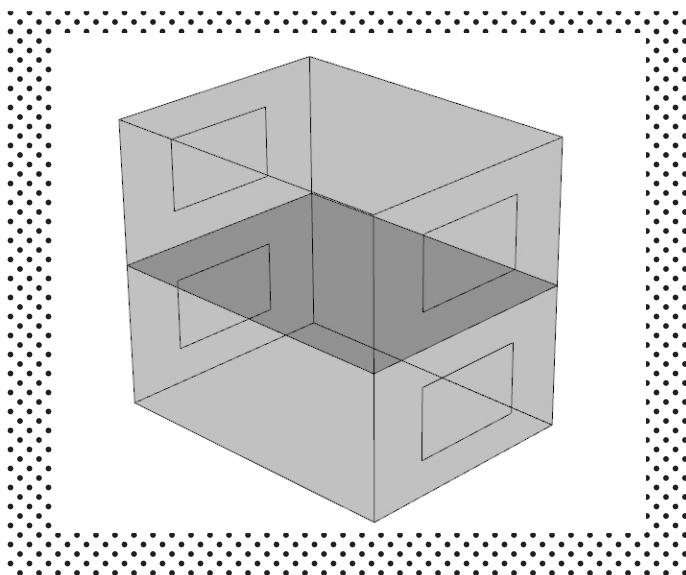
ENVIRONMENTAL ANALYSIS

Post Mid-term

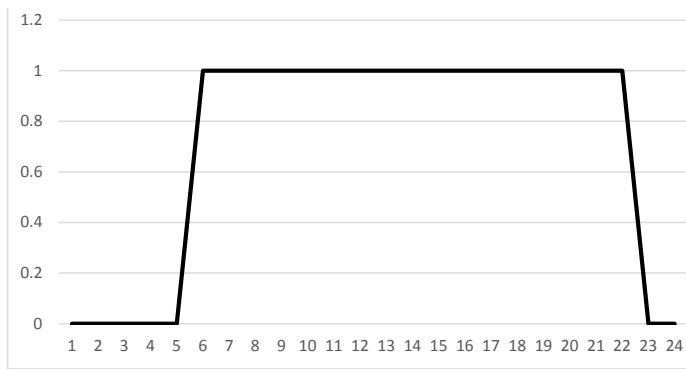
3

Test Geometry

Two Floors
Volume 235m³
9m width x 10m depth x
4m height

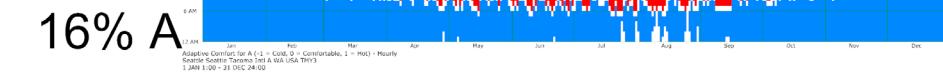
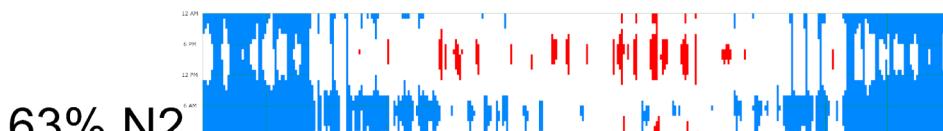
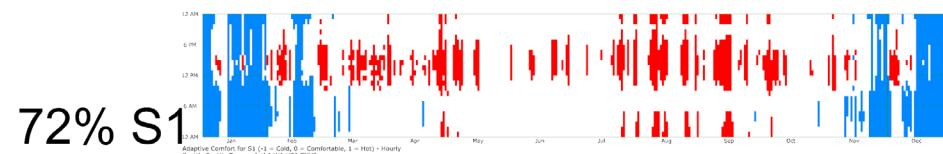


Residential Natural Ventilation Schedule



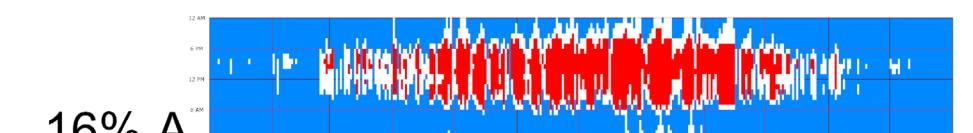
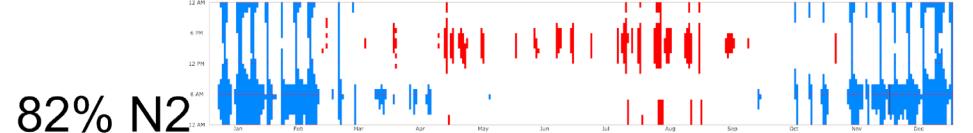
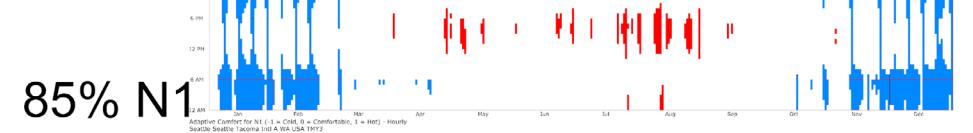
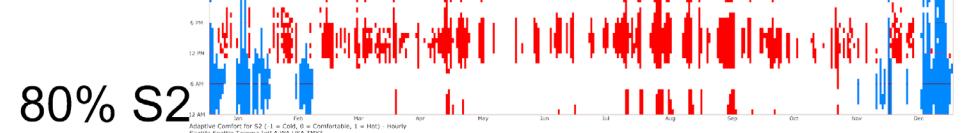
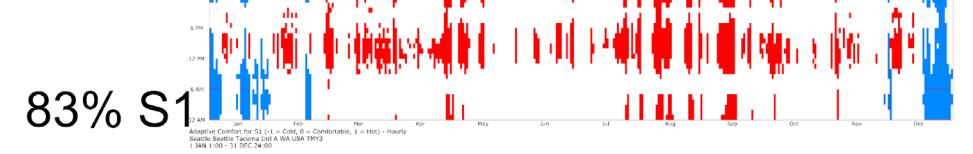
Residential Program facing South

