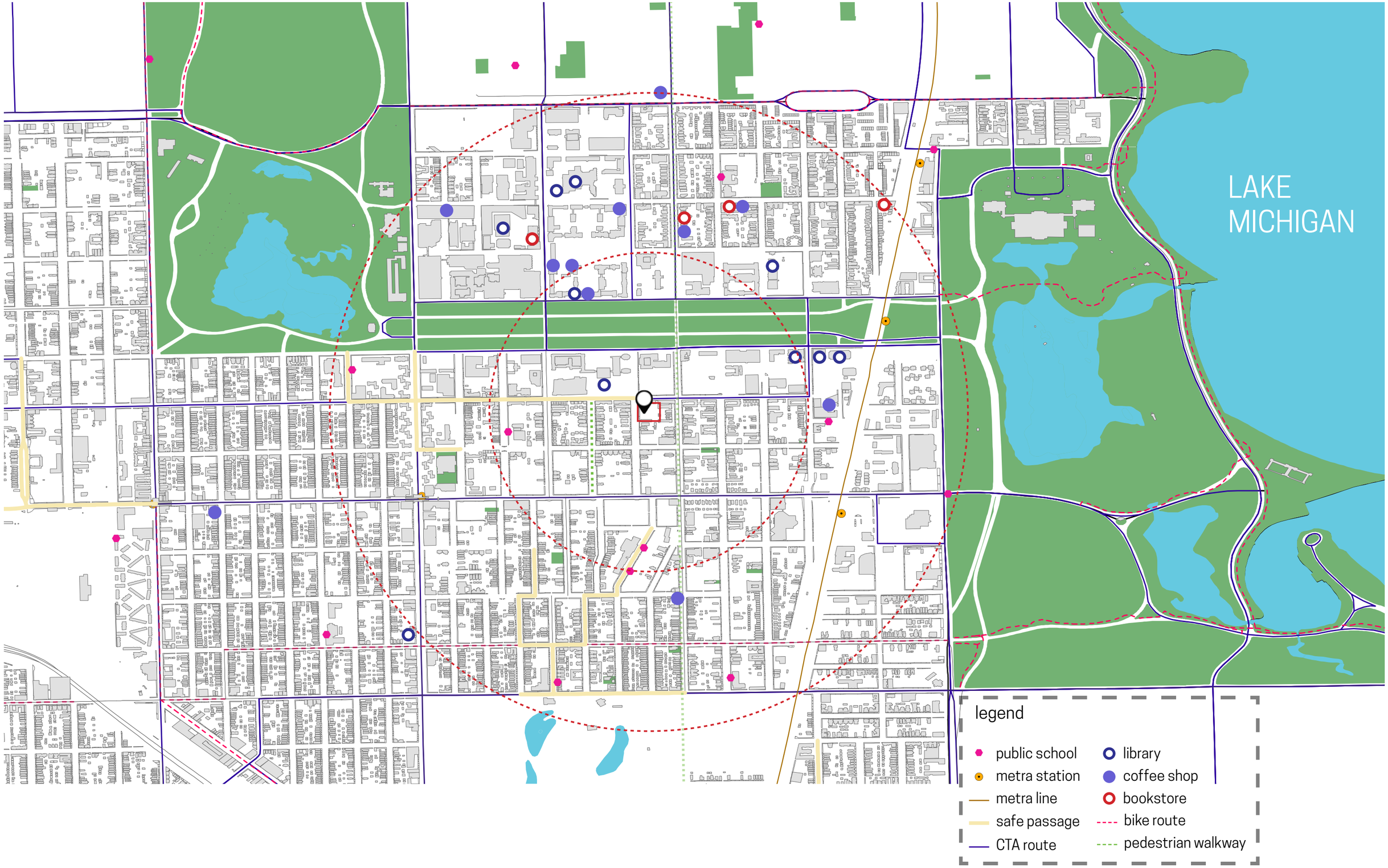

CHICAGO
ILLINOIS
Climate Zone 5

CHICAGO
ILLINOIS

WOODLAWN
ILLINOIS

6103 S University Ave


6103 S
UNIVERSITY AVE
1” = 100’-00”


LAKE
MICHIGAN
legend
public school
metra station
metra line
safe passage
CTA route
library
coffee shop
bookstore
bike route
pedestrian walkway