Non-insulated Glass



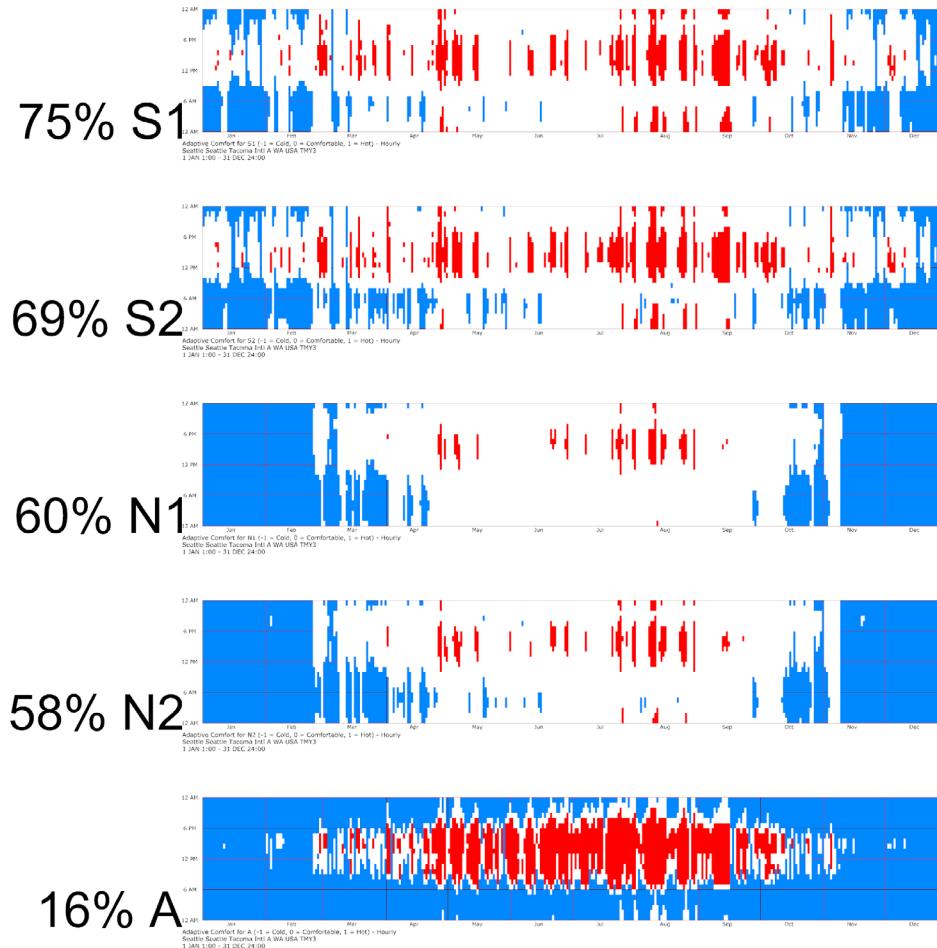
Residential Program facing South

Insulated Glass



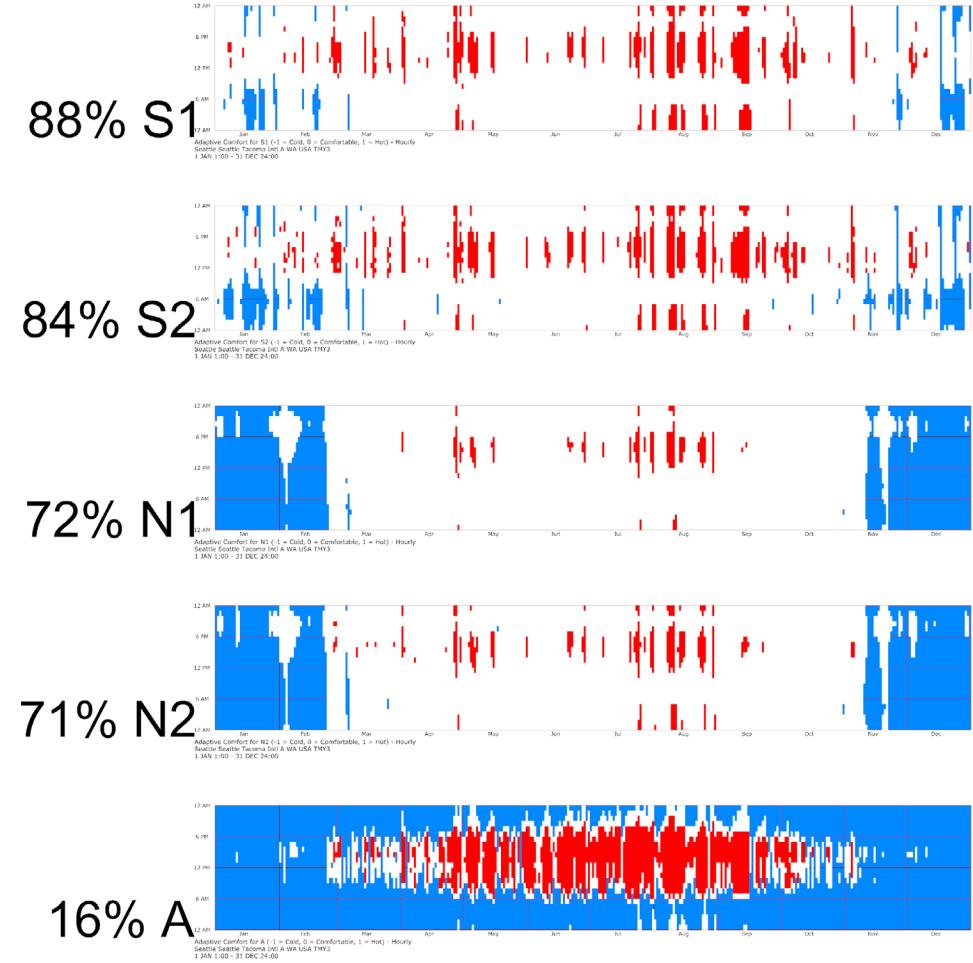
Residential Program facing North

Non-insulated Glass



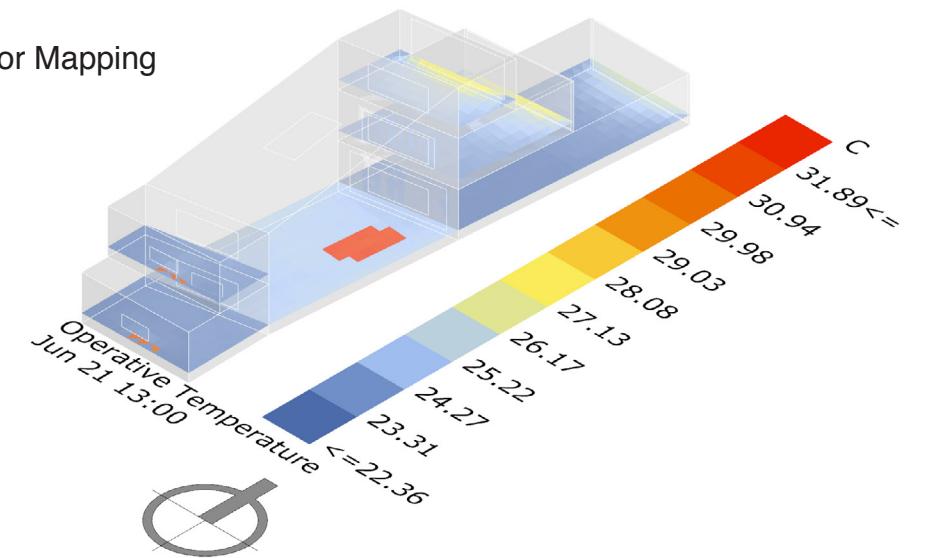
Residential Program facing North

Insulated Glass



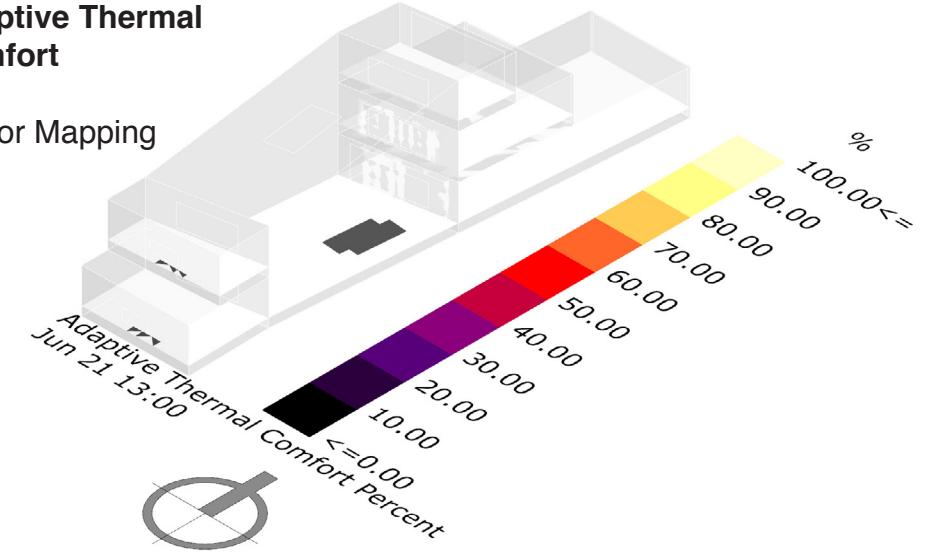
Operative Temperature

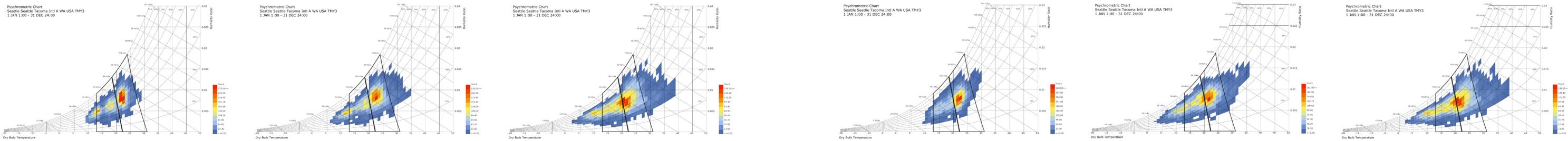
Indoor Mapping



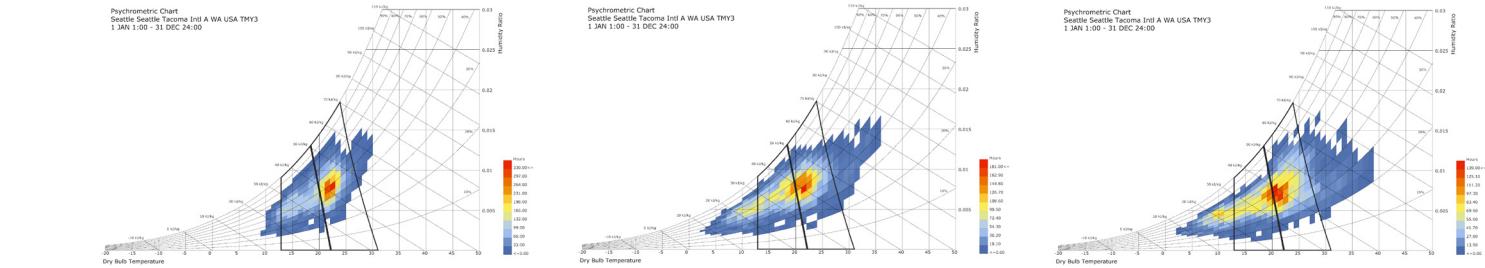
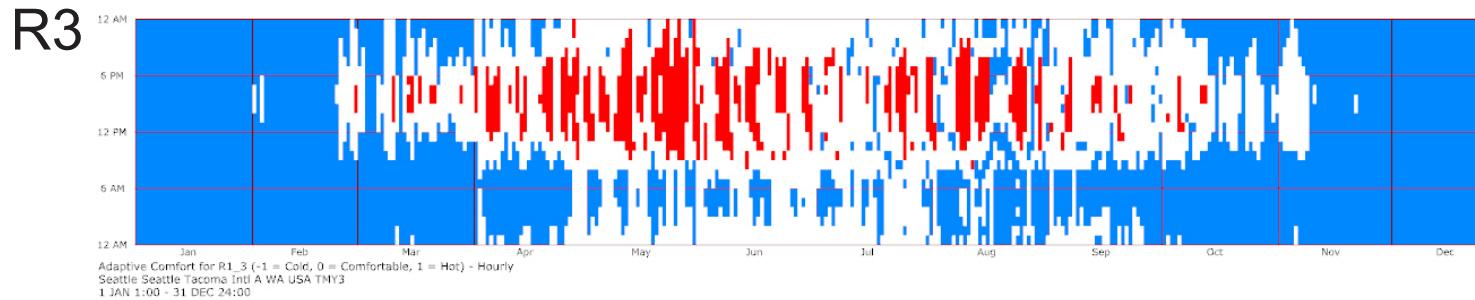
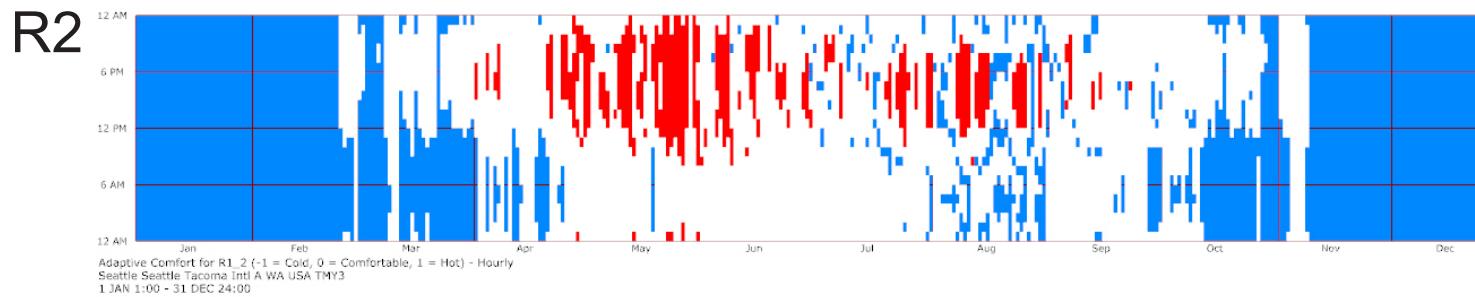
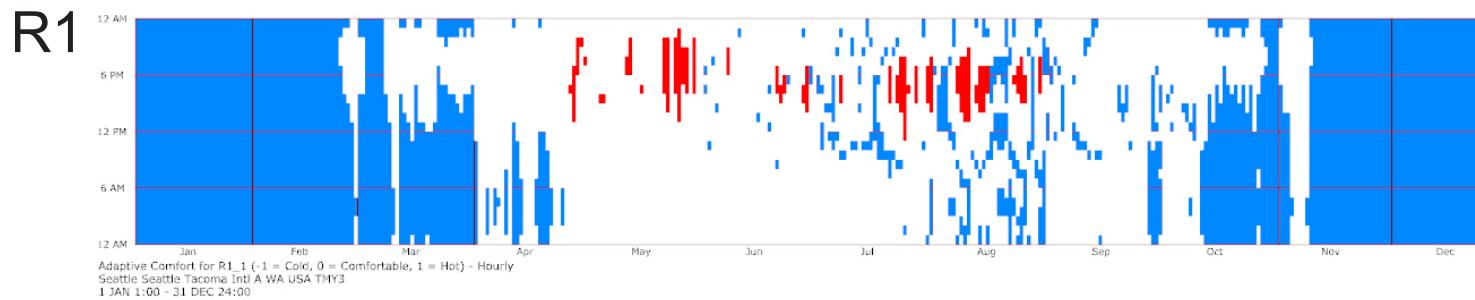
Adaptive Thermal Comfort

Indoor Mapping

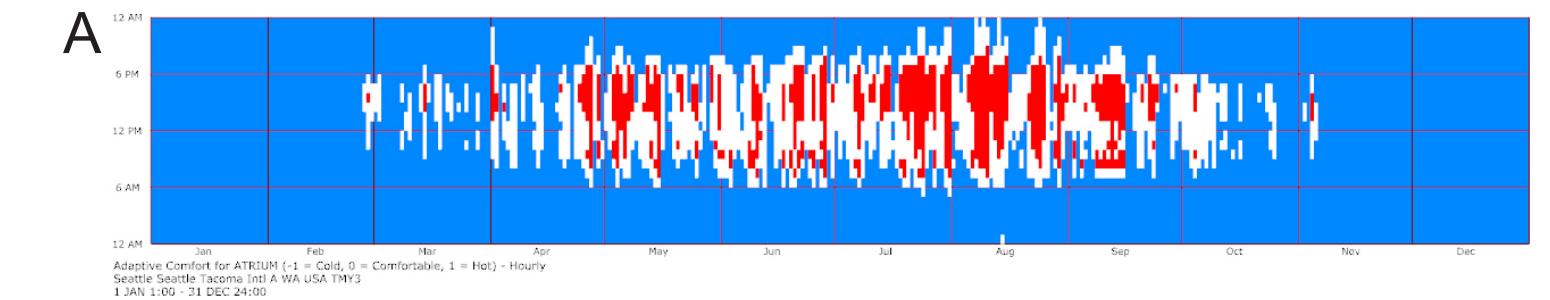
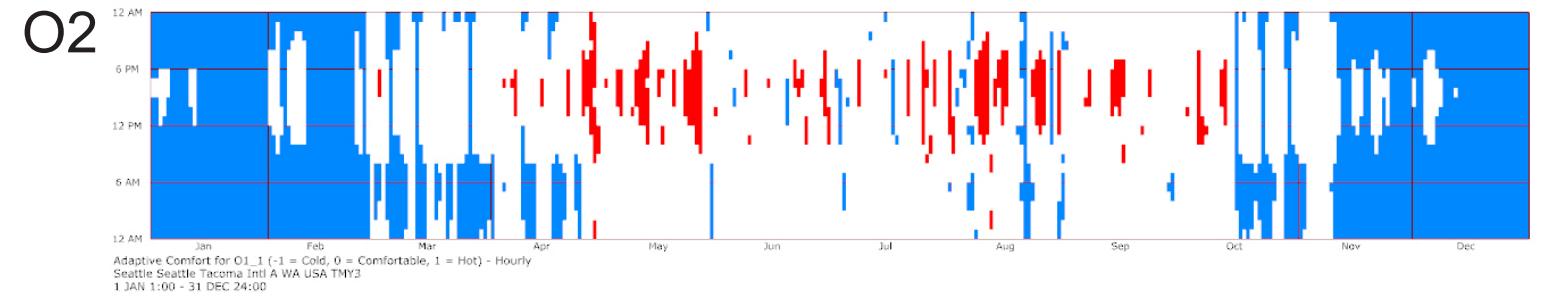
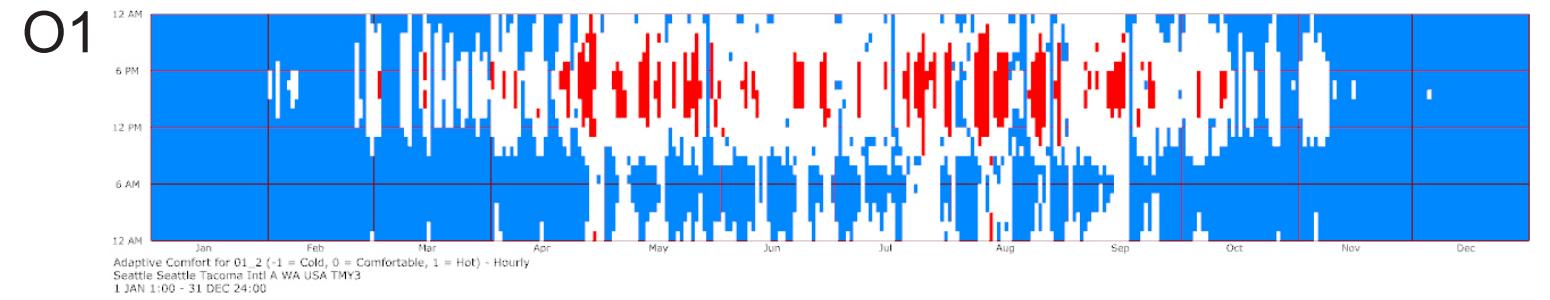




Comfort Analysis Residential



Comfort Analysis Office + Atrium



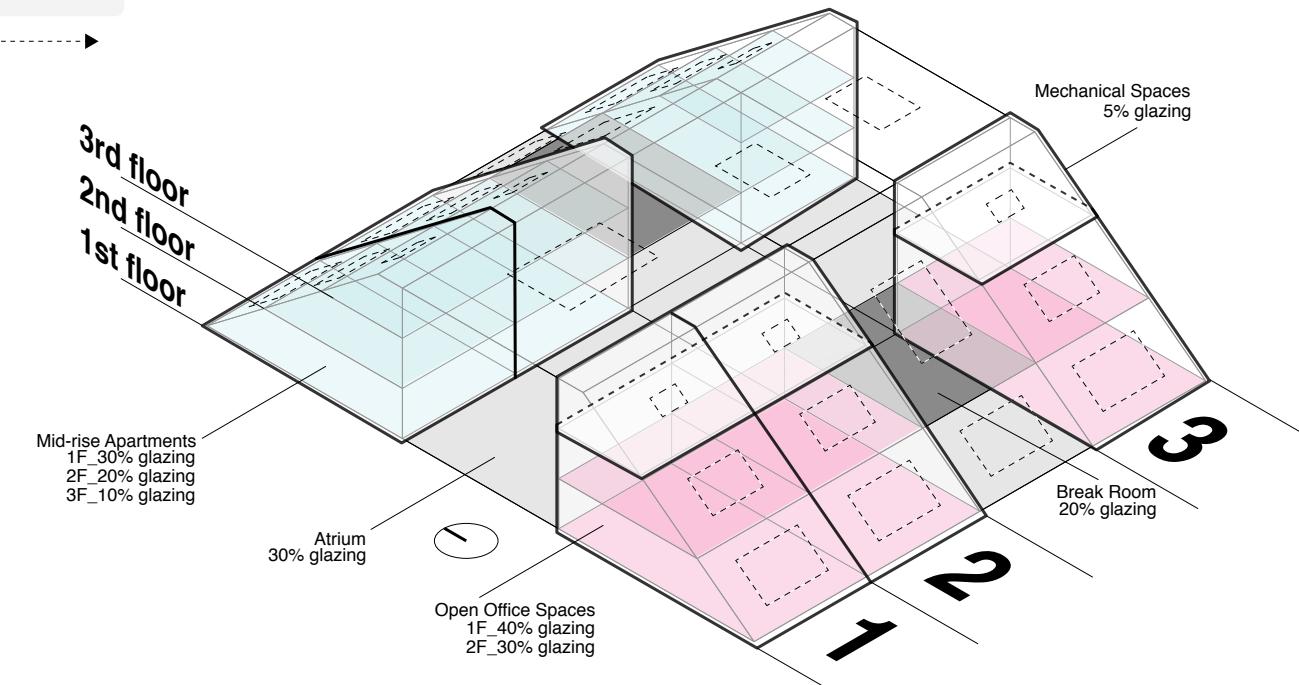
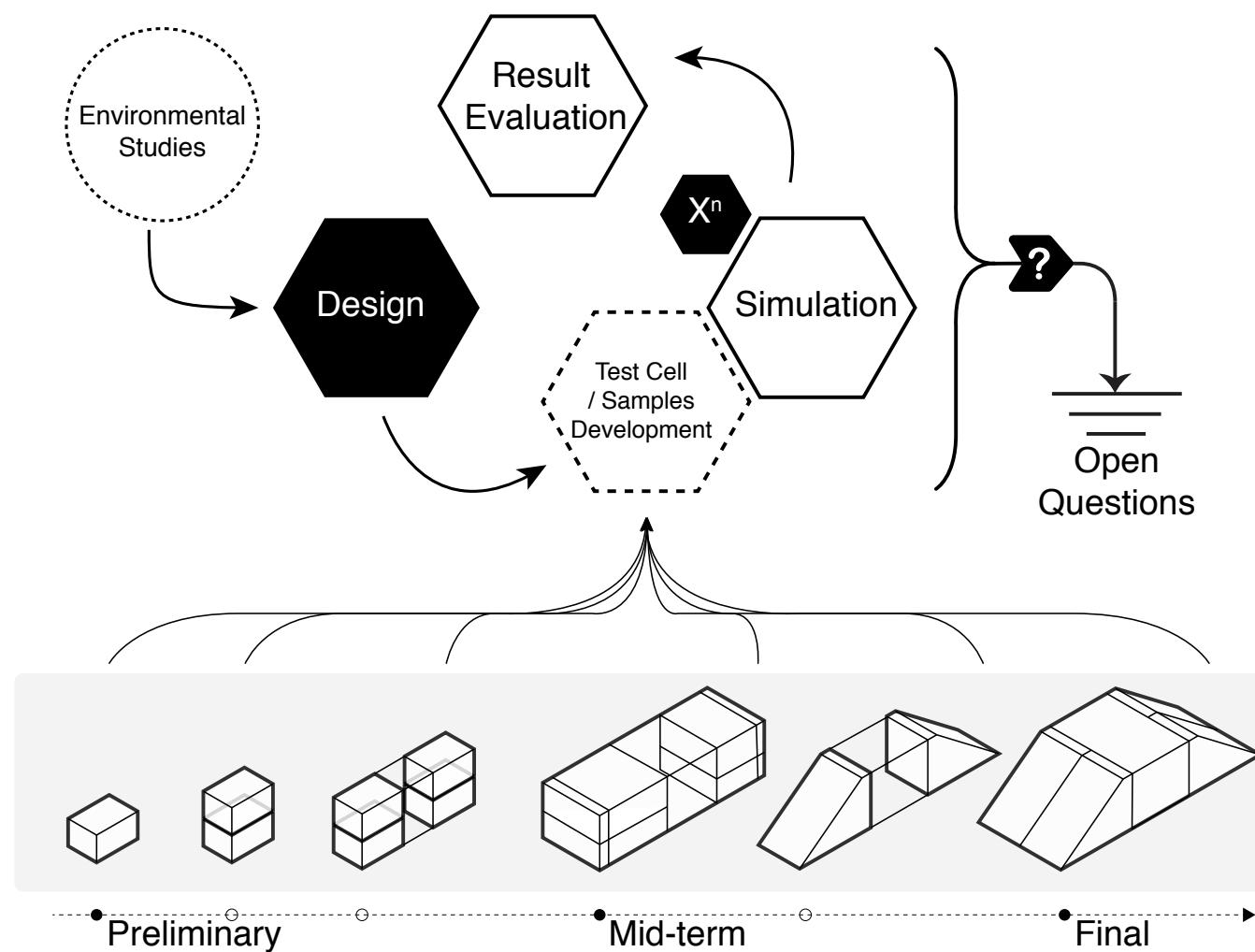
ENVIRONMENTAL ANALYSIS

Final Studies

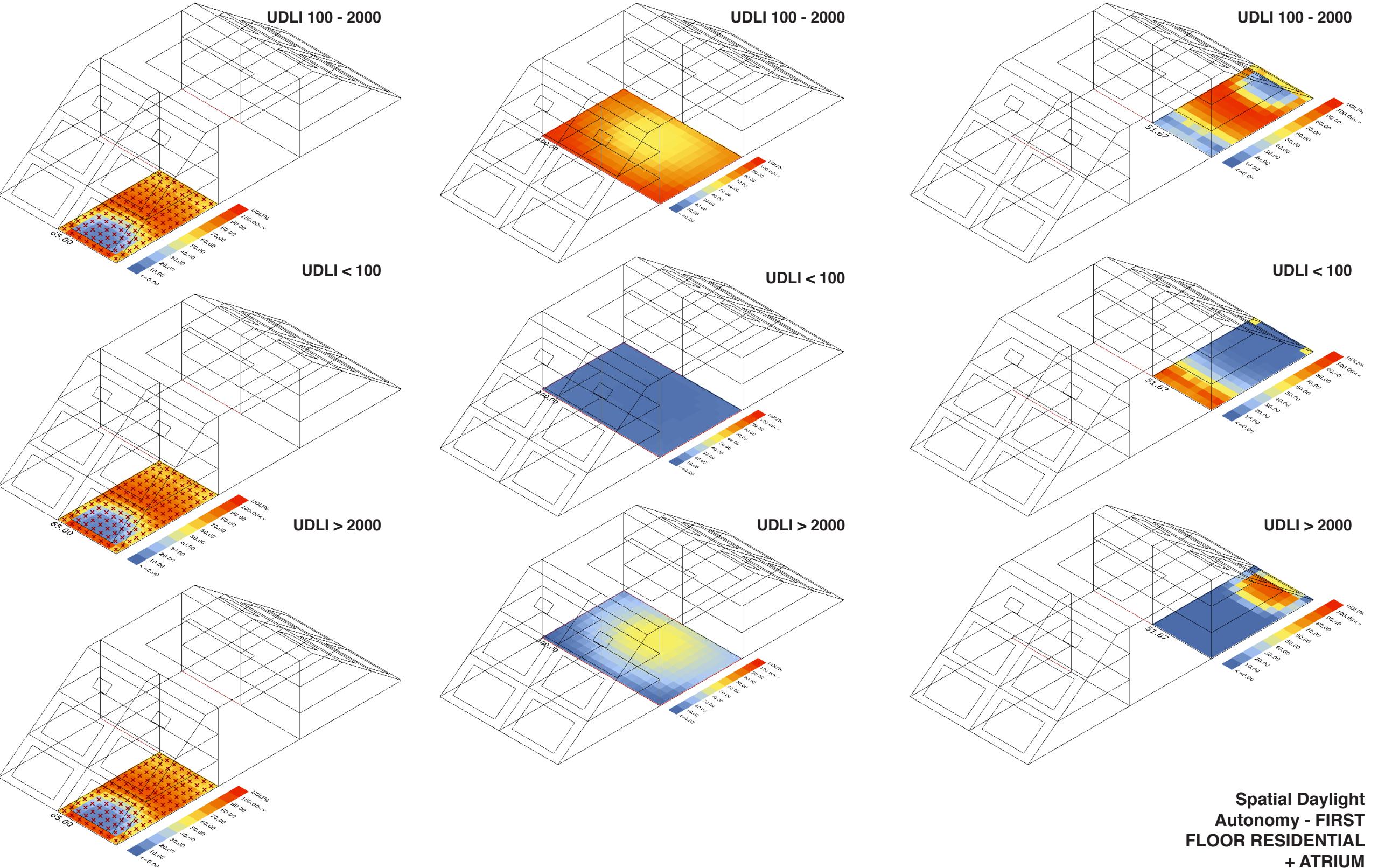
4

**Spatial Daylight
Autonomy - FIRST
FLOOR OFFICE**

Due to its depth, first floor was the first object of analysis, according to glazing percentage intended from the design.