Chicago Climate Analysis

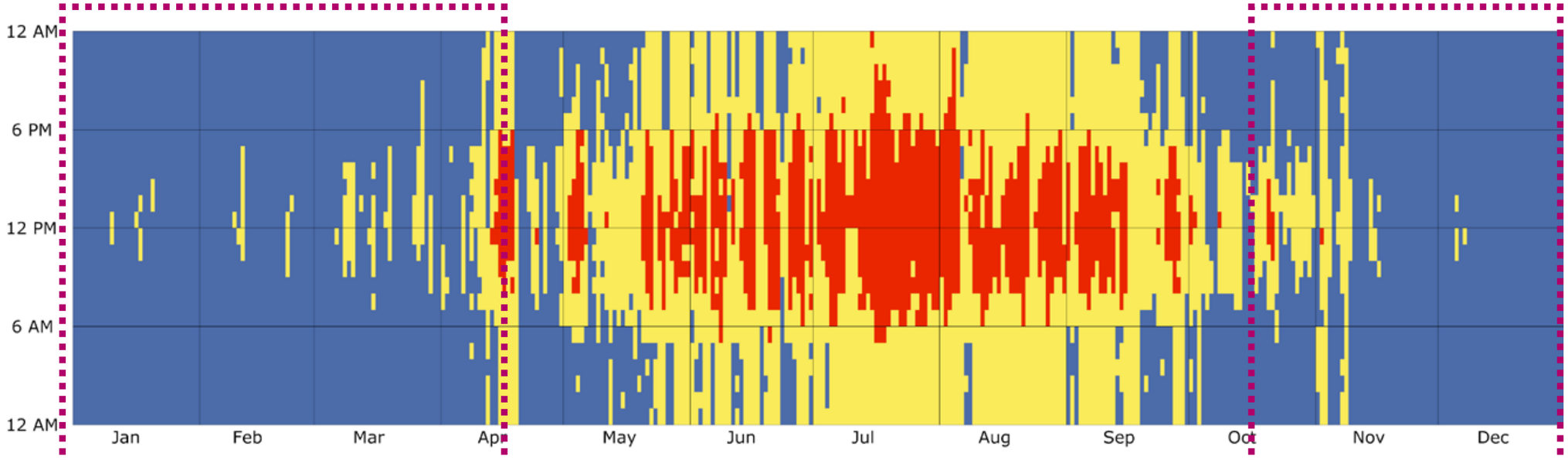
OUTDOOR THERMAL COMFORT

UNSHADED

32.19%
COMFORTABLE

8.65%
HOT

41.53%
COLD

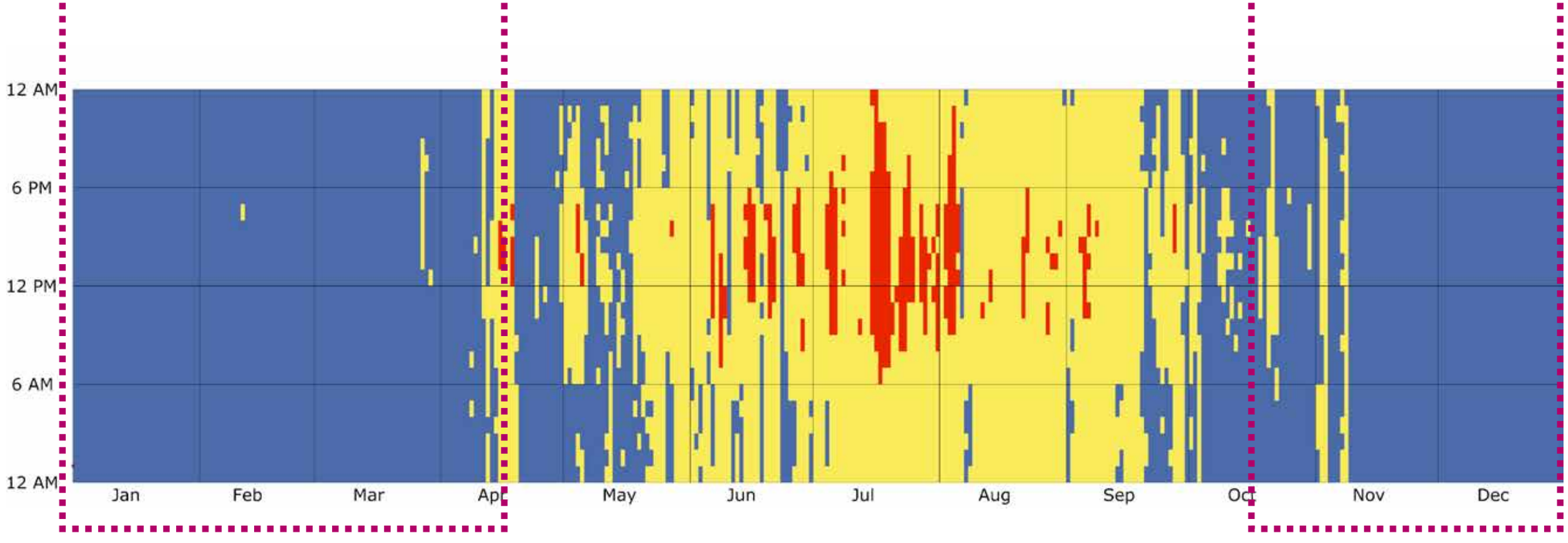


SHADED

35.68%
COMFORTABLE

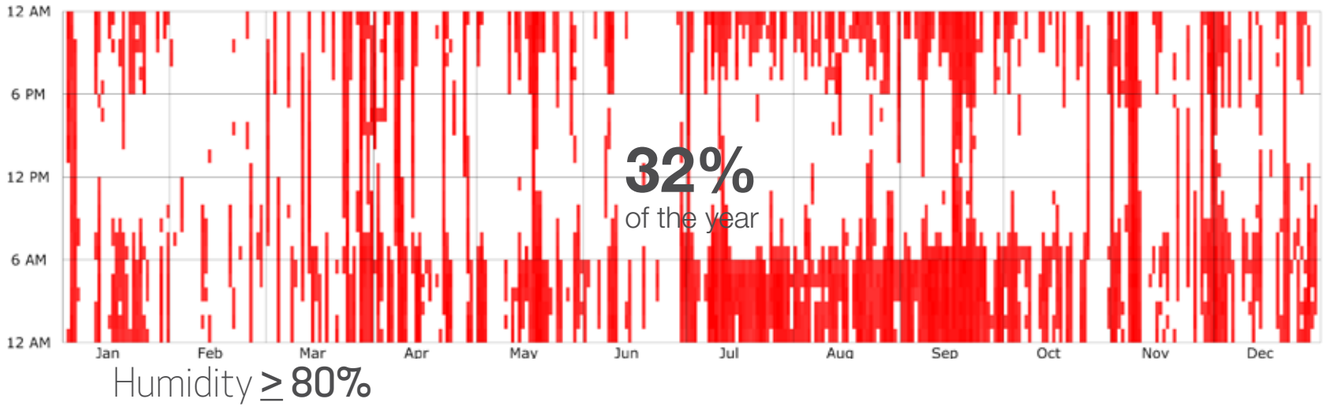
1.52%
HOT

45.10%
COLD

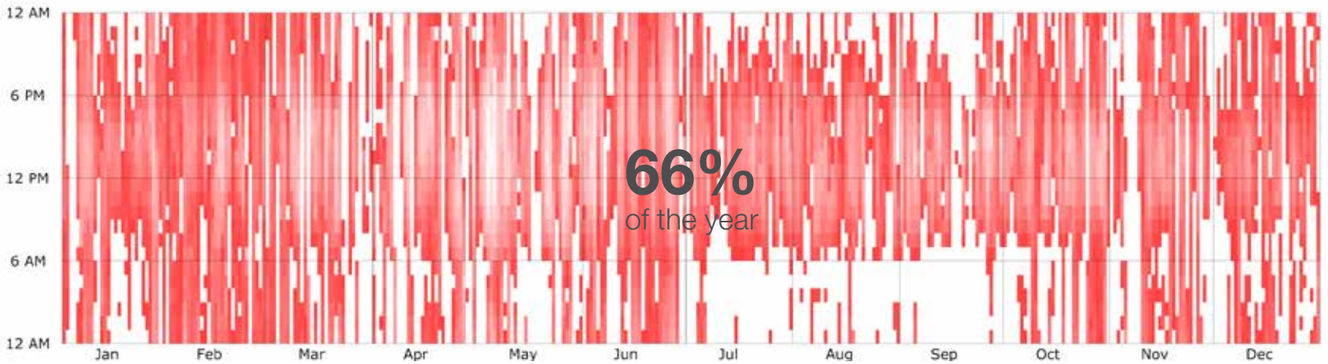


Chicago Climate Analysis

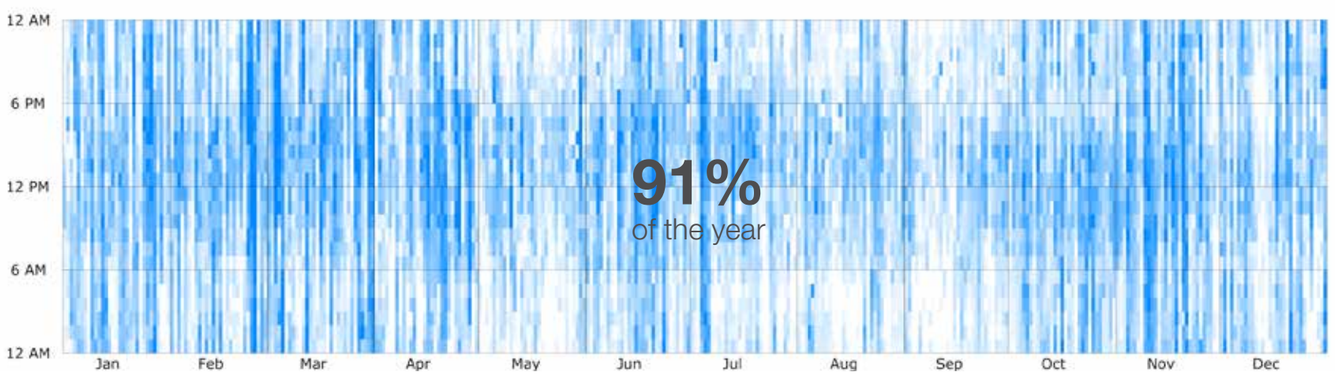
FACTORS DETERMINING COMFORT



Humidity ≥ 80%



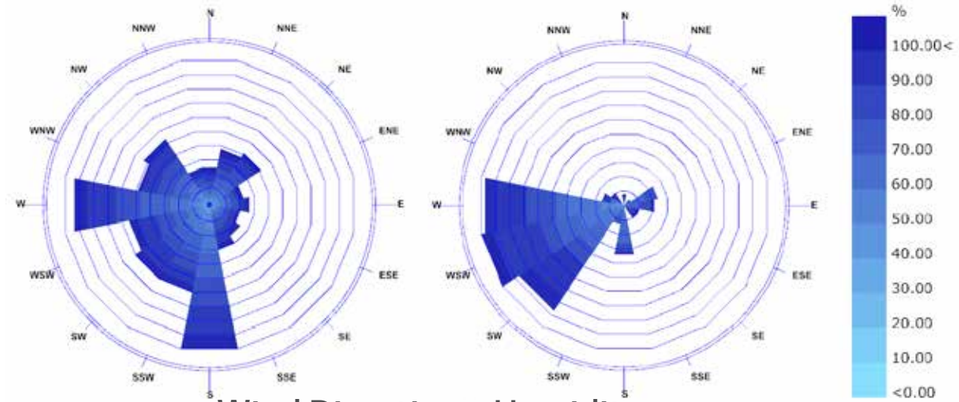
80% ≥ Humidity ≤ 80%



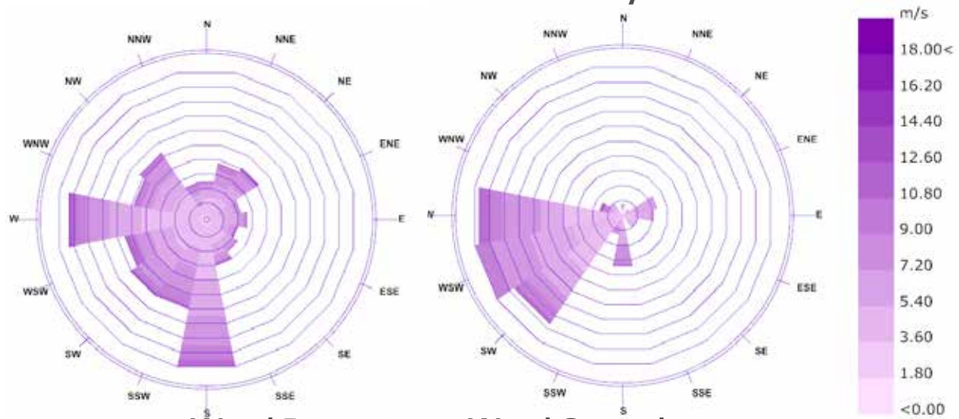
2 m/s ≤ Wind Speed ≤ 8 m/s

ANNUAL

HOTTEST WEEK



Wind Direction v Humidity



Wind Direction v Wind Speed

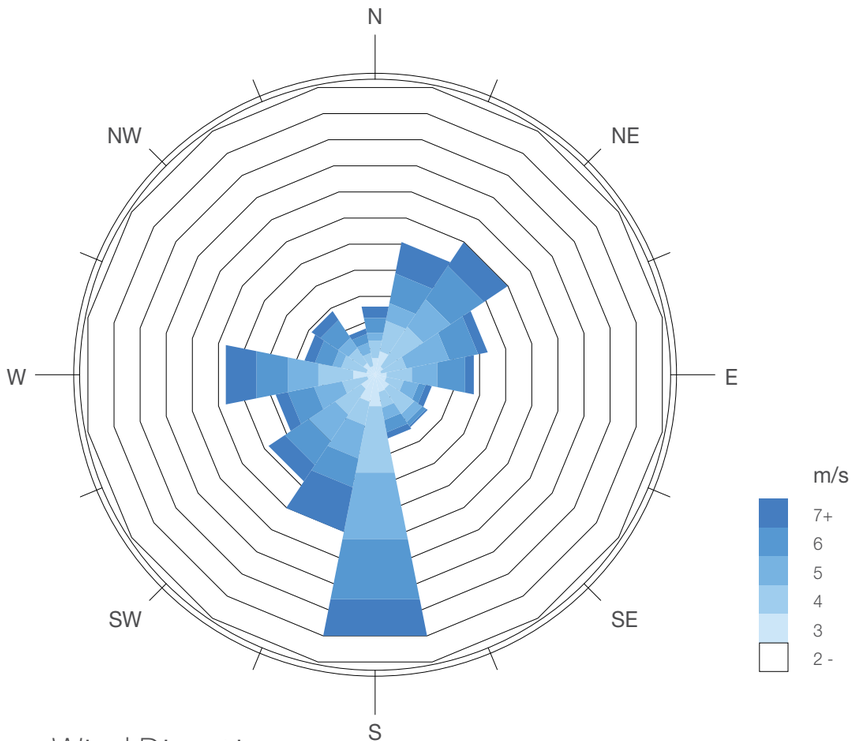
Chicago Climate Analysis

IDEAL CONDITION FOR VENTILATION

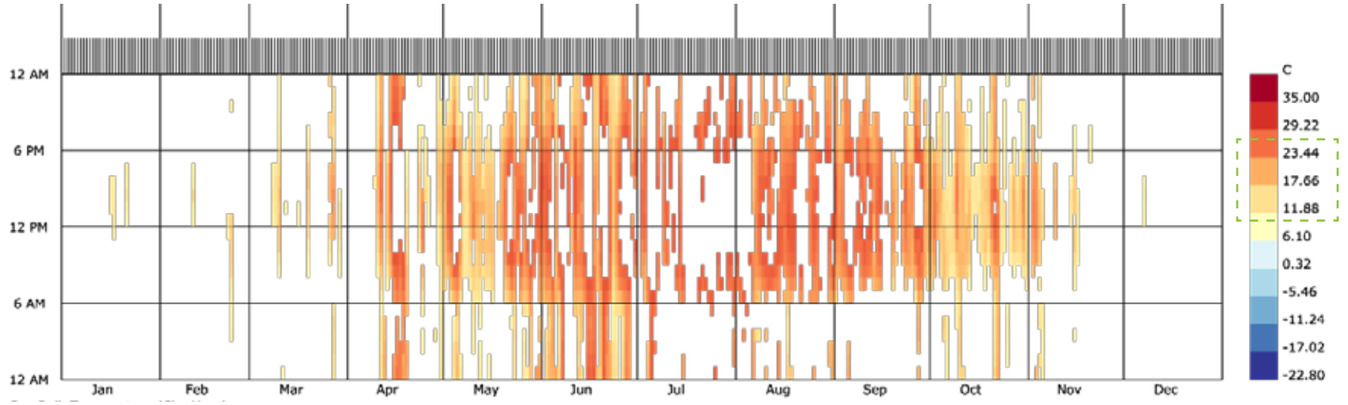
is indicated by the following parameters:

Outdoor Temperature: **9 °C (42.8 °F) > T_o > 26 °C (78.8 °F)**
Indoor Temperature: **$T_i \geq$ 24 °C (75.2 °F)**
Humidity: **20% > H > 80%**
Wind Speed: **2 m/s < Wind Speed < 8 m/s**

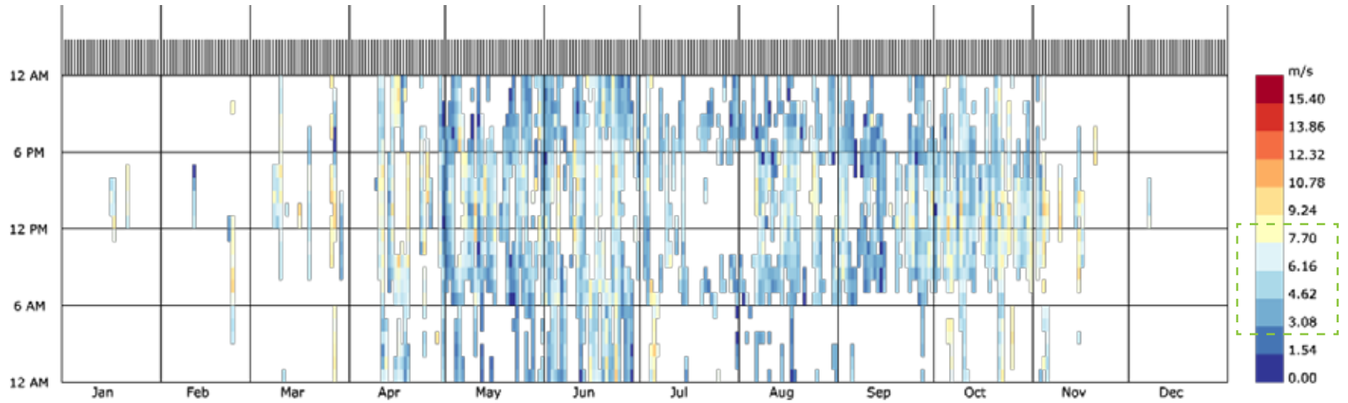
27.5%
of the year
Ideal for Natural Ventilation



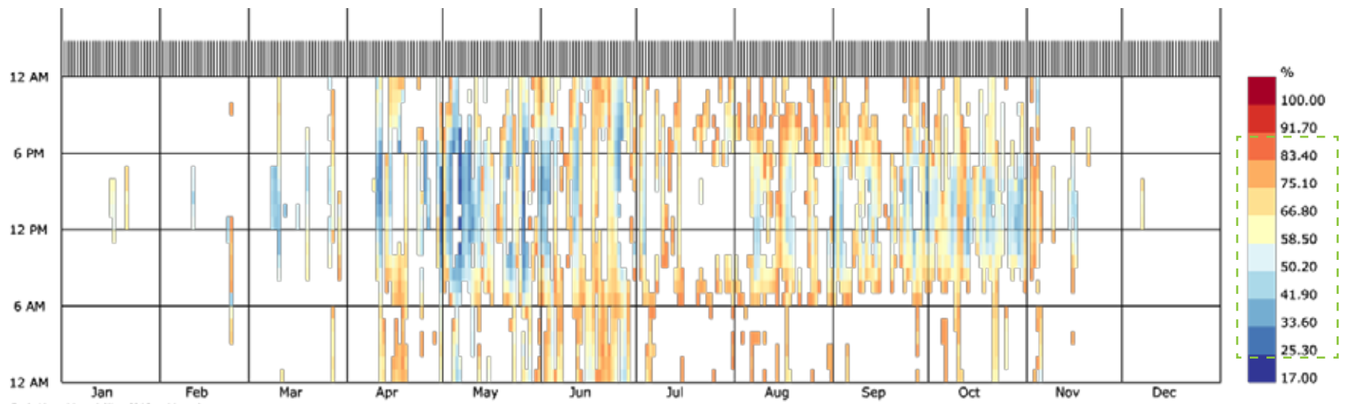
Wind Direction



Dry Bulb Temperature



Wind Speed



Humidity

FACTORS

Chicago experiences **primarily long winters** and **short summers**, with short shoulder seasons. Approximately **2/3 of the year is considered too cold for comfort.** Even deep in the seasons, **sporadic weather changes happen on an hourly and daily basis**.

PRIORITIES & GOALS

Our aim is to **maximize thermal comfort in the winter time and cross-checking with summer parameters to prevent overheating**. We also want to **maximize hours of natural daylight** throughout the year.

DESIGN & TEST

MASS

- **Increase solar gain (exposure) by increasing south-facing surface area**

MATERIAL & CONSTRUCTION

- **Increase insulation (R-value)**
- **Increase solar gain (exposure) by increasing WWR on the south and west**
- **Reduce infiltration (increase air tightness)**
- **Reduce thermal loss**

Climate to Building

SHOE-BOX STUDY TO INCREASE R-VALUE

[Fixed Parameters]

0.4 WWR

50’ X 100’ SHOE-BOX

[Tested Parameters]

ASHRAE 90.1-2010 **CZ 5**

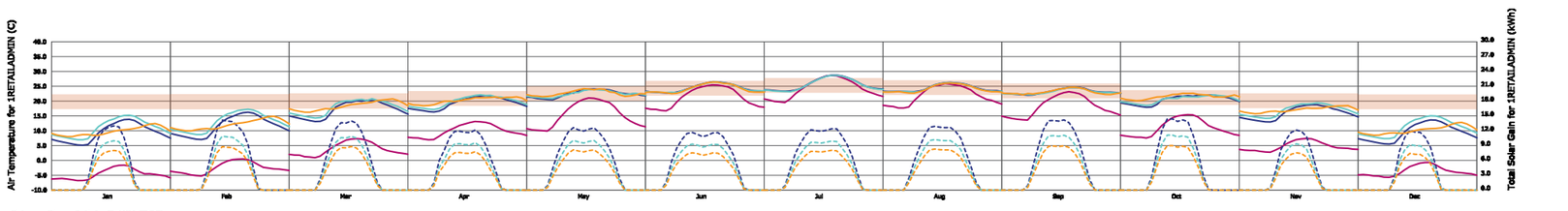
R-VALUE (SI / IP)

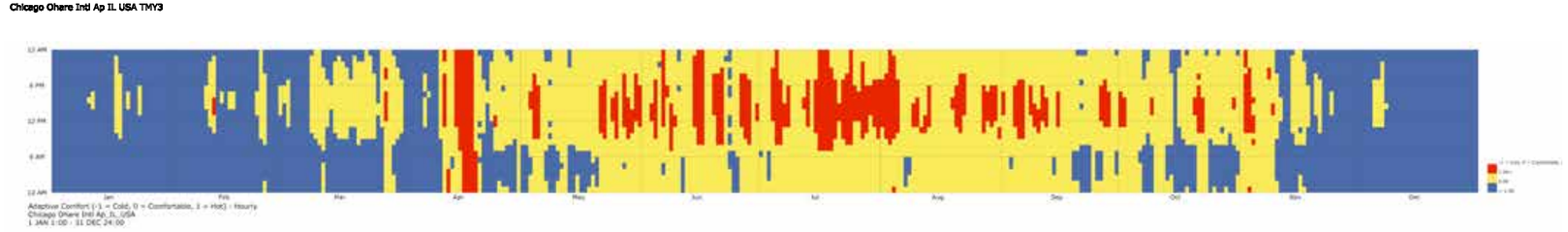
Ext. Wall **1.81 / 10.26**
Ext. Window **0.32 / 1.82**
Ext. Roof **3.53 / 20.05**
Attic Floor **6.33 / 35.97**

53.07%
COMFORTABLE

9.40%
HOT

37.53%
COLD





ASHRAE 90.1-2010 **CZ 8**

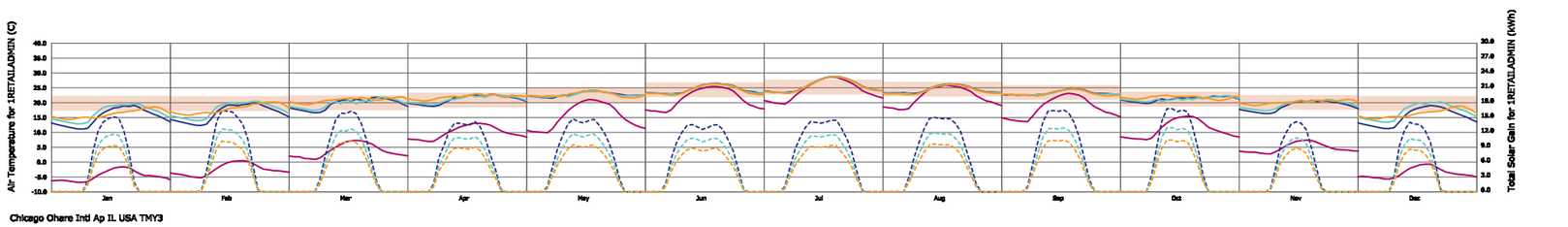
R-VALUE (SI / IP)

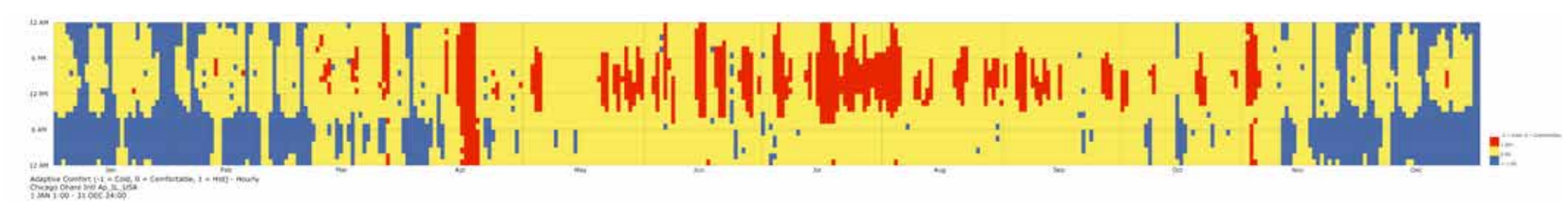
Ext. Wall **4.74 / 26.93**
Ext. Window **0.50 / 2.86**
Ext. Roof **4.89 / 27.79**
Attic Floor **6.33 / 35.97**

68.90%
COMFORTABLE

11.68%
HOT

19.41%
COLD





Climate to Building

SHOE-BOX STUDY TO INCREASE R-VALUE

[Fixed Parameters]

50’ X 100’ SHOE-BOX
ASHRAE 90.1-2010 CZ 8 CONSTRUCTION

TOTAL SOLAR GAIN | AIR TEMPERATURE

Retail + Admin/Office

Education

Residential

OUTDOOR TEMPERATURE | ADAPTIVE COMFORT RANGE

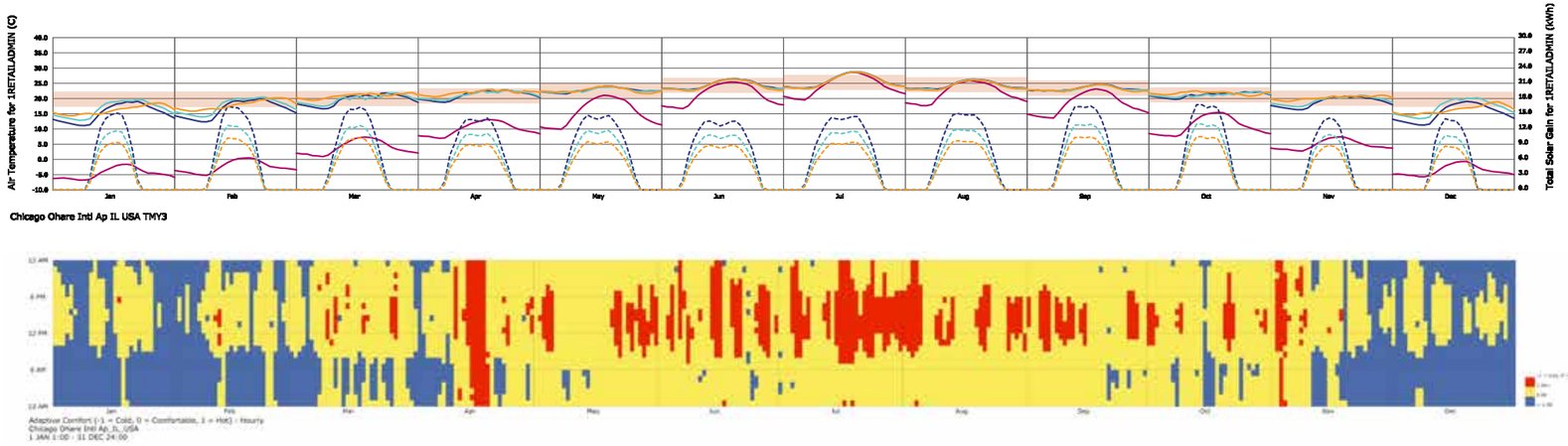
[Tested Parameters]

0.4 WWR 50’ X 100’ SHOE-BOX

68.90%
COMFORTABLE

11.68%
HOT

19.41%
COLD

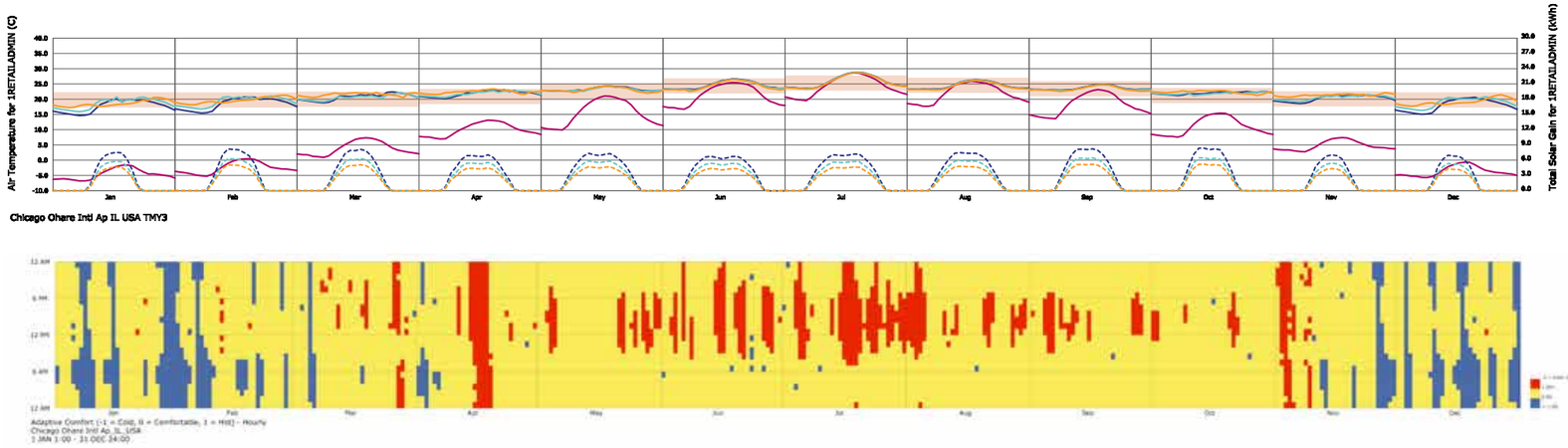


0.2 WWR 50’ X 100’ SHOE-BOX

79.70%
COMFORTABLE

10.94%
HOT

9.36%
COLD



Climate to Building
SHOE-BOX STUDY

[Fixed Parameters]

50’ X 100’ SHOE-BOX
ASHRAE 90.1-2010 CZ 8 CONSTRUCTION

[Tested Parameters]

TO REDUCE THERMAL LOSS AND INCREASE SOLAR GAIN

0.2 WWR N & E | 0.4 WWR S & W

75.20%
COMFORTABLE

12.16%
HOT

12.64%
COLD

FOR ARCHITECTURAL EXPRESSION

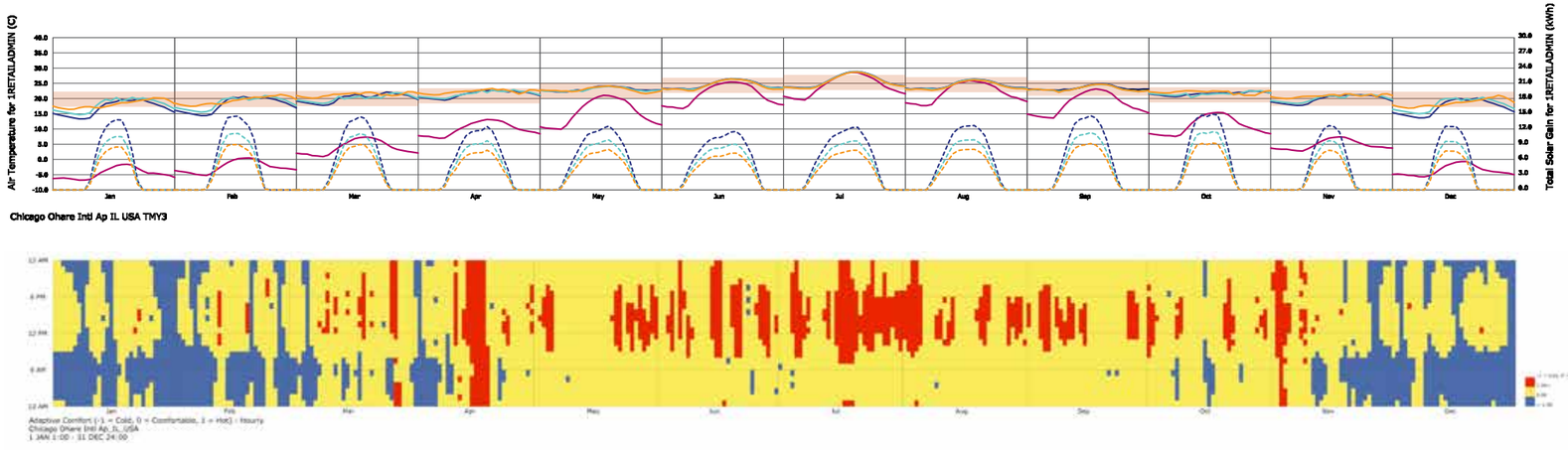
0.2 WWR N & E | 0.6 WWR S & W

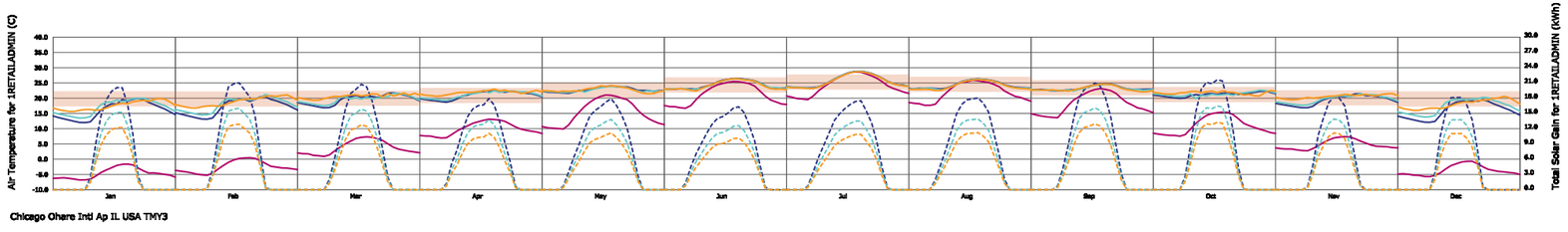
71.32%
COMFORTABLE

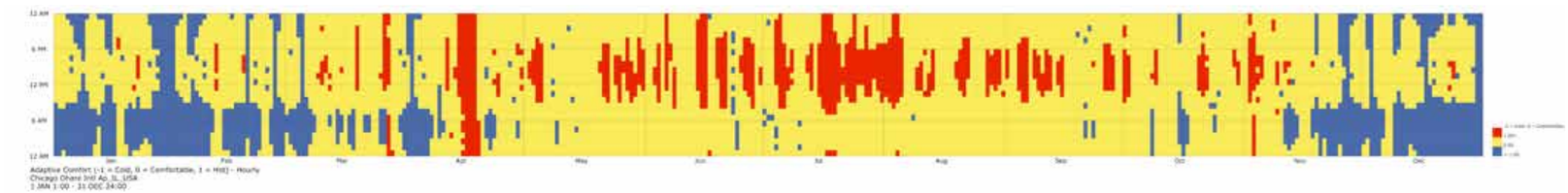
12.82%
HOT

15.86%
COLD

TOTAL SOLAR GAIN
AIR TEMPERATURE
Retail + Admin/Office
Education
Residential
OUTDOOR TEMPERATURE
ADAPTIVE COMFORT RANGE







Climate to Building

ENVELOPE BEHAVIOR + MECHANISM **INSPIRATIONS**

Climate to Building

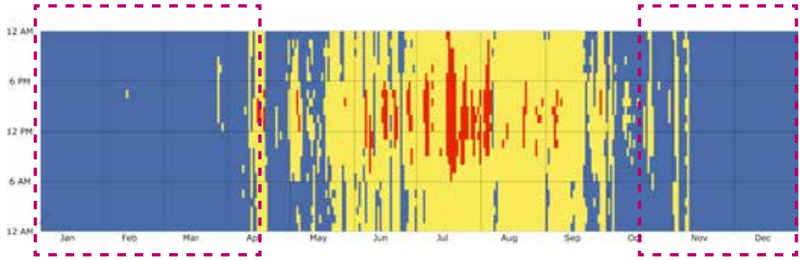
WHAT THE SKIN SHOULD DO IN THE DESIGN PERIOD