Daylight Analysis



Spatial Daylight Autonomy - FIRST FLOOR OFFICE

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Spatial Daylight Autonomy - FIRST FLOOR RESIDENTIAL + ATRIUM

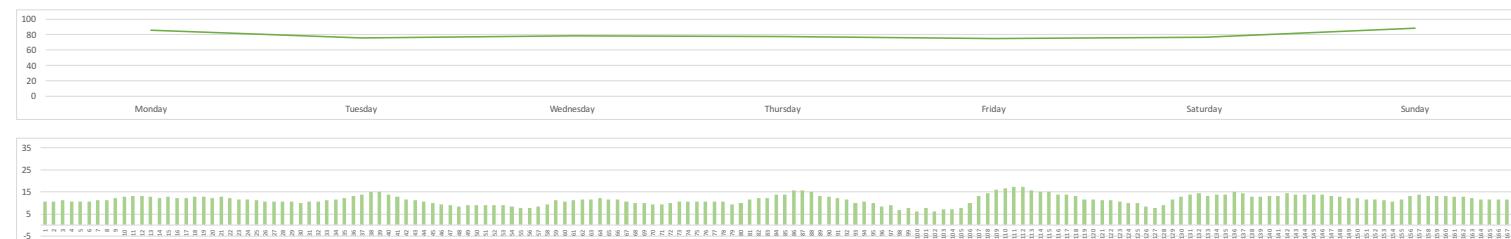
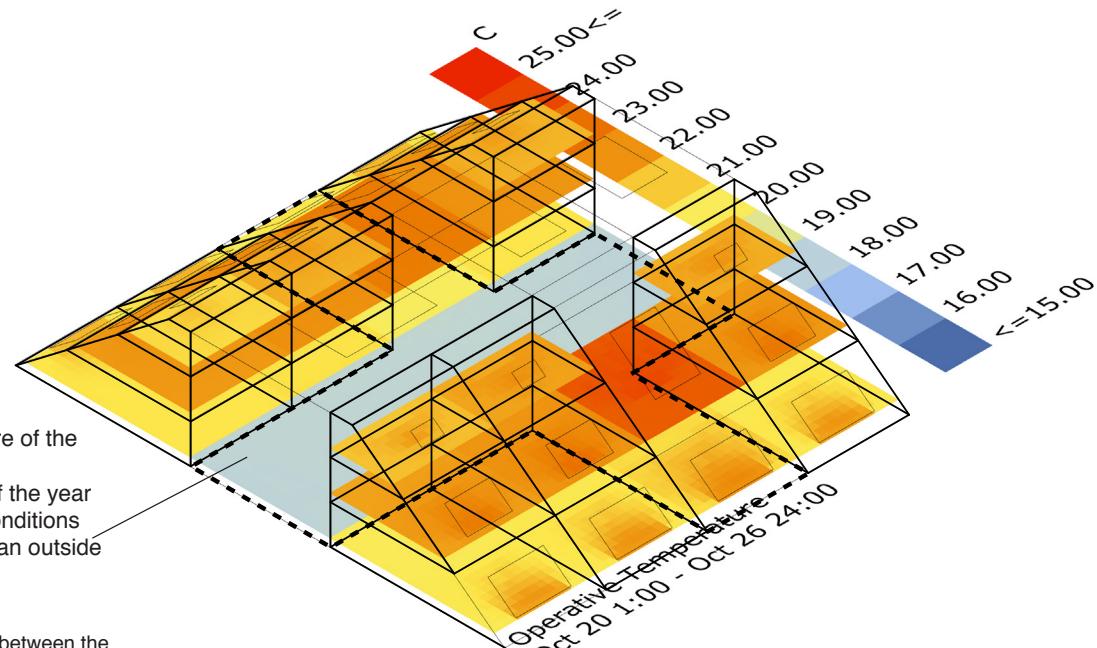
The same simulation was done for the residential unit sample and the related sector of the central atrium.

Indoor Microclimate

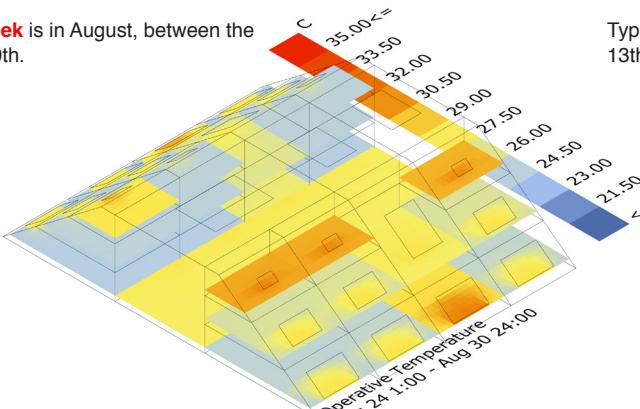
Typical Weeks Analysis

The operative temperature of the atrium during the typical week of the year provides good comfort conditions globally (4-5° C higher than outside temperature).

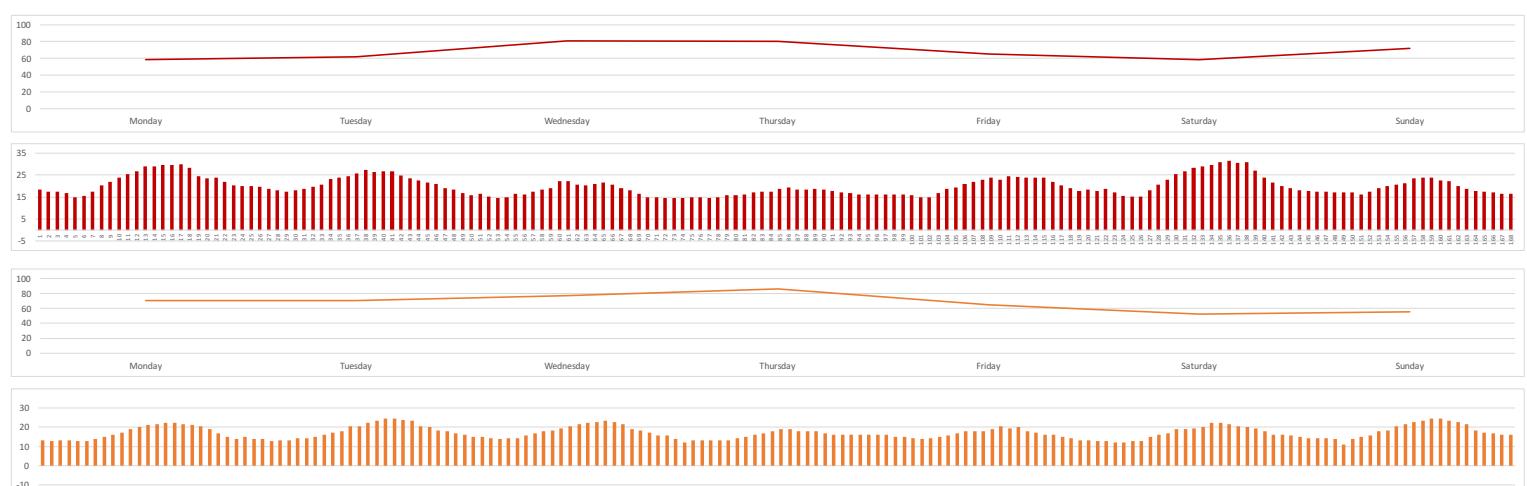
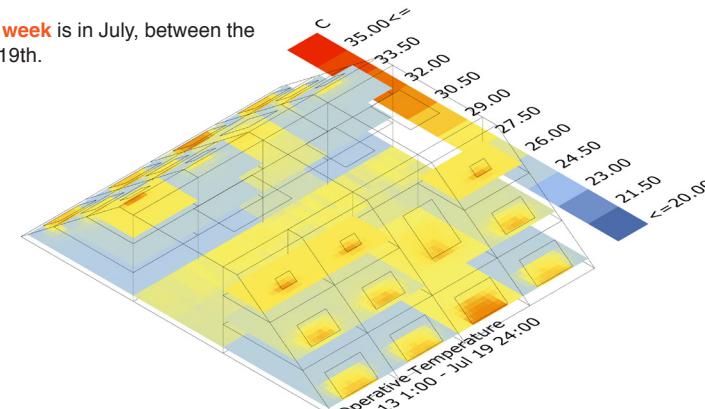
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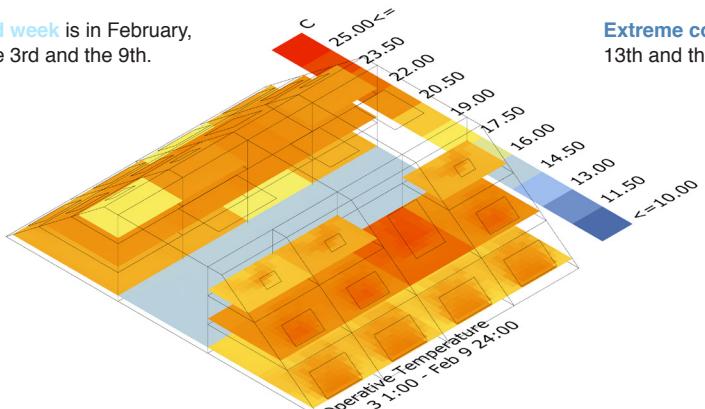
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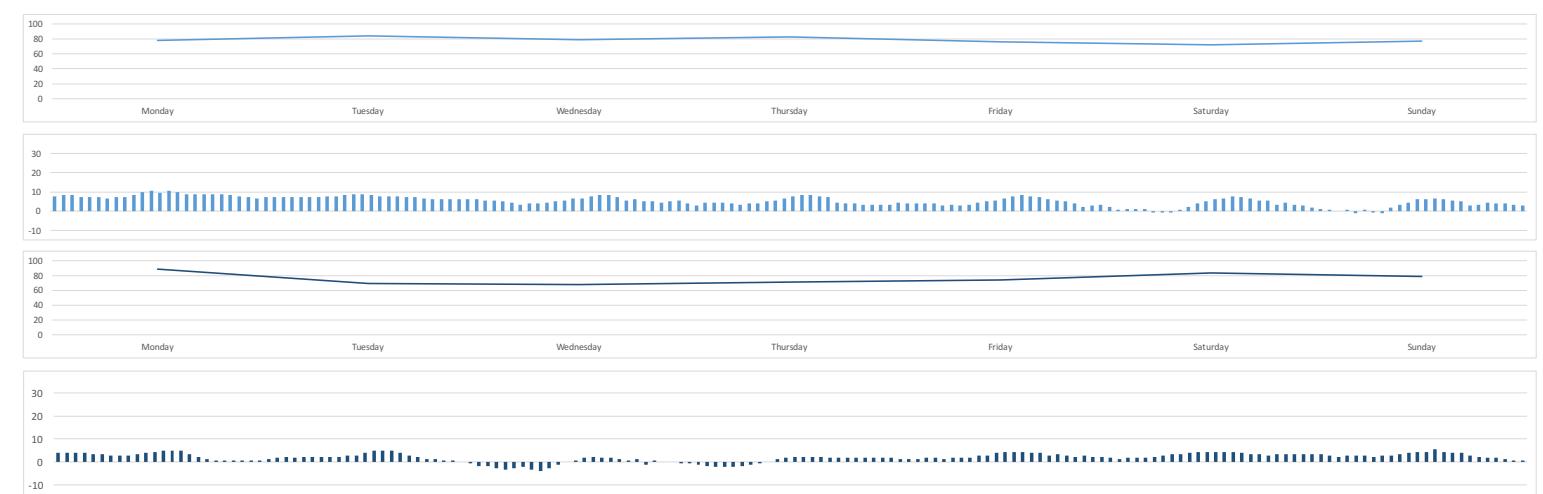
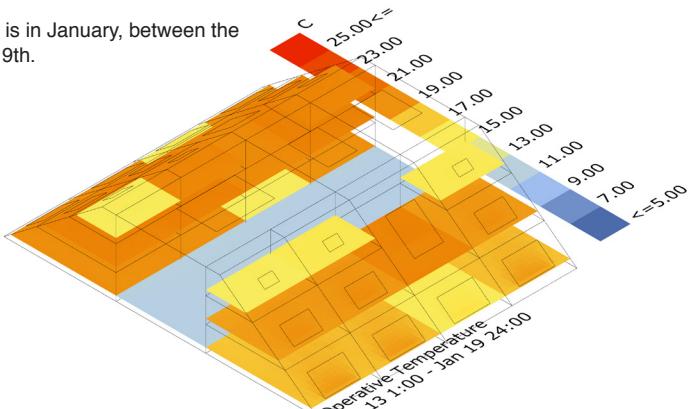
Typical **hot week** is in July, between the 13th to the 19th.