SHADED

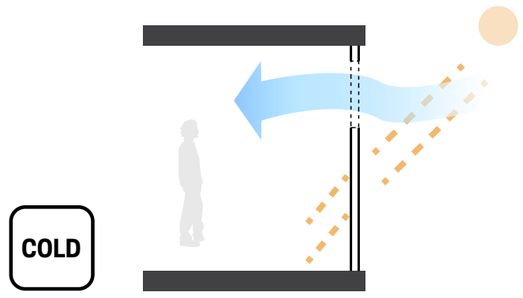
35.68%
COMFORTABLE

1.52%
HOT

45.10%
COLD



IN

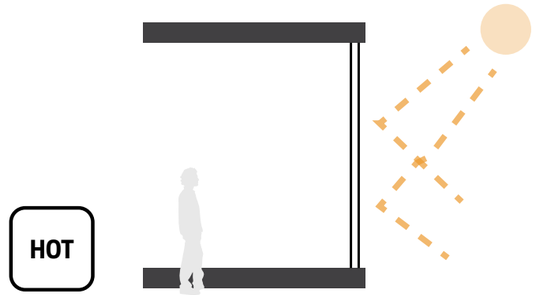


COLD

NO shade
Open Windows
Low R-Value

HOT

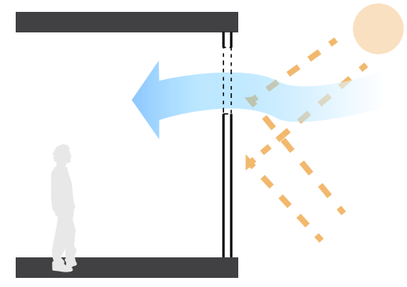
OUT



HOT

YES shade
CLOSE windows
Low R-Value

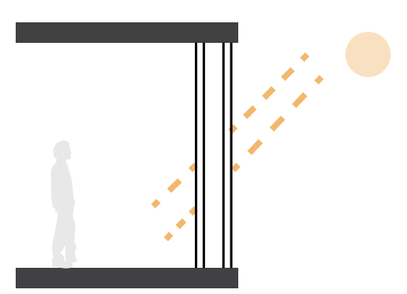
HOT



HOT

YES shade
OPEN windows
Low R-Value

COLD



COLD

NO shade
CLOSE windows
Increase R-Value

COLD

Climate to Building

PROGRAM ALLOCATION

PUBLIC

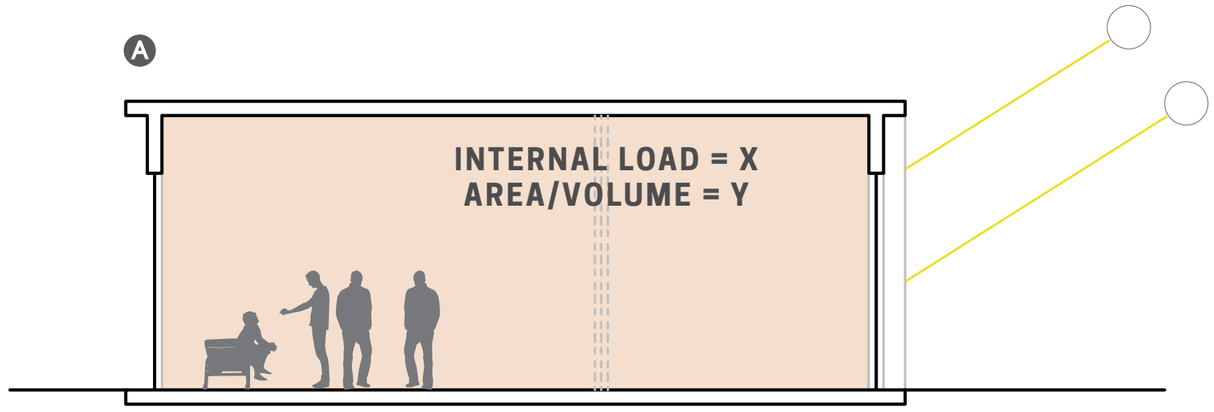
Cafe
Auditorium
Conference Rooms (varying in size)

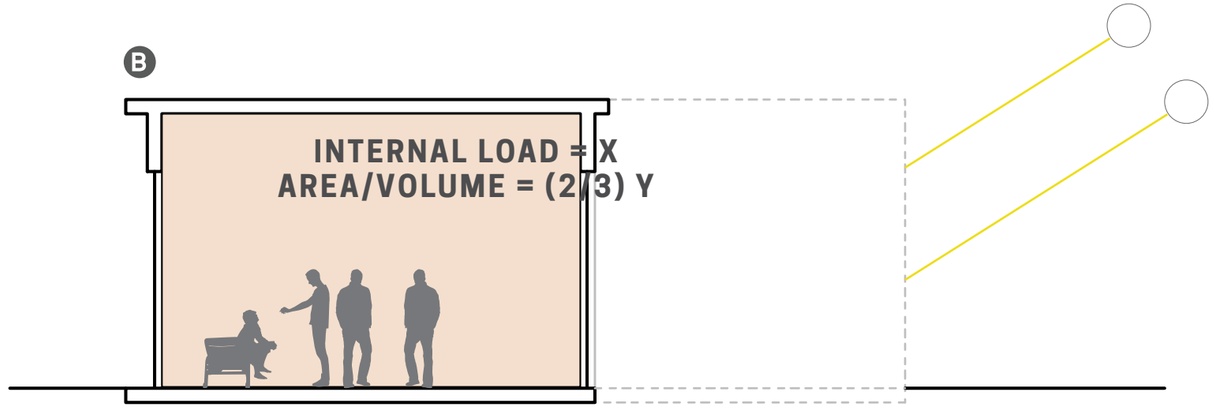
SEMI-PUBLIC
COLLABORATIVE

Research Director + Staff
Small + Large Offices
Research + Team Office
Director + Staff Office

PRIVATE

Apartment Units with Shared Lounge + Kitchen

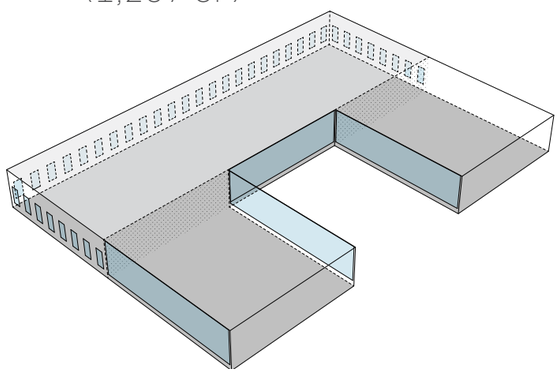

A
INTERNAL LOAD = X
AREA/VOLUME = Y


B
INTERNAL LOAD = X
AREA/VOLUME = (2/3) Y

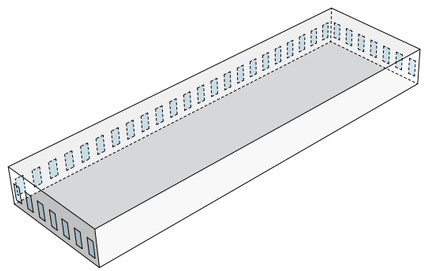
Climate to Building

SQUARE FOOTAGE + VOLUME REDUCTION ANALYSIS

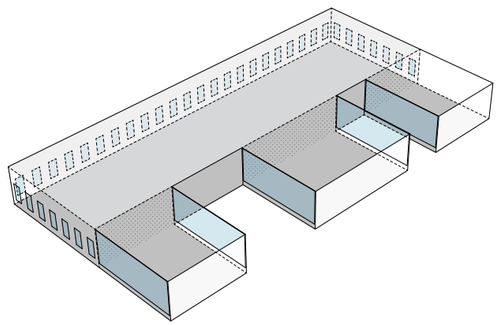
1 BASE U
(1,207 SF)



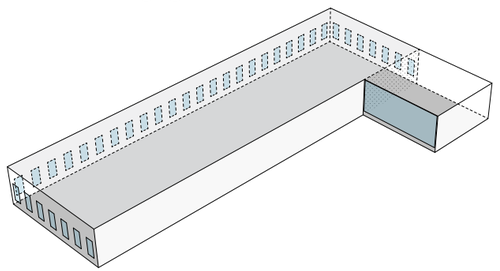
2 BAR
(627 SF)



3 BAR FULL EXPANSION
(953 SF)

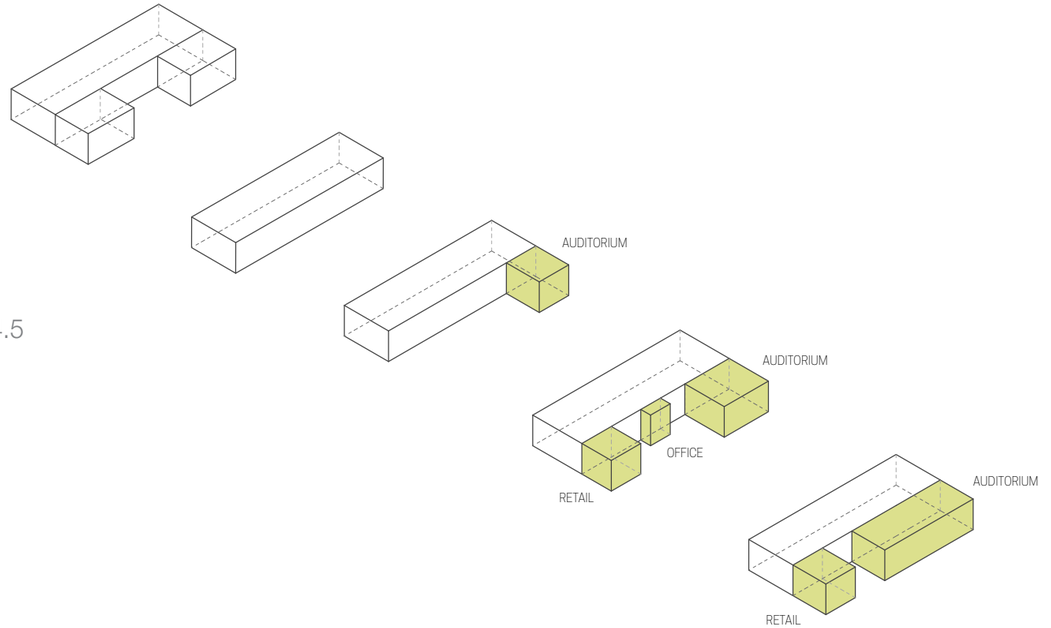


4 BAR + AUDITORIUM
(720 SF)



[Fixed Parameters]

- Adiabatic Floor
- Adiabatic Ceiling/Roof
- Glazing: Triple-pane, Low-e, Argon: R(IP)-5
- 2” Aerogel: R(IP)-20
- Passivhaus Wall Construction: R(IP)-40
- Enclosure: Triple-pane, Low-e, Argon: R(IP)-4.5

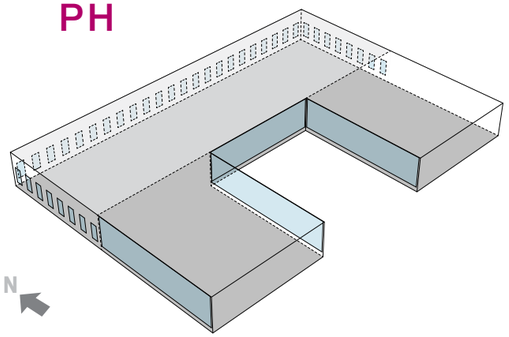


Climate to Building

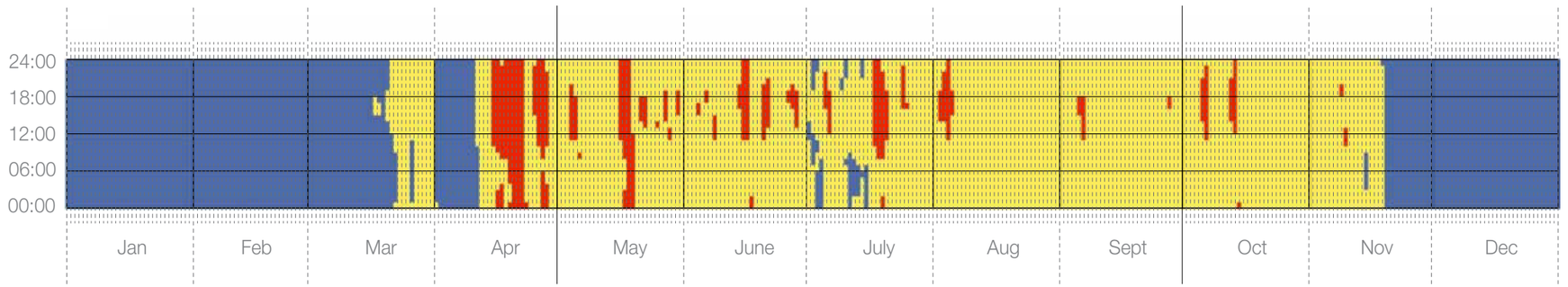
NARRATIVE ANALYSIS RESULTS

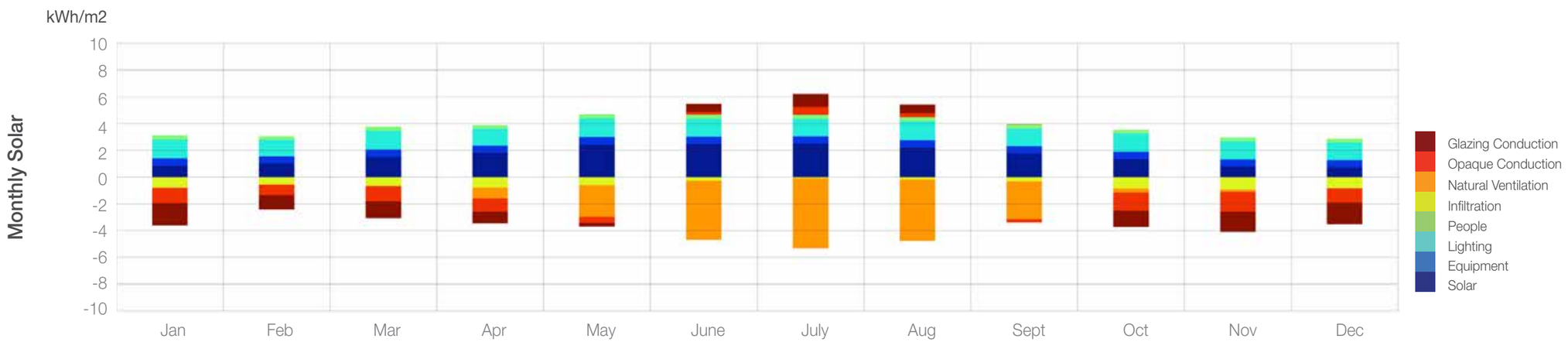
1 BASE U OPEN SPACE
(1,207 SF)

PH



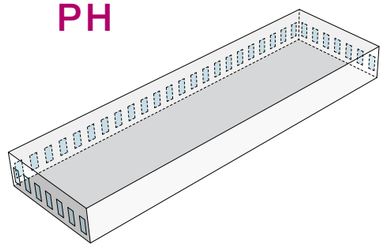
	ANNUAL
COMFORTABLE	54.99%
HOT	07.69%
COLD	37.32%





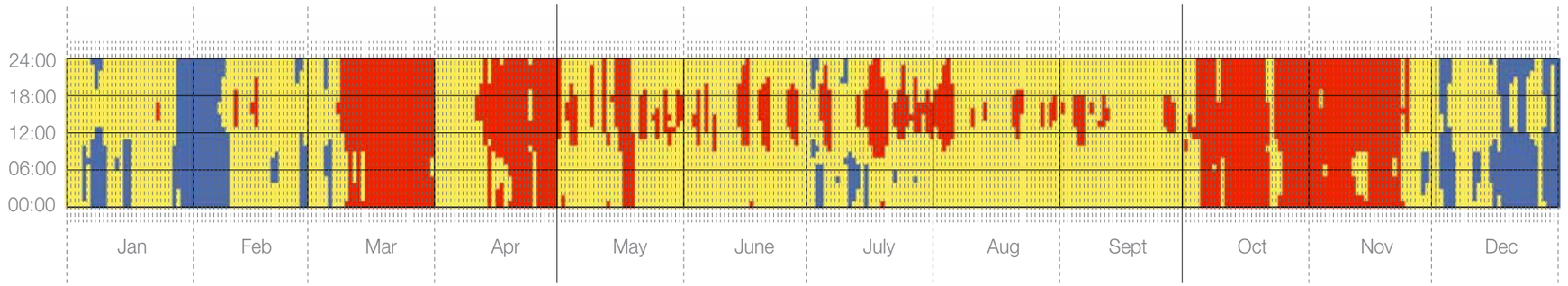
2 BAR
(627 SF)

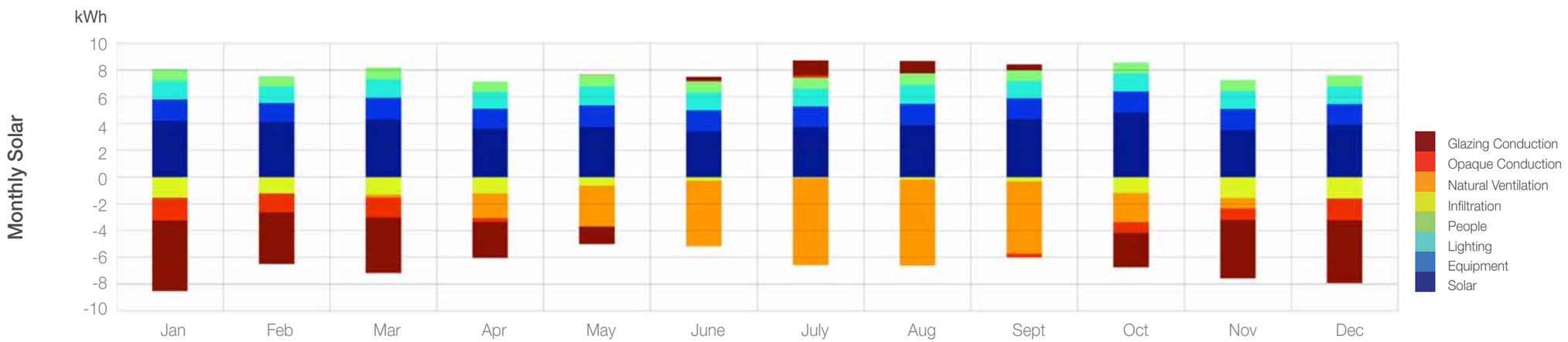
PH



N

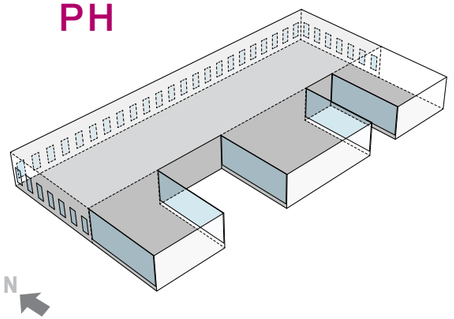
	ANNUAL
COMFORTABLE	57.13%
HOT	32.38%
COLD	10.47%



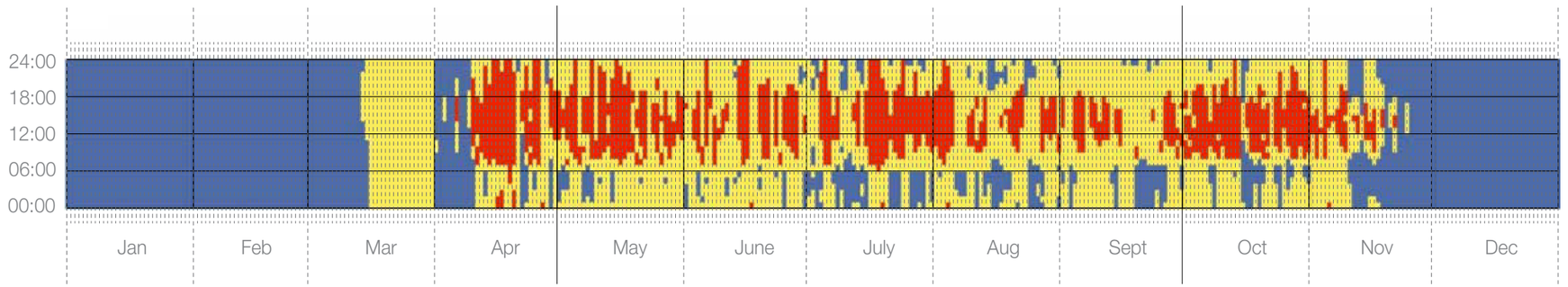


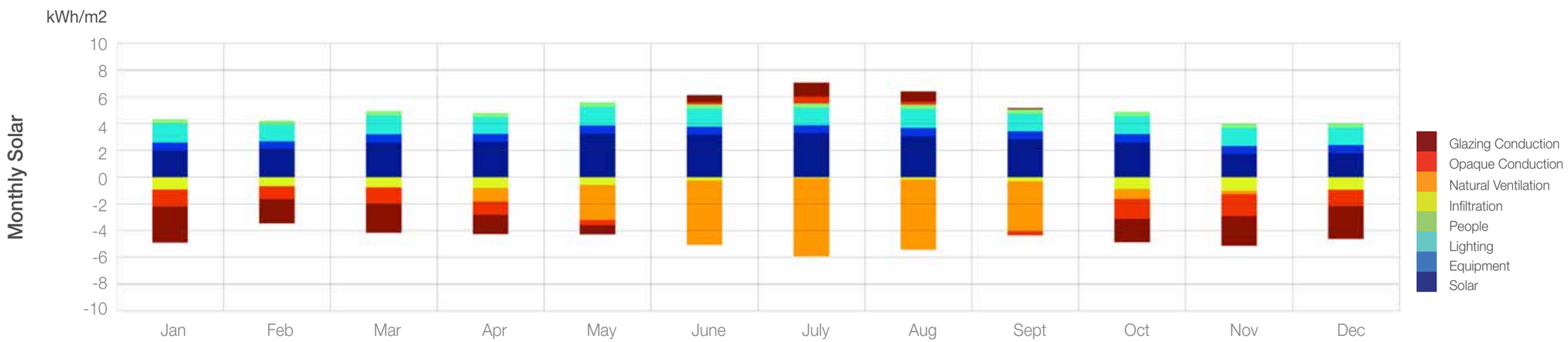
3 BAR FULL EXPANSION
(953 SF)

PH



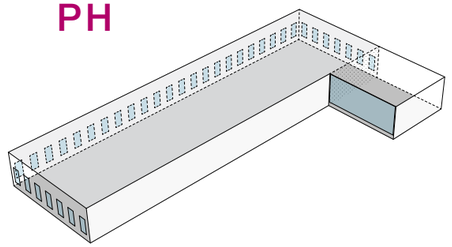
	ANNUAL
COMFORTABLE	55.43%
HOT	10.21%
COLD	34.36%





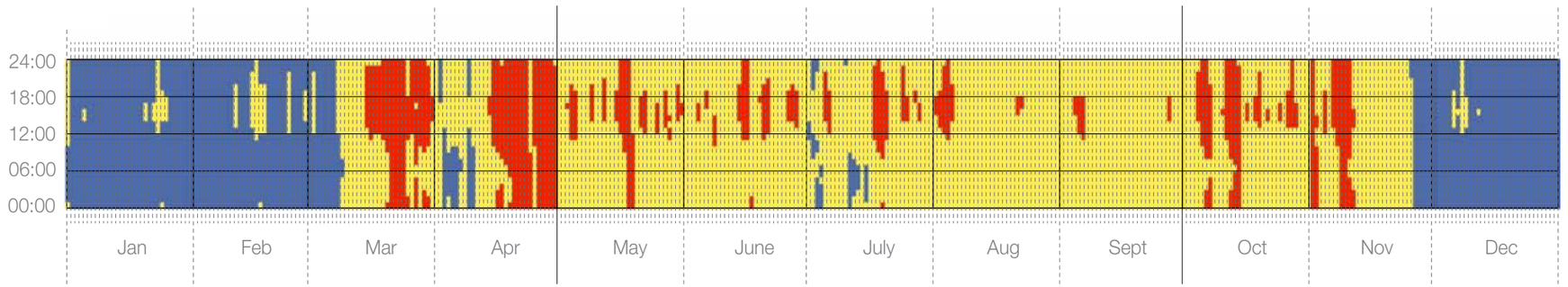
4 BAR FIXED AUDITORIUM
(720 SF)

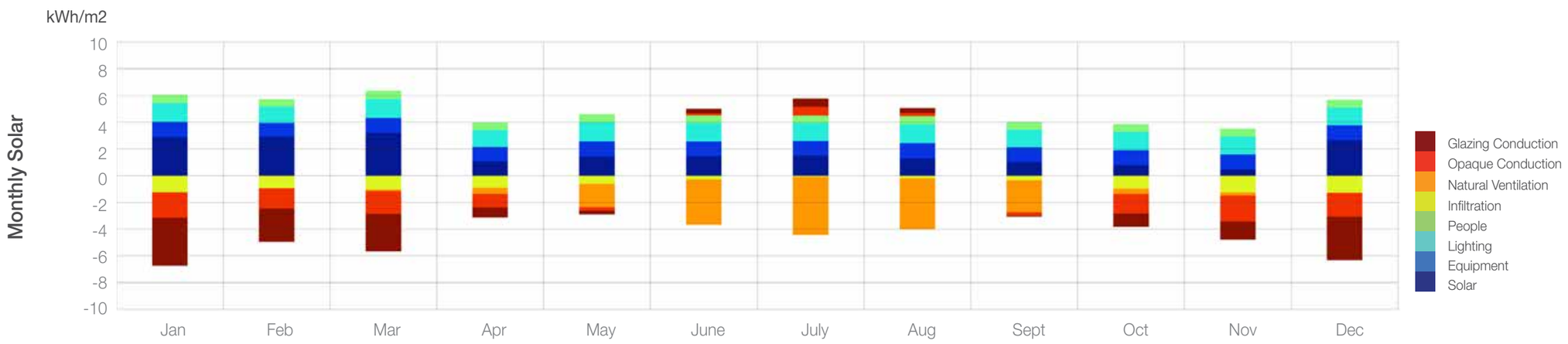
PH



N

	ANNUAL
COMFORTABLE	58.63%
HOT	14.02%
COLD	27.33%

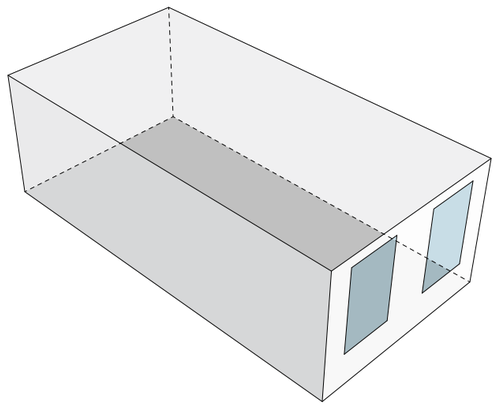




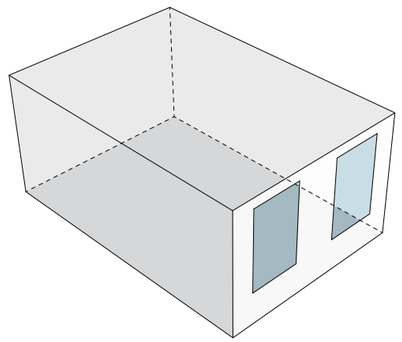
Climate to Building

NARRATIVE ANALYSIS PARAMETERS

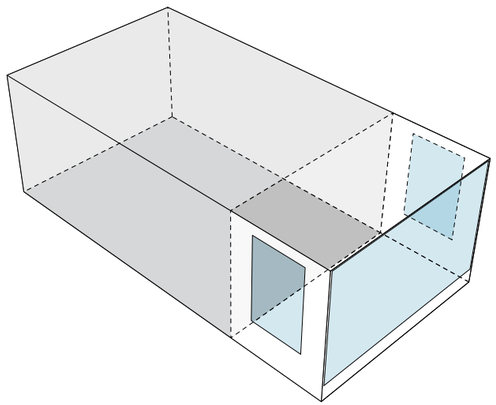
1 RESIDENTIAL UNIT
(442.5 SF)



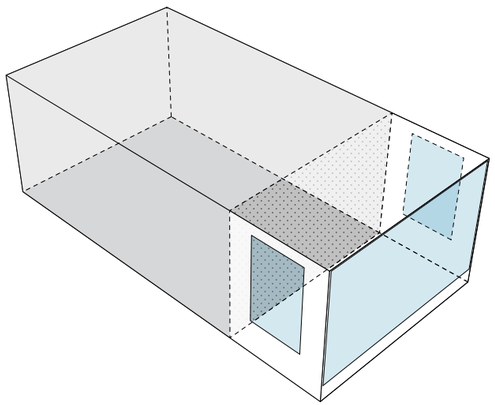
2 25% REDUCTION
(330 SF)



3 EXPANDED SKIN
(442.5 SF)



4 EXPANDED DOUBLE SKIN
(330 + 112.5 SF)



[Fixed Parameters]

- Adiabatic Floor
- Adiabatic Ceiling/Roof
- Glazing: Triple-pane, Low-e, Argon: R(IP)-4.919
- 2” Aerogel: R(IP)-41.335
- Passivhaus Wall Construction: R(IP)-41.335
- Enclosure: Triple-pane, Low-e, Argon: R(IP)-4.919