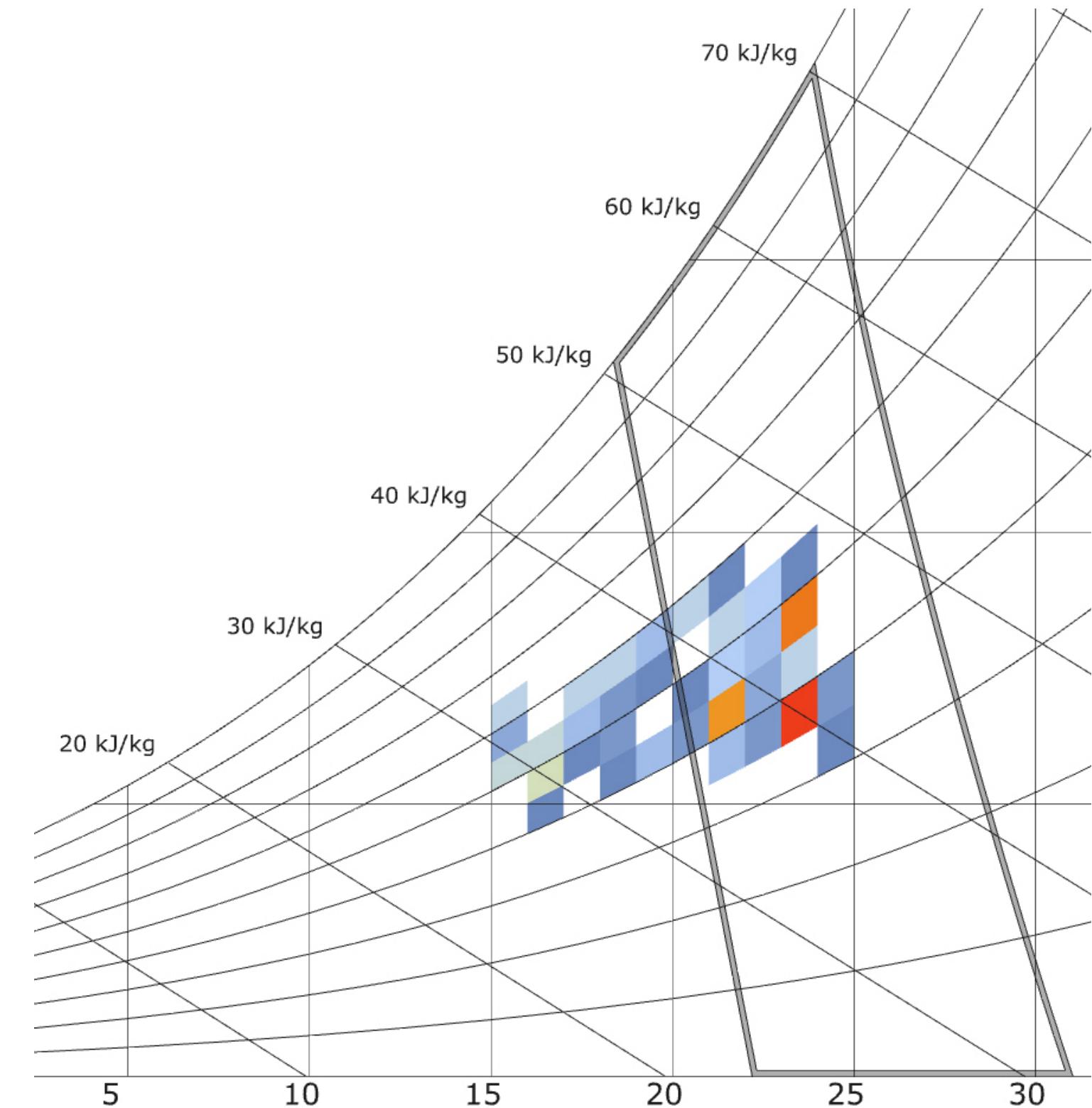
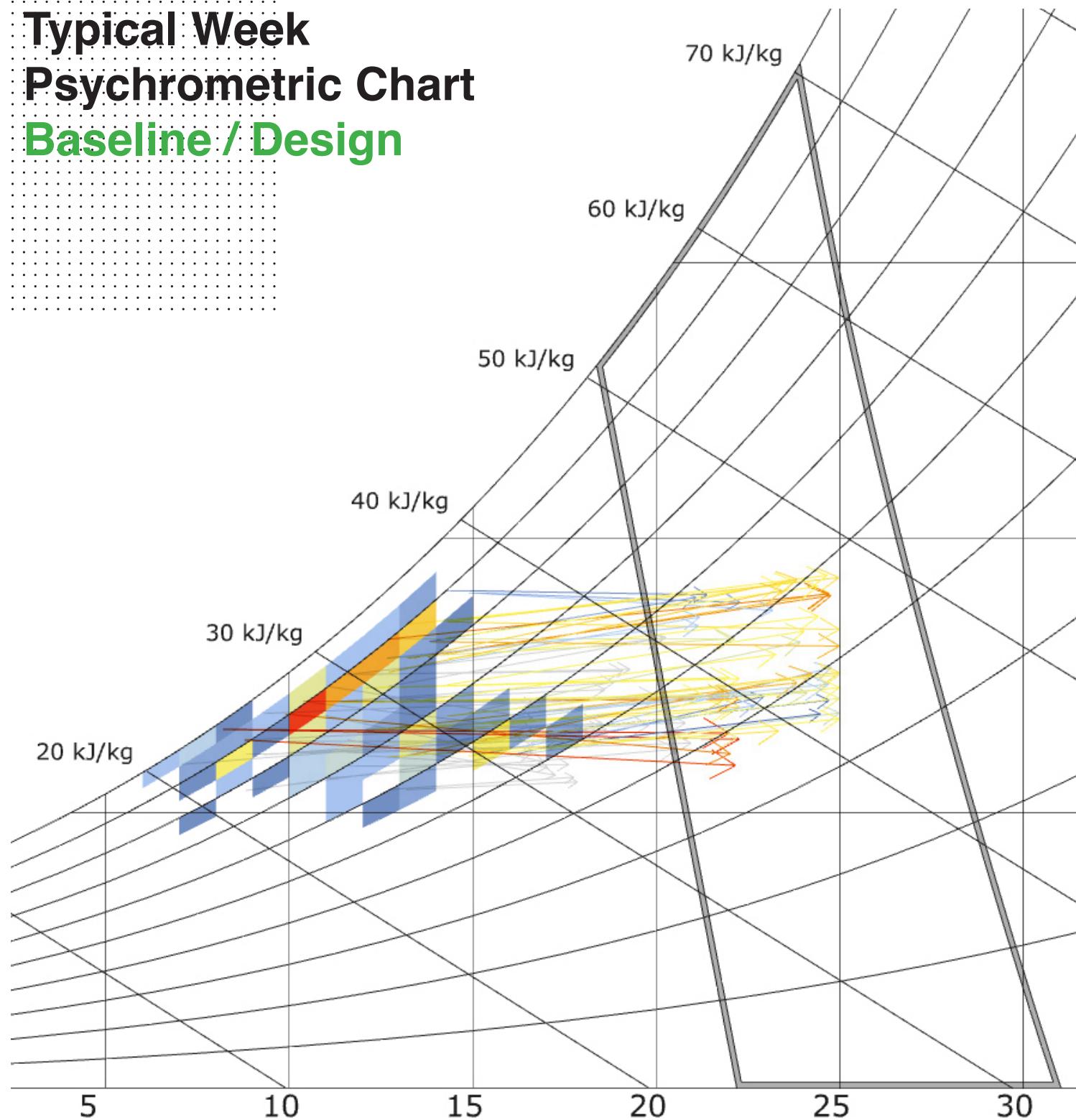
Typical **cold week** is in February, between the 3rd and the 9th.



Extreme cold is in January, between the 13th and the 19th.