N

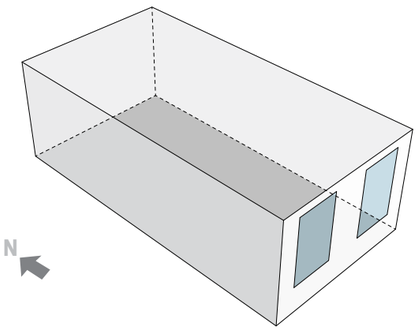
Climate to Building

NARRATIVE ANALYSIS RESULTS

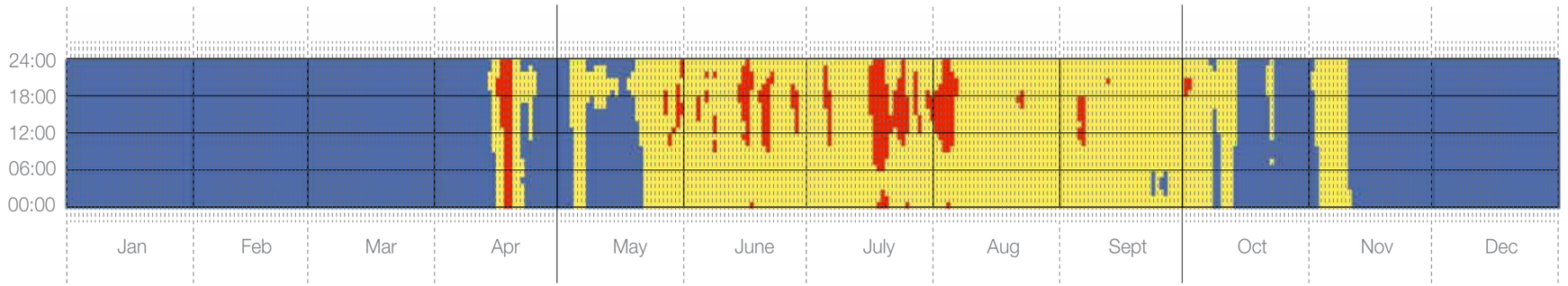
1 RESIDENTIAL UNIT

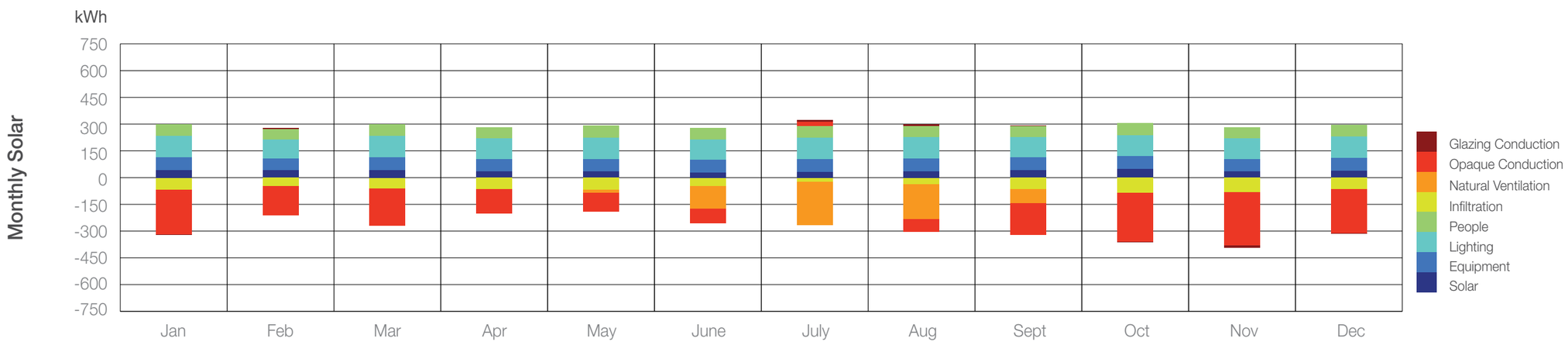
(442.5 SF)

PH



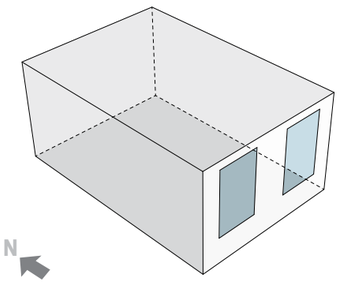
	ANNUAL
COMFORTABLE	40.89%
HOT	04.57%
COLD	54.54%



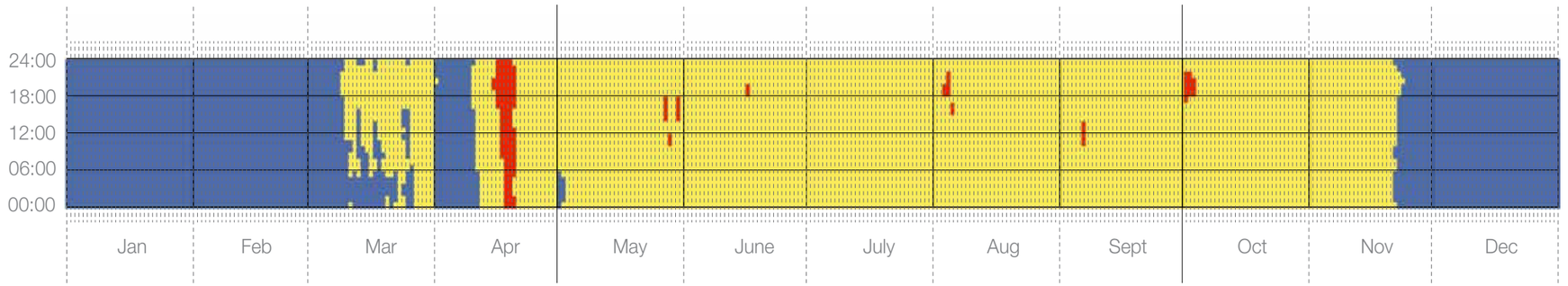


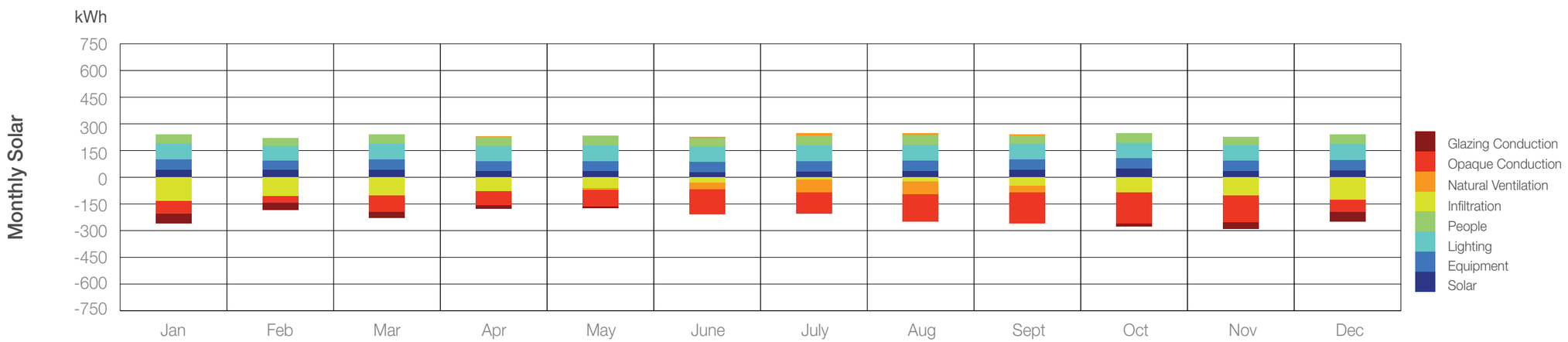
2 25% REDUCTION
(330 SF)

PH



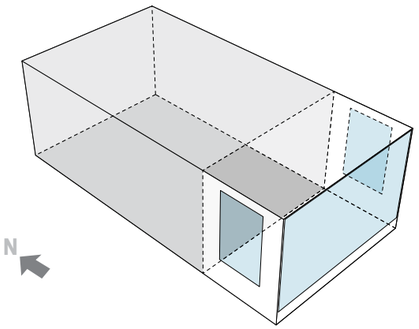
	ANNUAL	COLD PERIOD OCT 1 - APR 30	HOT PERIOD MAY 1 - SEPT 30
COMFORTABLE	64.60% ↑	39.72%	99.07%
HOT	01.45% ↓	02.02%	00.65%
COLD	33.95% ↑	58.25%	00.27%



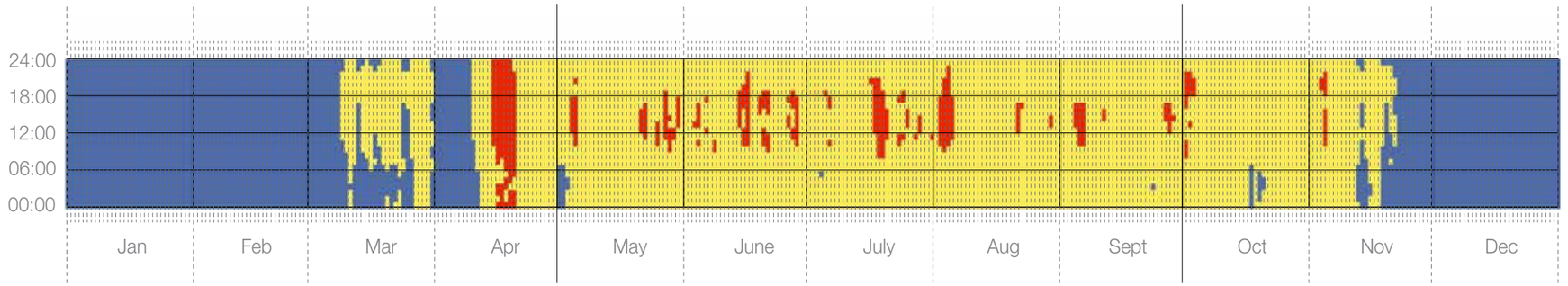


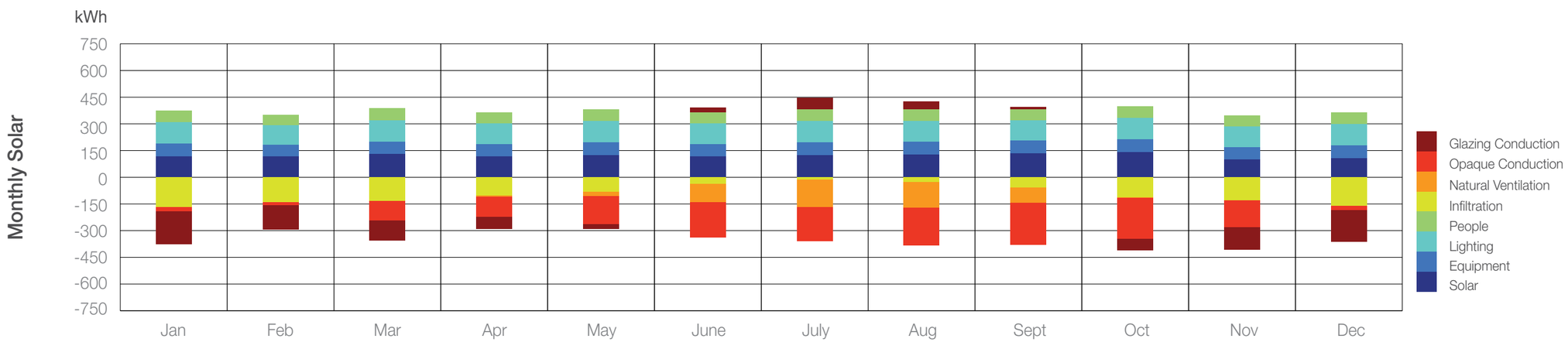
3 EXPANDED SKIN
(442.5 SF)

PH



	ANNUAL	COLD PERIOD OCT 1 - APR 30	HOT PERIOD MAY 1 - SEPT 30
COMFORTABLE	60.03% ↓	36.46%	92.70%
HOT	04.53% ↑	02.89%	06.81%
COLD	35.43% ↑	60.65%	00.49%





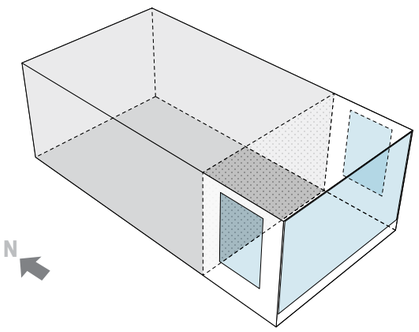
Climate to Building

NARRATIVE ANALYSIS RESULTS

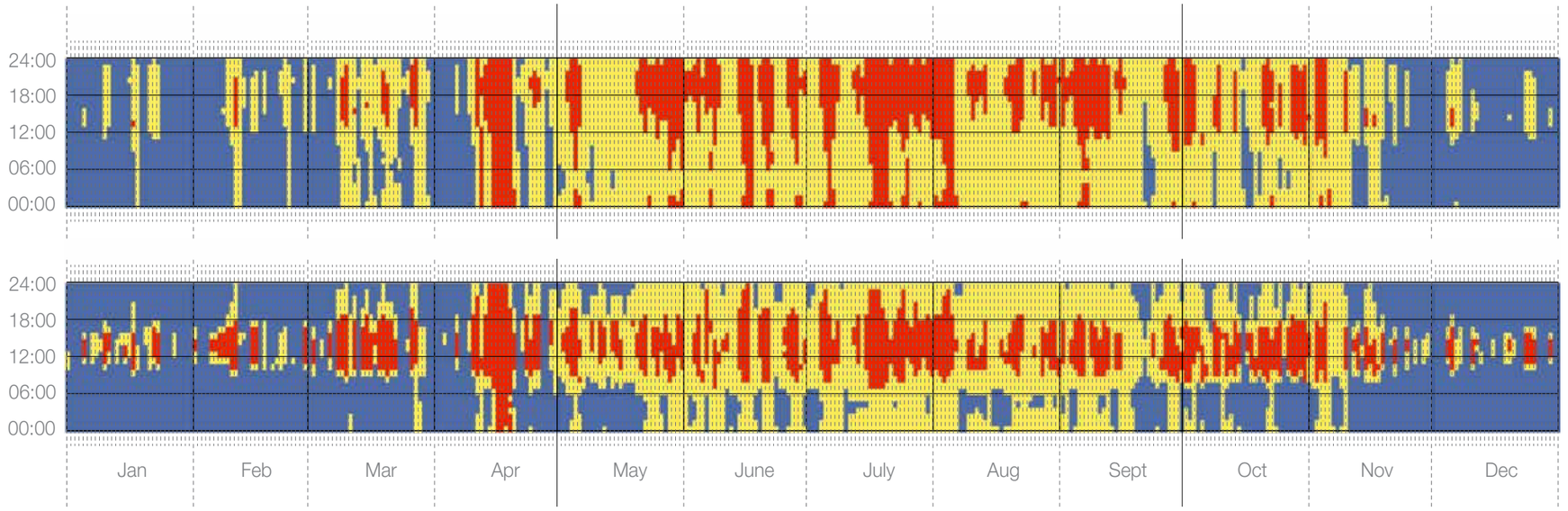
4 EXPANDED DOUBLE SKIN

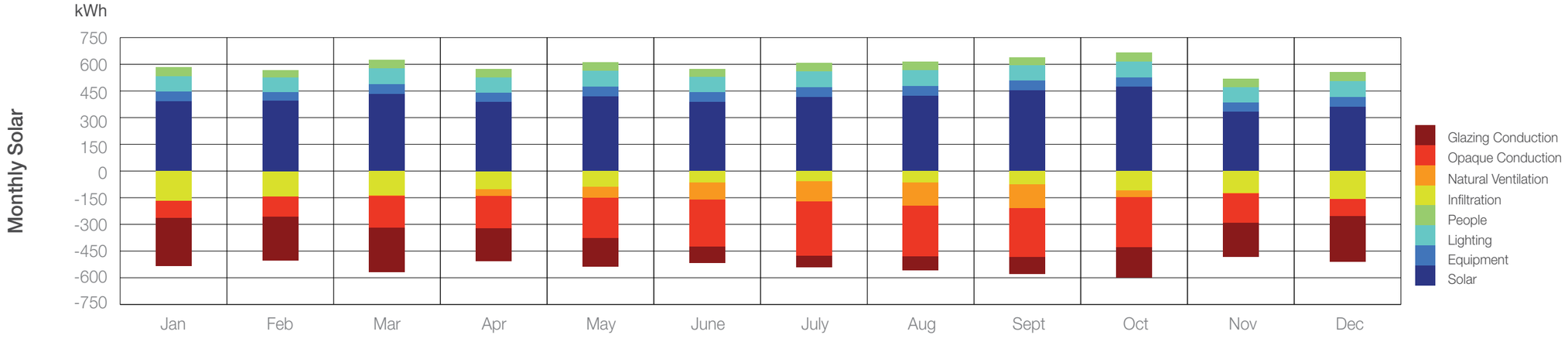
(330 + 112.5 SF)

CZ-8



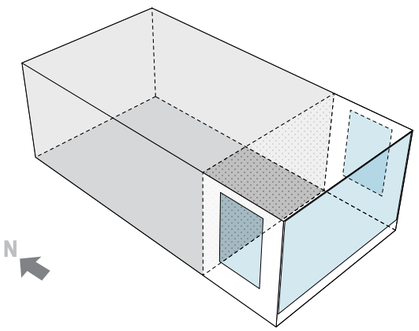
	ANNUAL	COLD PERIOD OCT 1 - APR 30	HOT PERIOD MAY 1 - SEPT 30
COMFORTABLE	51.84% ↑	26.92%	64.09%
HOT	16.50% ↓	11.44%	27.63%
COLD	31.67% ↑	61.64%	08.27%



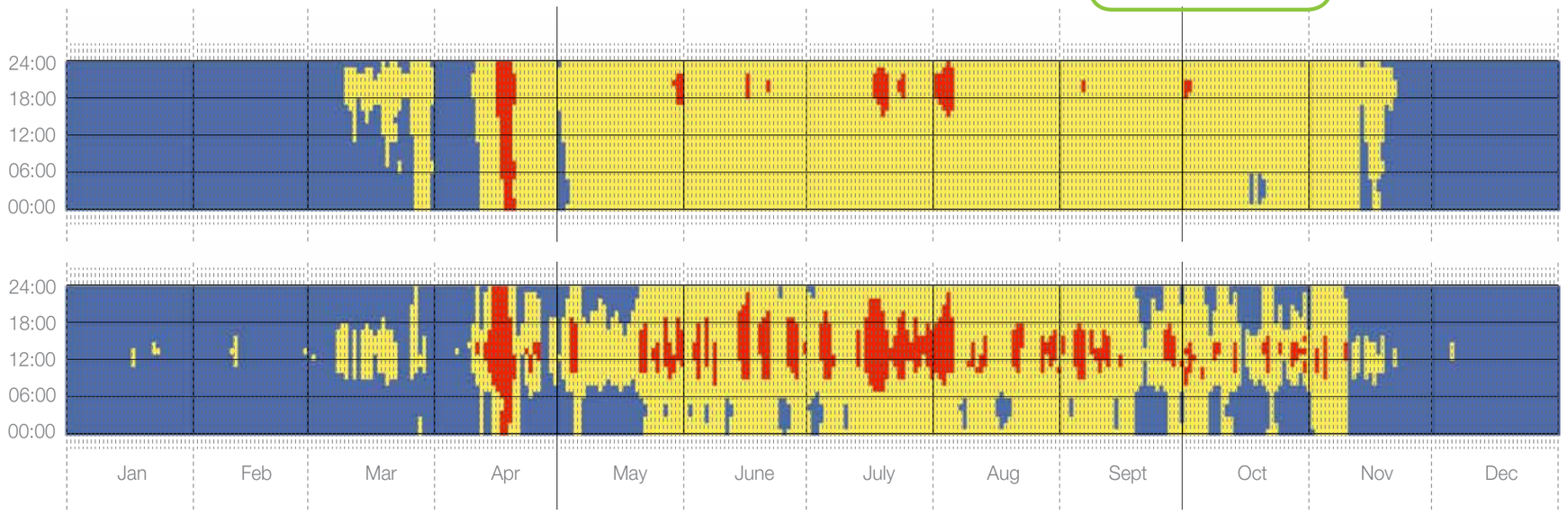


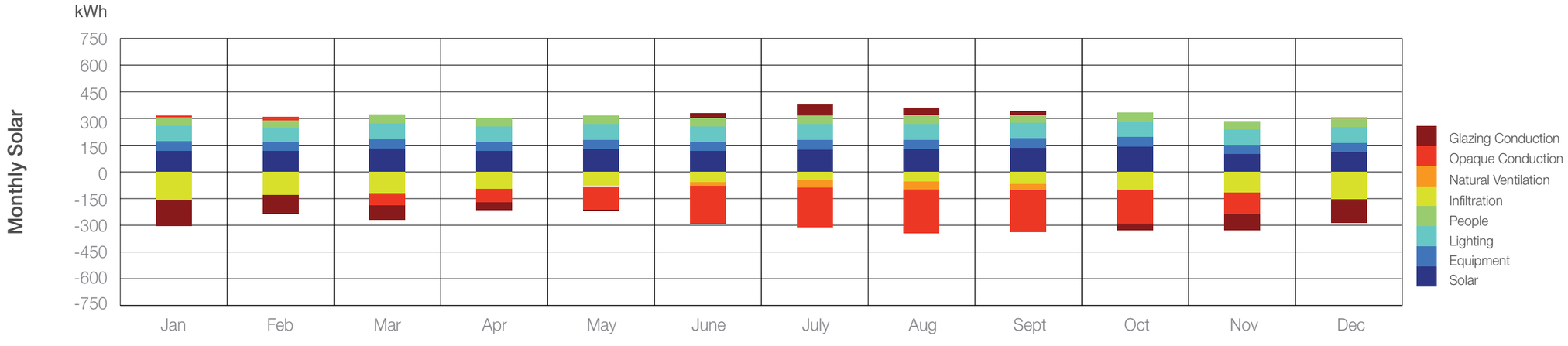
4 EXPANDED DOUBLE SKIN
(330 + 112.5 SF)