Typical Week Psychrometric Chart Baseline / Design

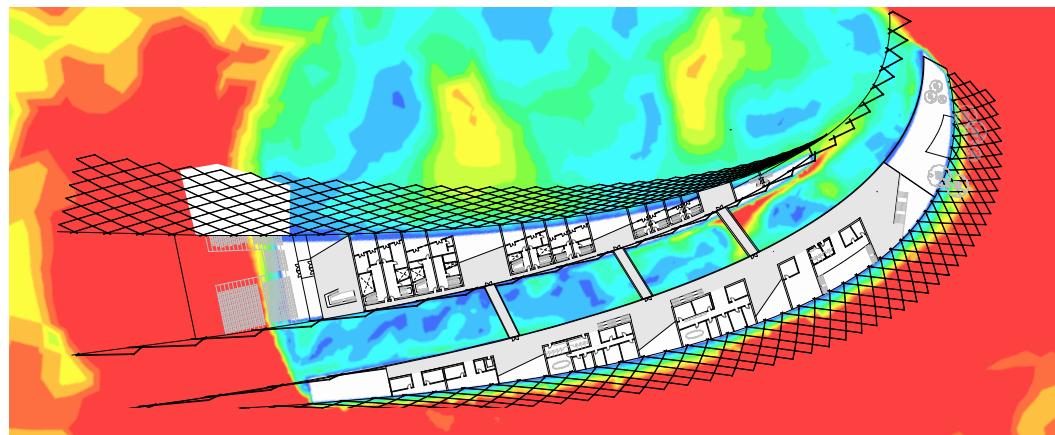


20 OCT 1:00 - 26 OCT 24:00

CFD Analysis

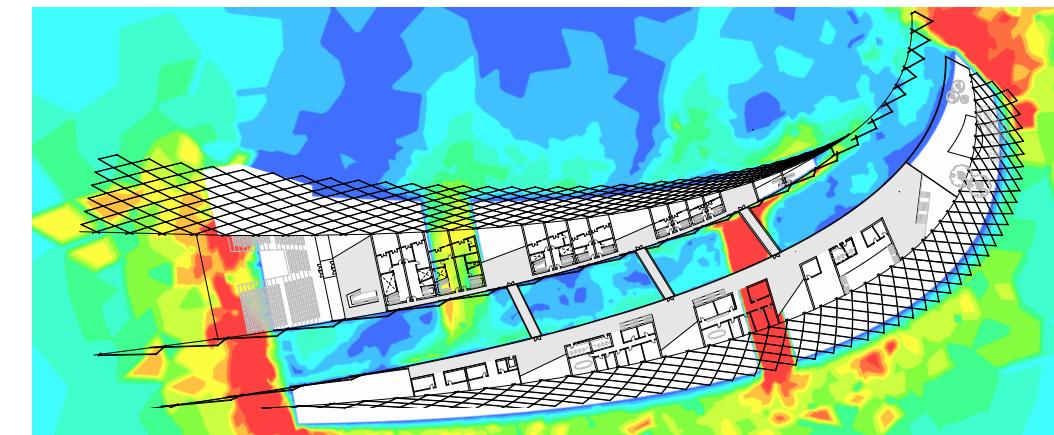
STATE 01

Fully Enclosed
plan 7-meter height



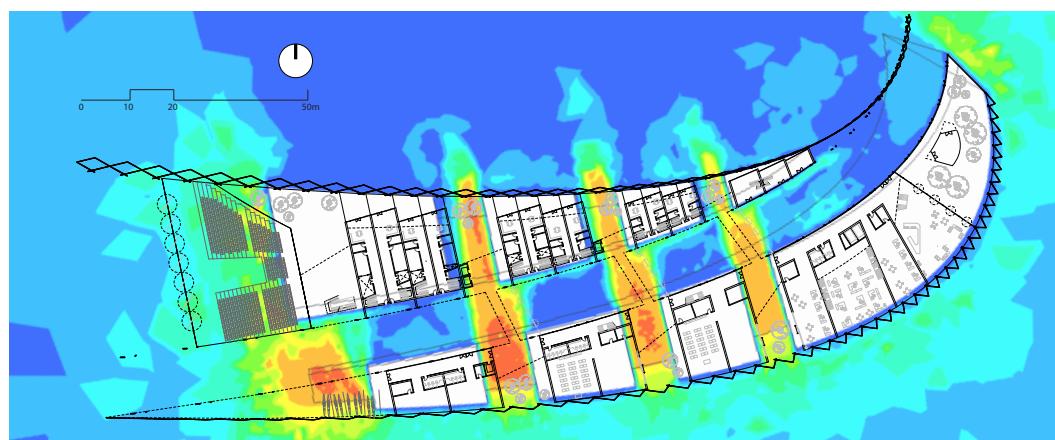
STATE 02

1-opening South East
plan 2-meter height

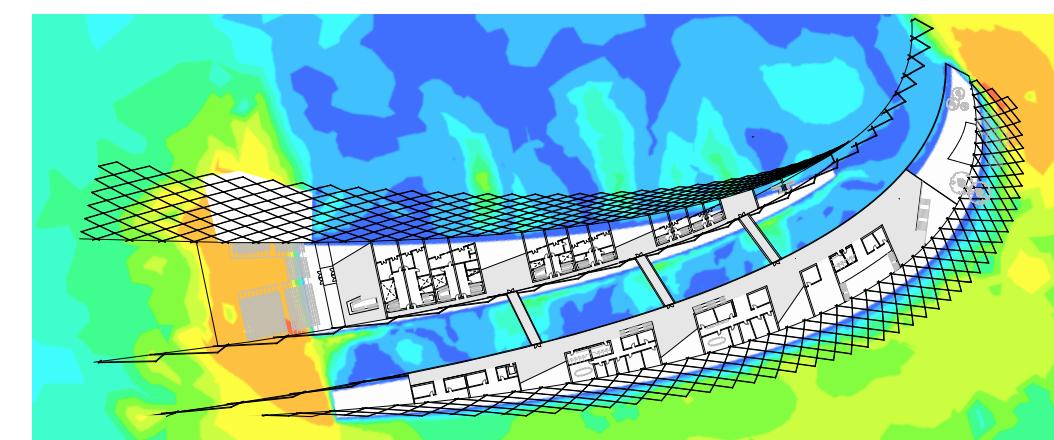


STATE 03

Fully Open South/North
plan 2-meter height

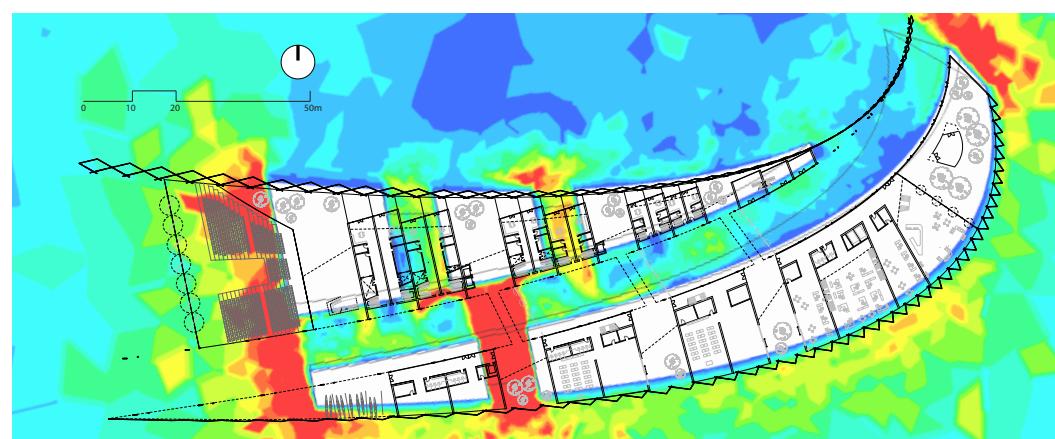


Fully Open South/North
plan 7-meter height

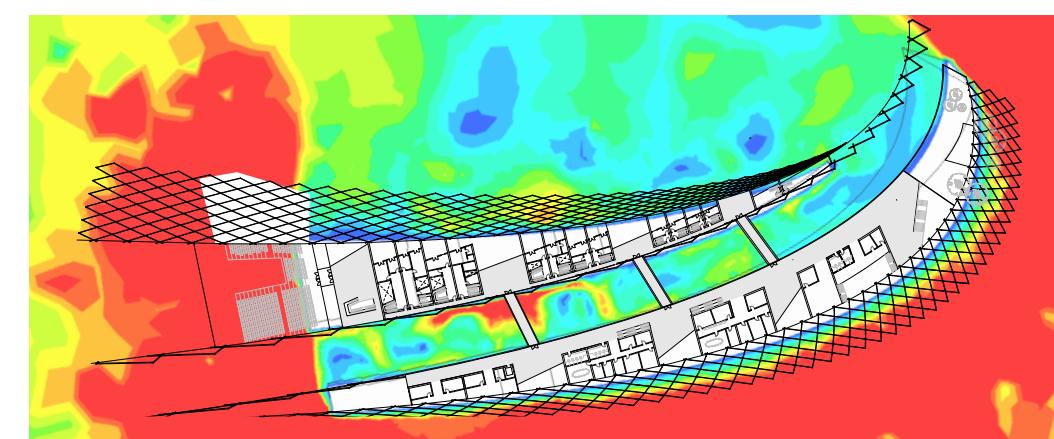


STATE 04

1-opening South West
plan 2-meter height



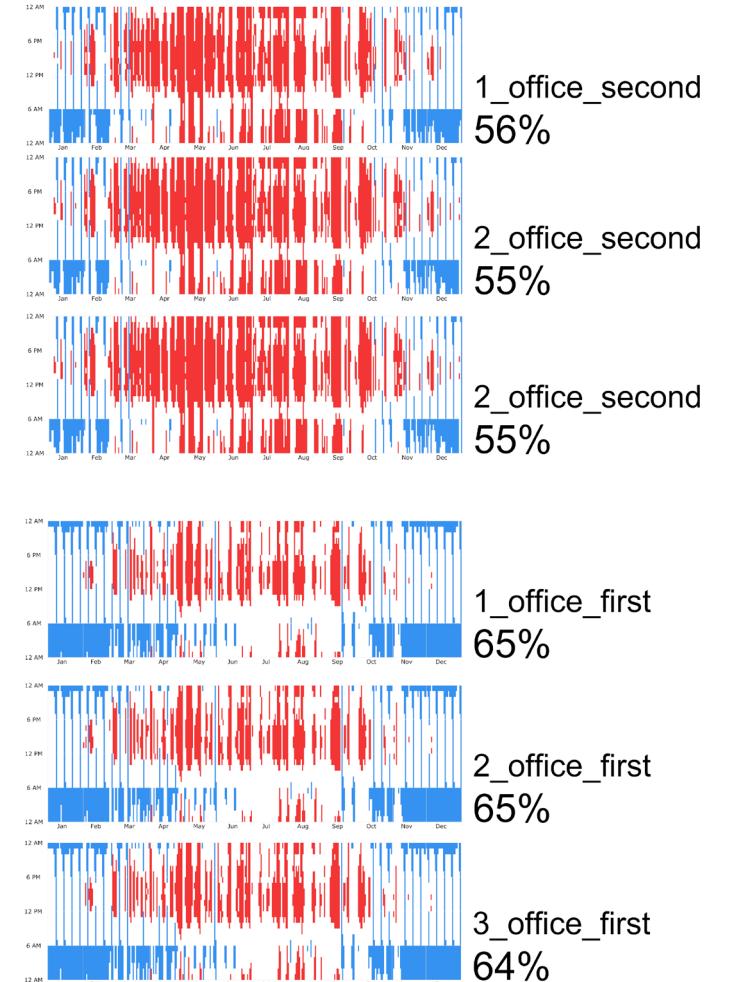
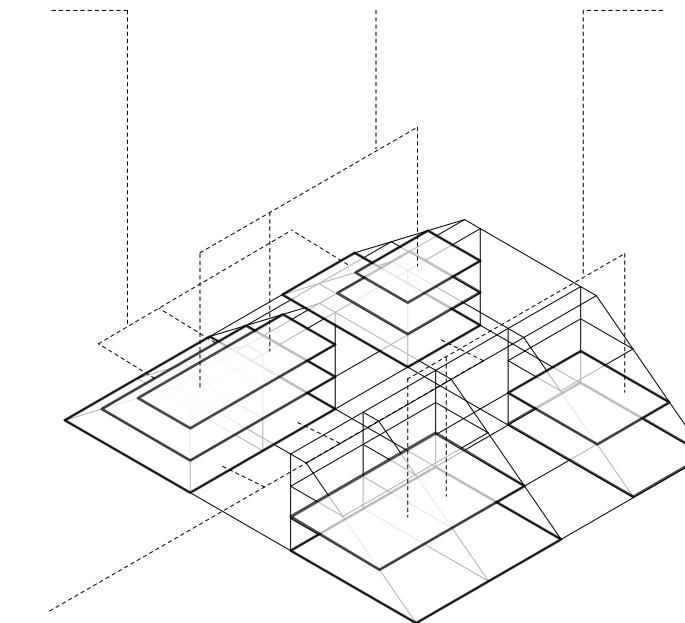
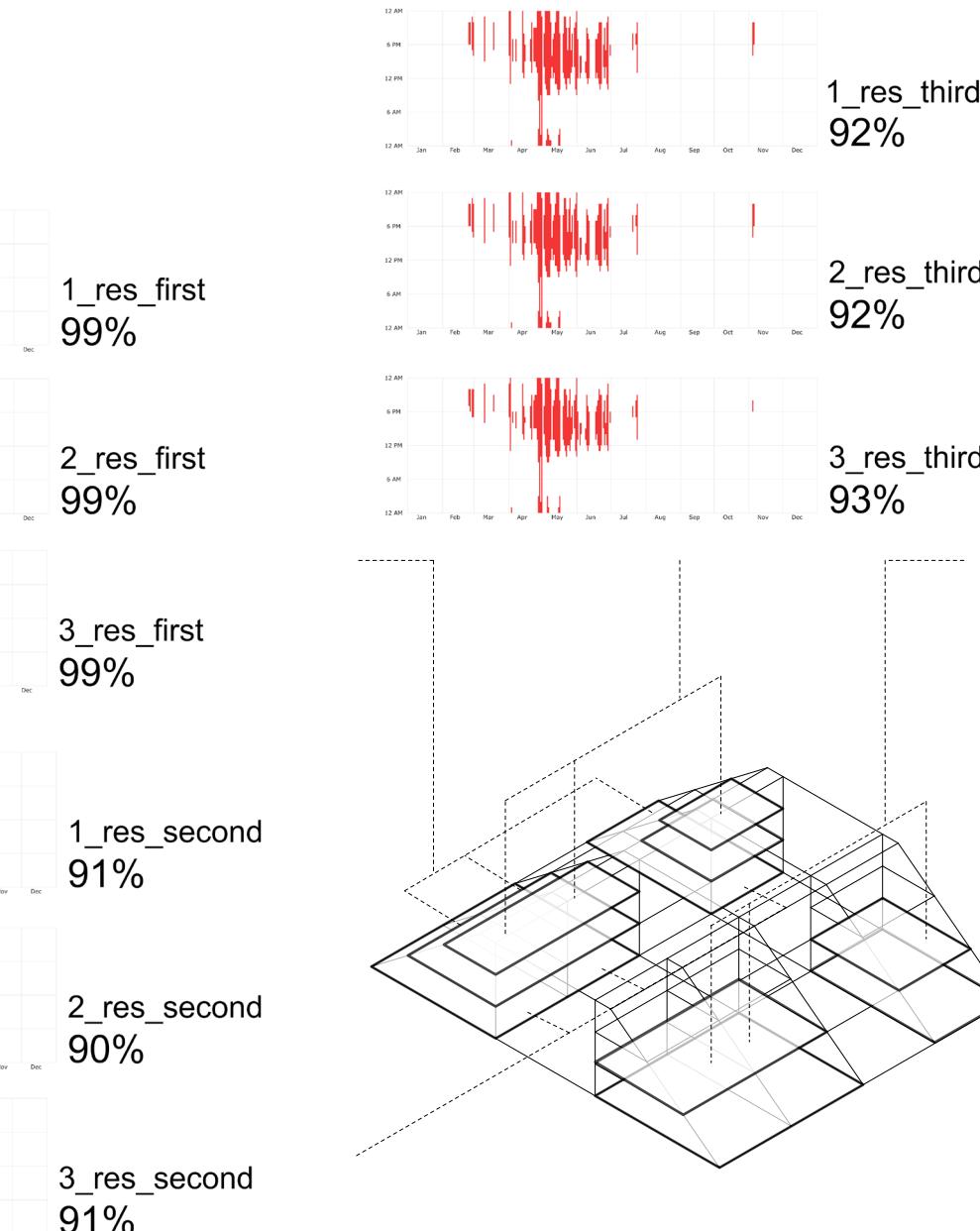
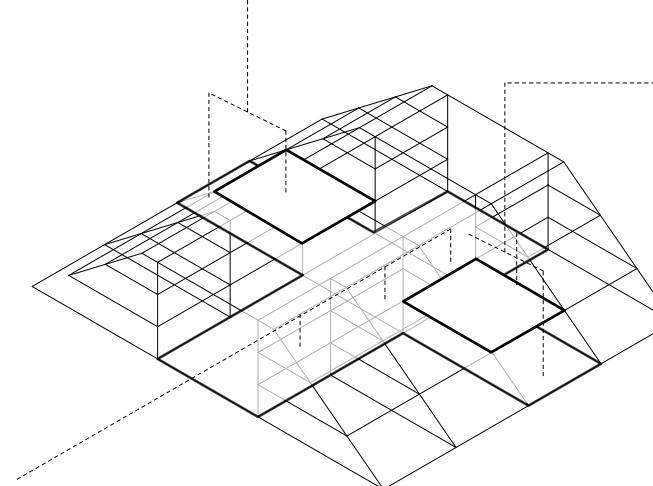
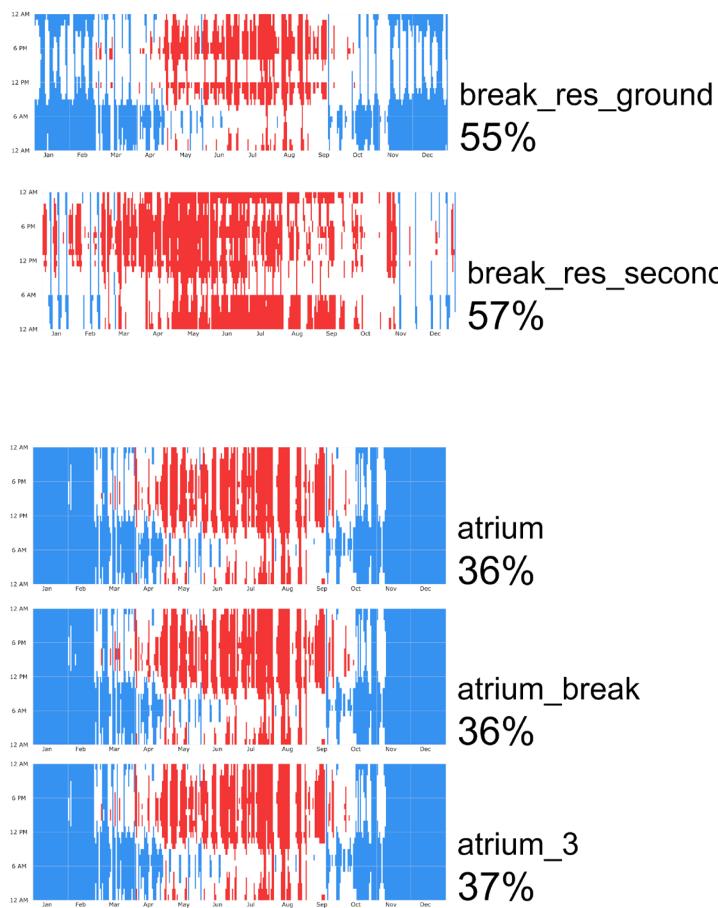
1-opening South West
plan 7-meter height