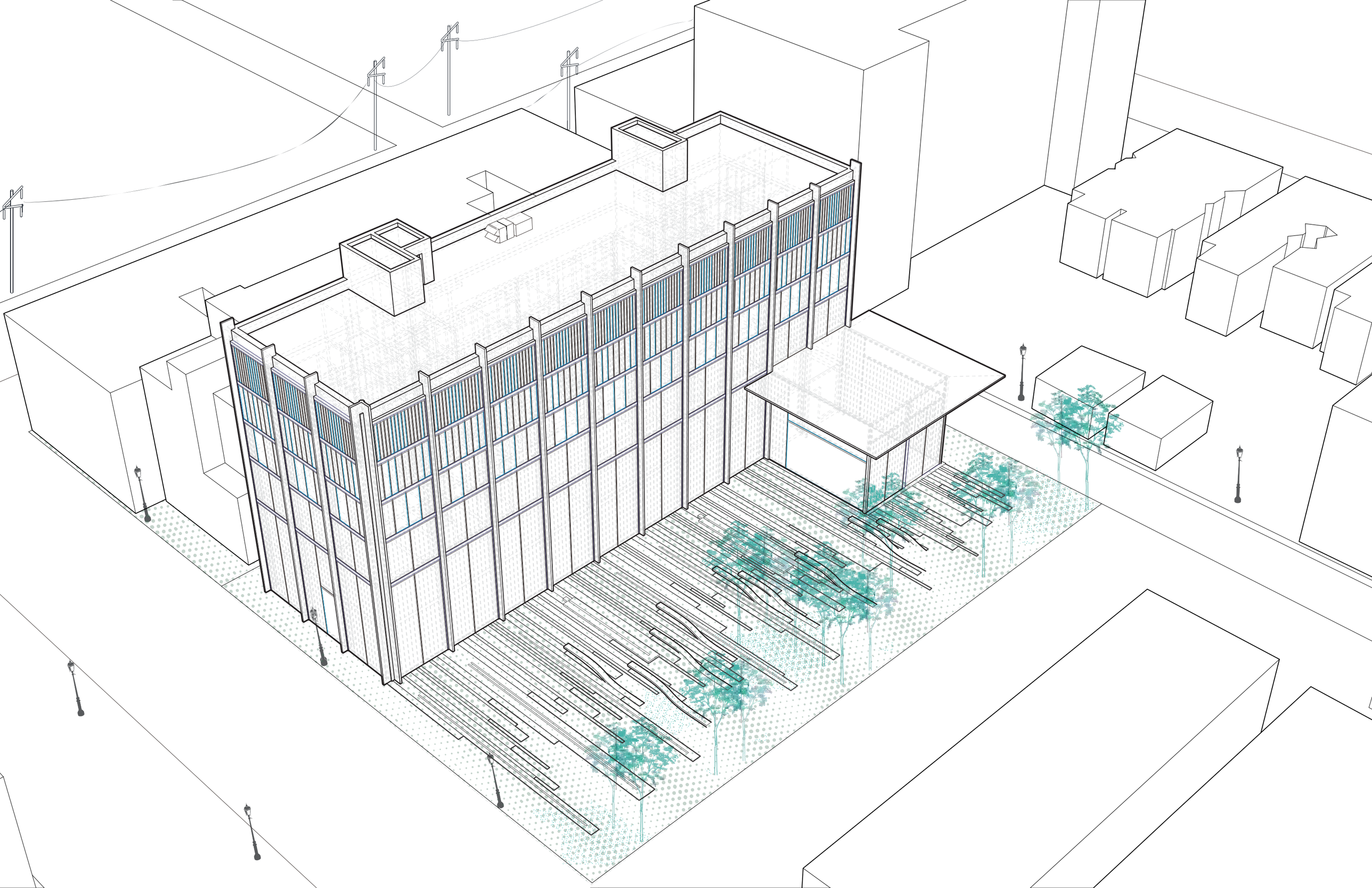
PH

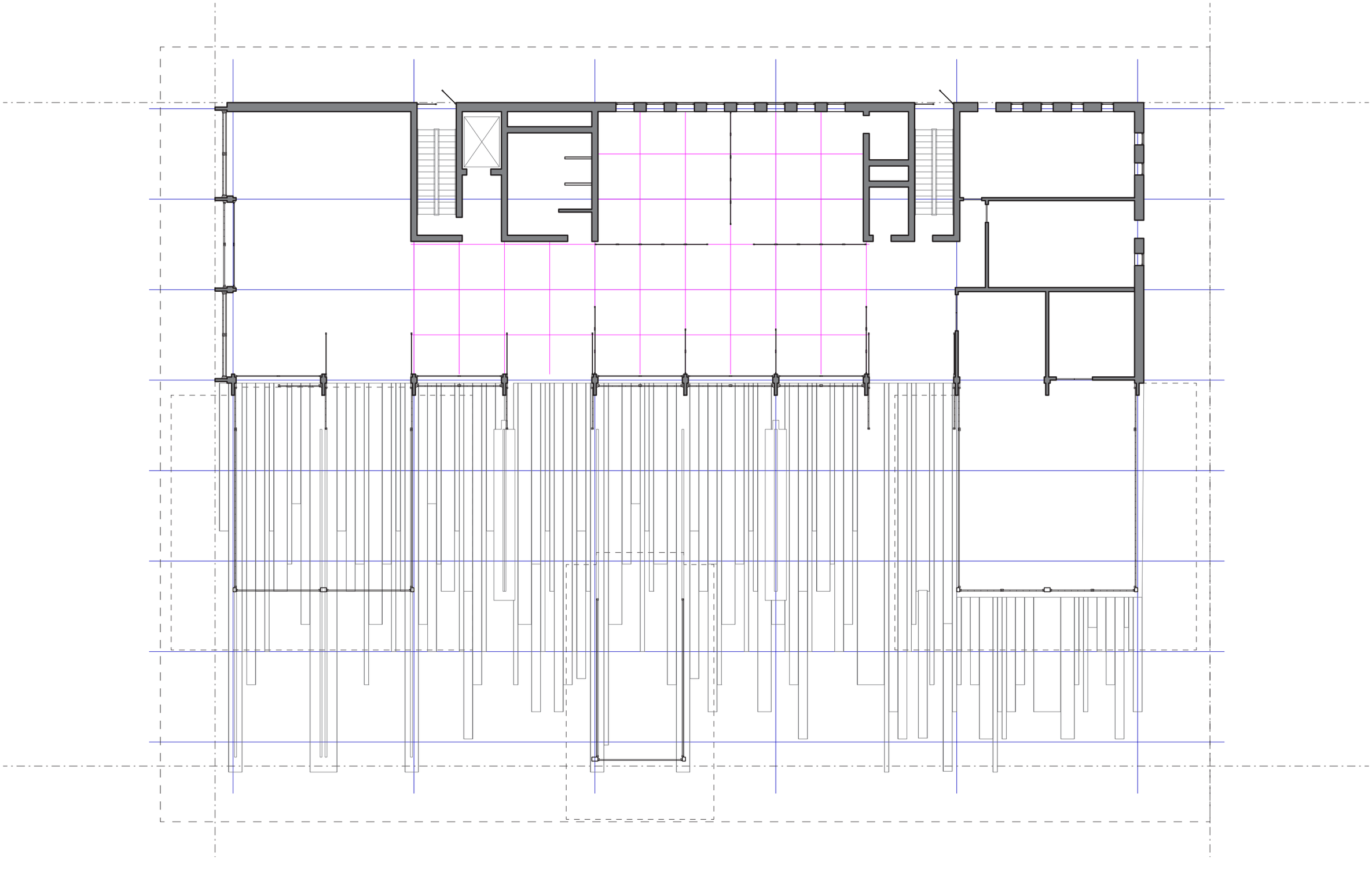


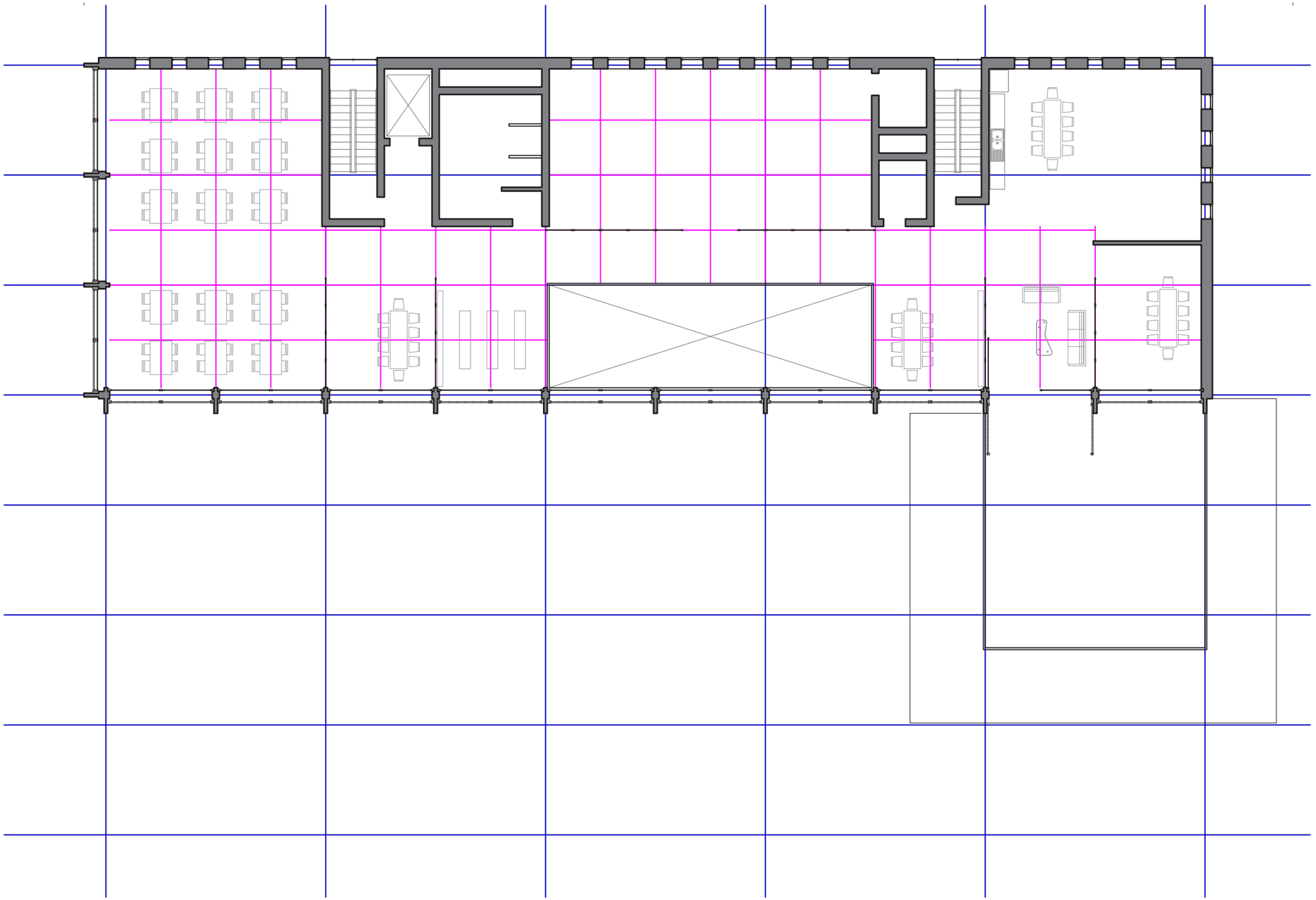
	ANNUAL	COLD PERIOD OCT 1 - APR 30	HOT PERIOD MAY 1 - SEPT 30
COMFORTABLE	51.84%	27.19%	85.40%
HOT	16.50%	02.65%	08.31%
COLD	31.67%	70.16%	06.29%

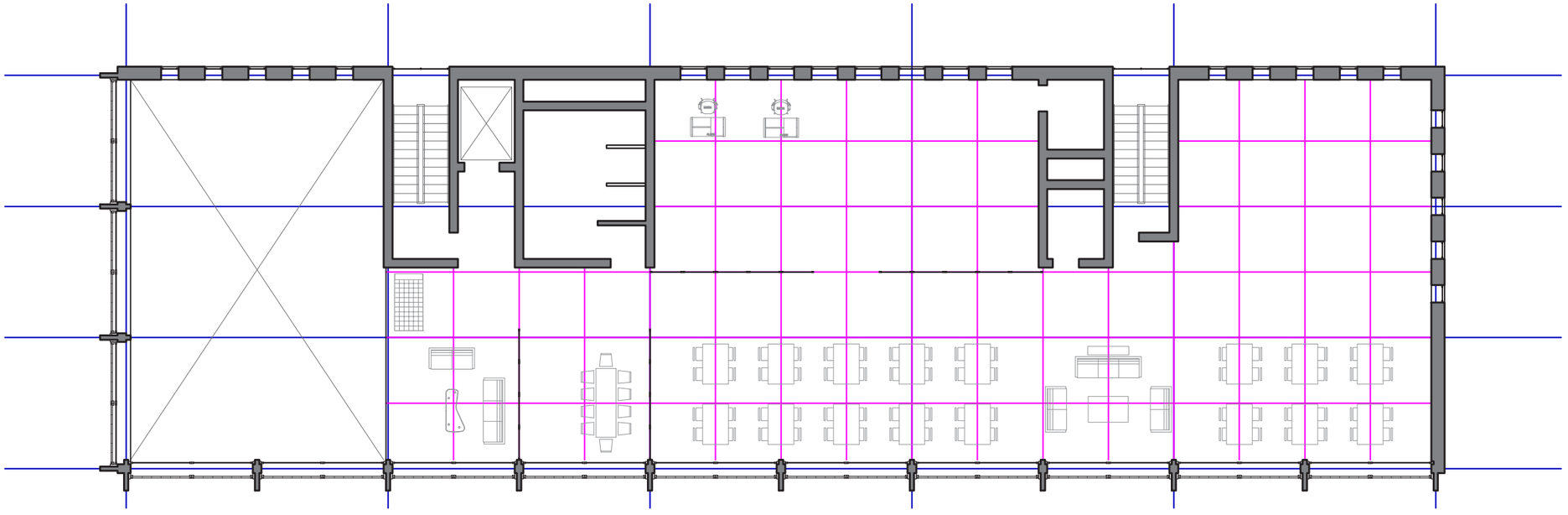


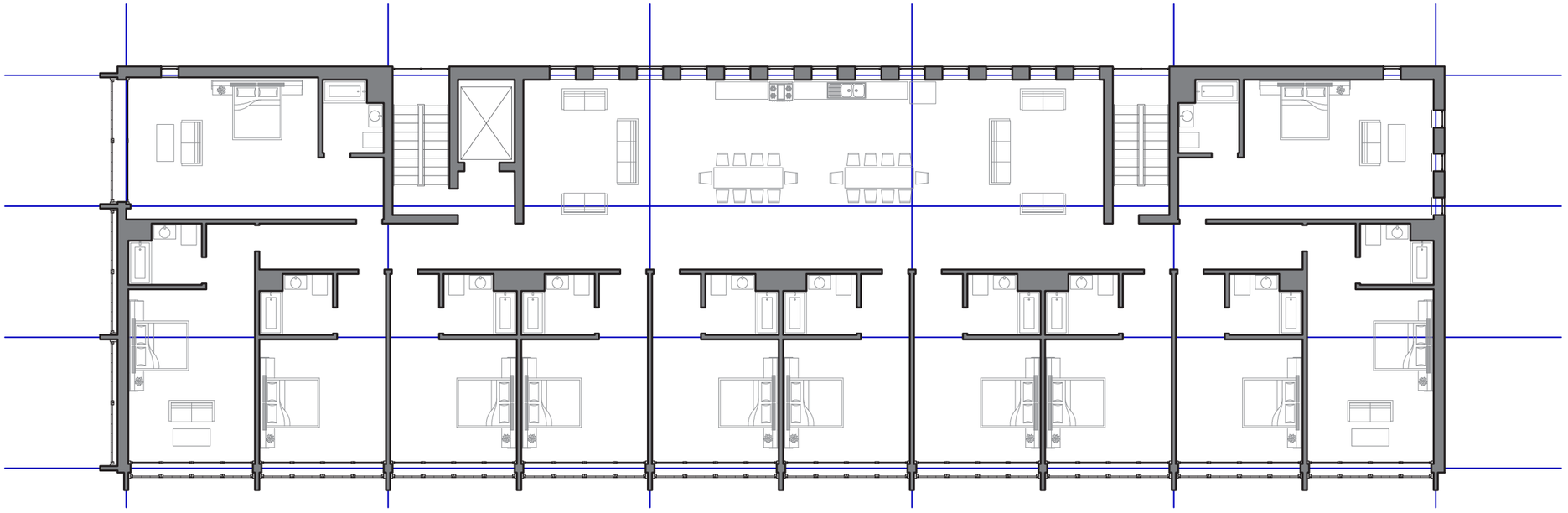












Pre-Warmed Fresh Air

Exhaust Air

Mechanical System
to Supplement Building Performance

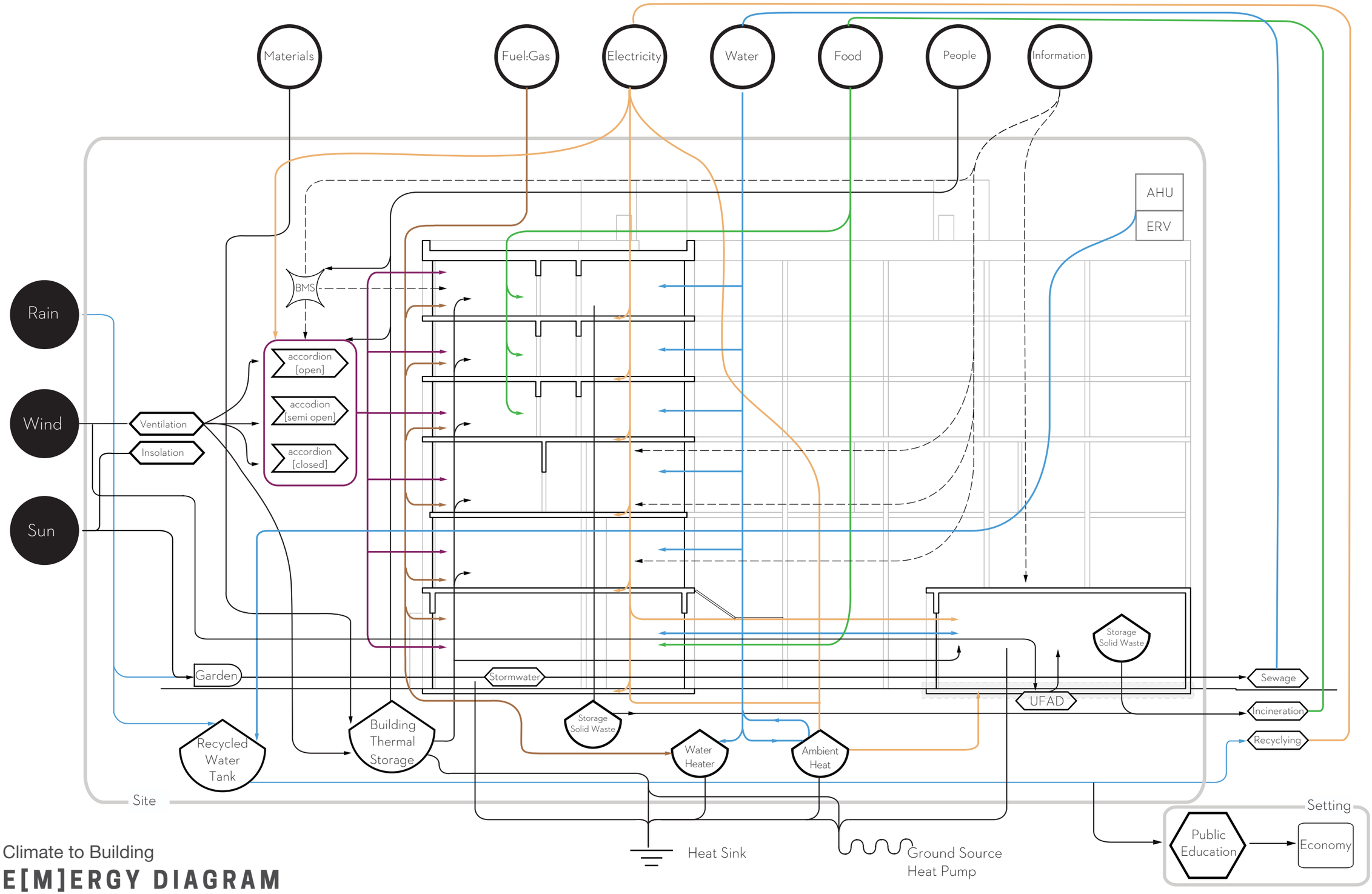
1. Ground Source Heat Pump
2. Radiant Floors
3. Air Handler
4. Energy Recovery Ventilator
5. Double Skin

Climate to Building
WINTER / PRIMARY MODE

Mechanical System
to Supplement Building Performance

1. Ground Source Heat Pump
2. Radiant Floors
3. Air Handler
4. Energy Recovery Ventilator
5. Operable Window Walls for Natural Ventilation

Climate to Building
SUMMER / EVENT MODE



Climate to Building

E[M]ERGY DIAGRAM