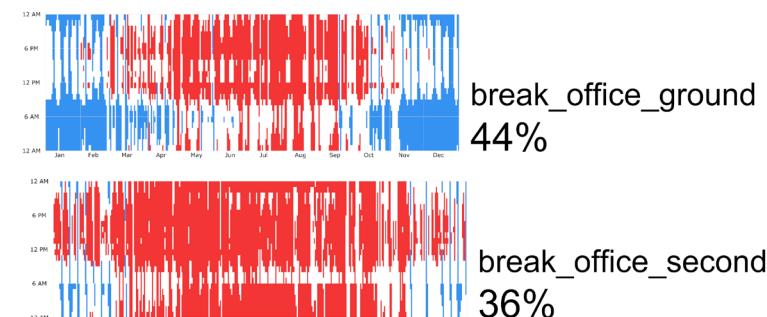
Velocity
Contour 2
2.000e+000
1.800e+000
1.600e+000
1.400e+000
1.200e+000
1.000e+000
8.000e-001
6.000e-001
4.000e-001
2.000e-001
0.000e+000
[m s⁻¹]

Adaptive Comfort Analysis

Atria and Break Rooms



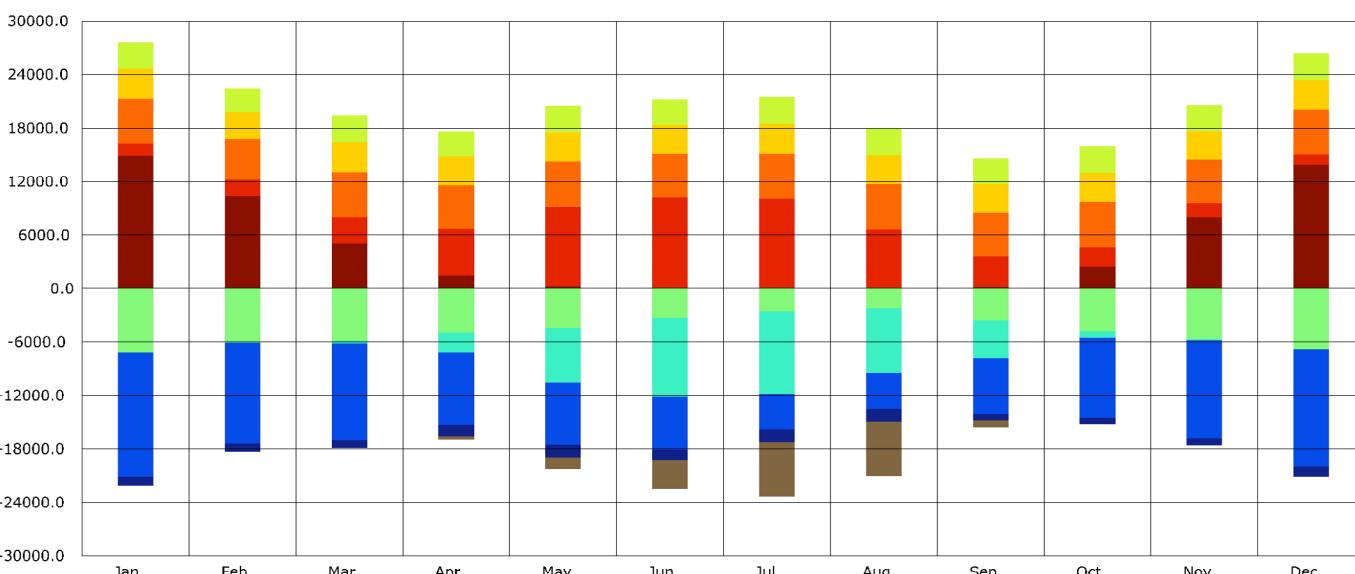
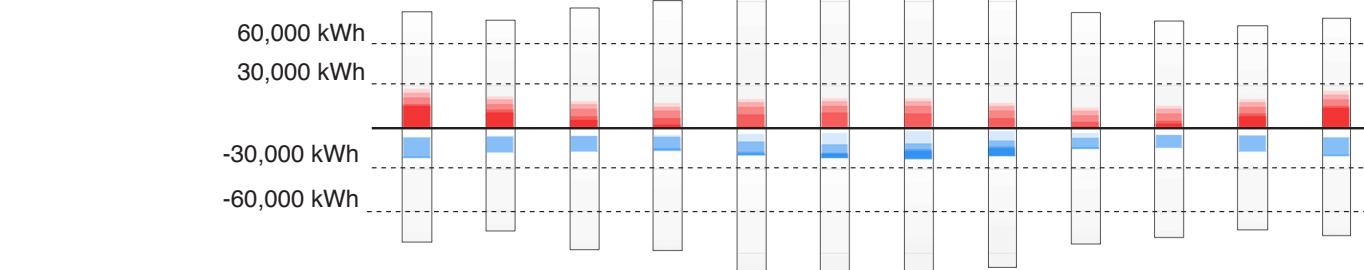
Residential Units and Offices



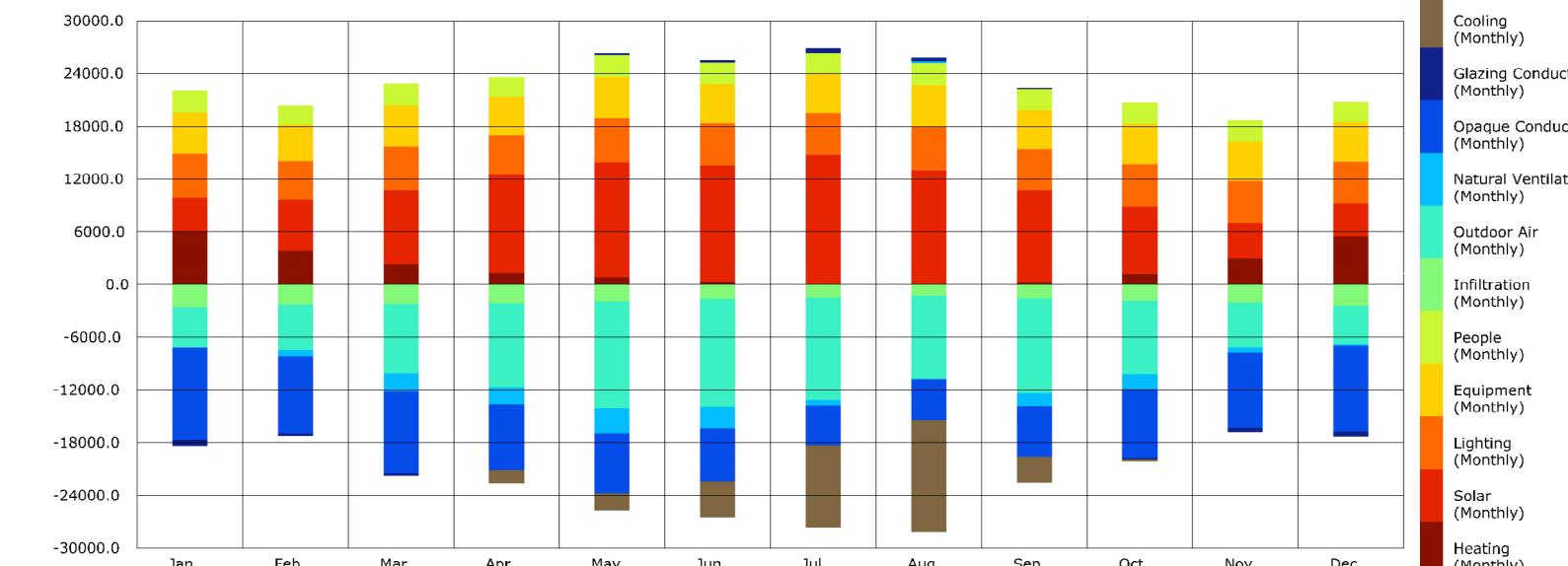
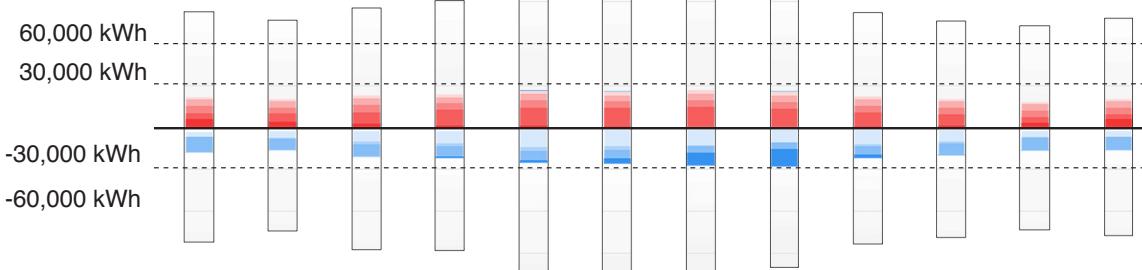
Energy Loads

Residential / Offices

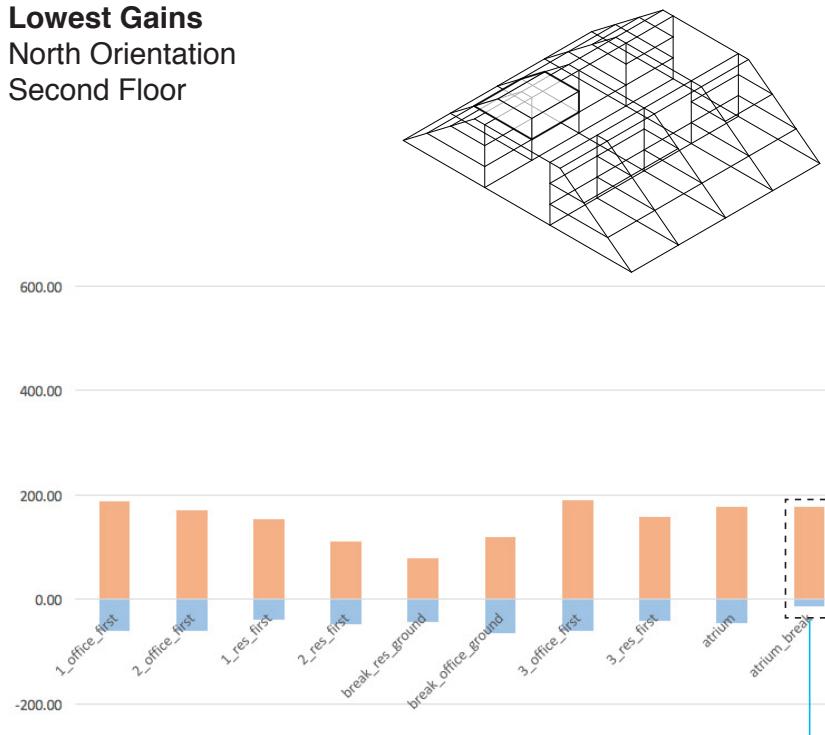
Residential Units



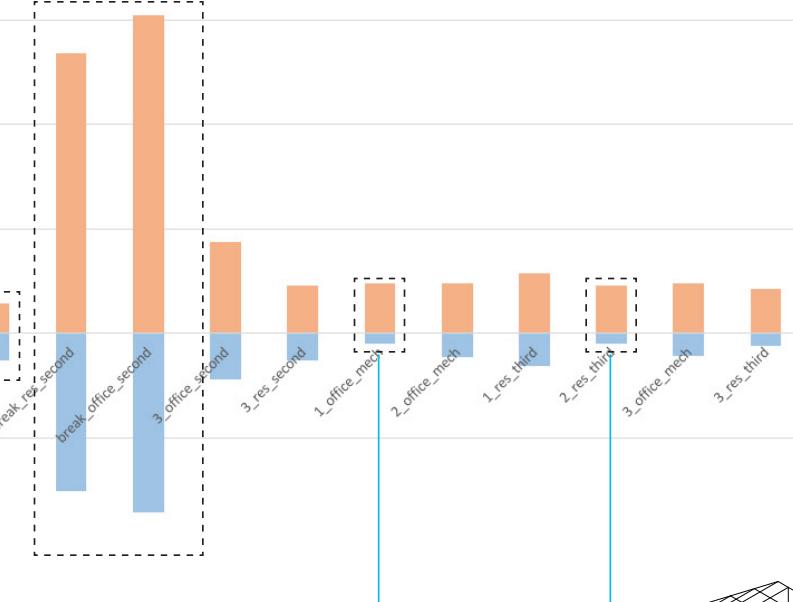
Offices



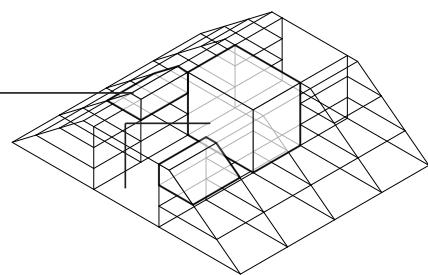
Lowest Gains
North Orientation
Second Floor



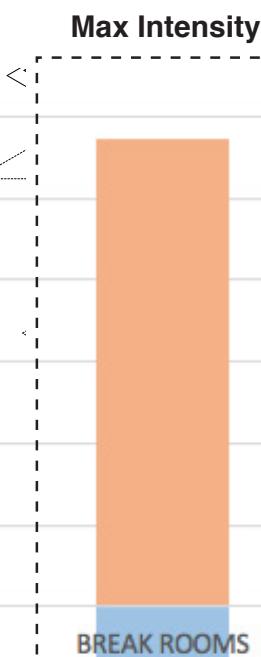
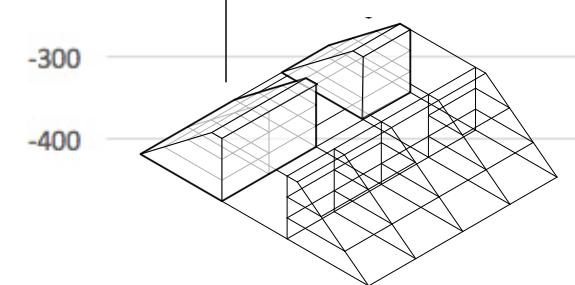
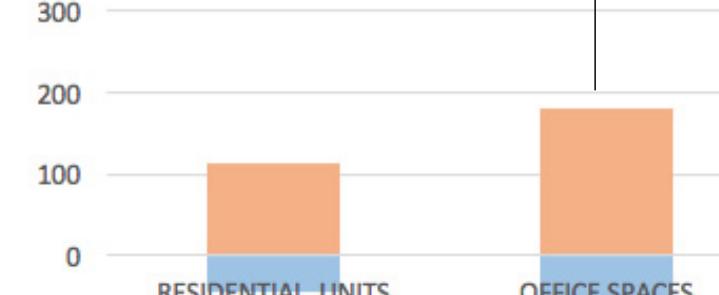
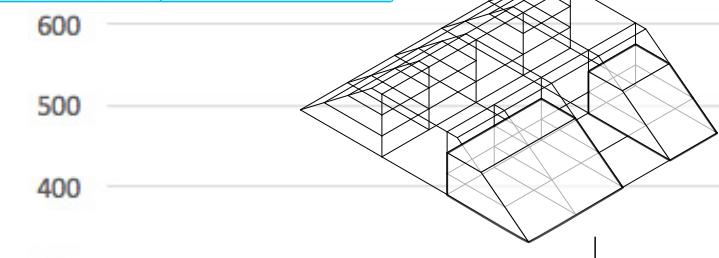
High S/V and windows to wall ratios
Break Rooms



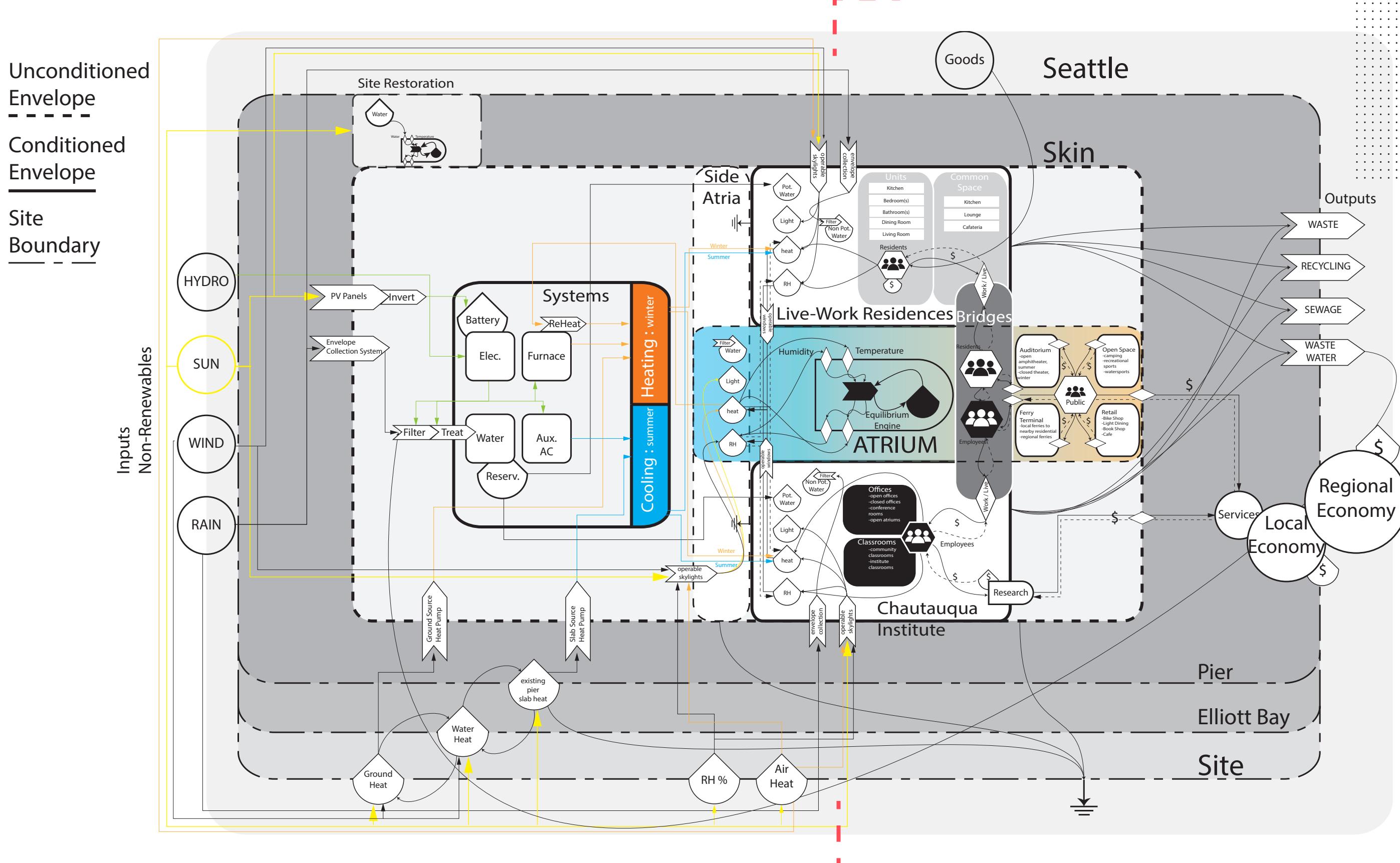
Lowest Losses
Low windows to wall ratio
No cooling (not conditioned)



Max Intensity



Energy Analysis



Emergency Section Detail

