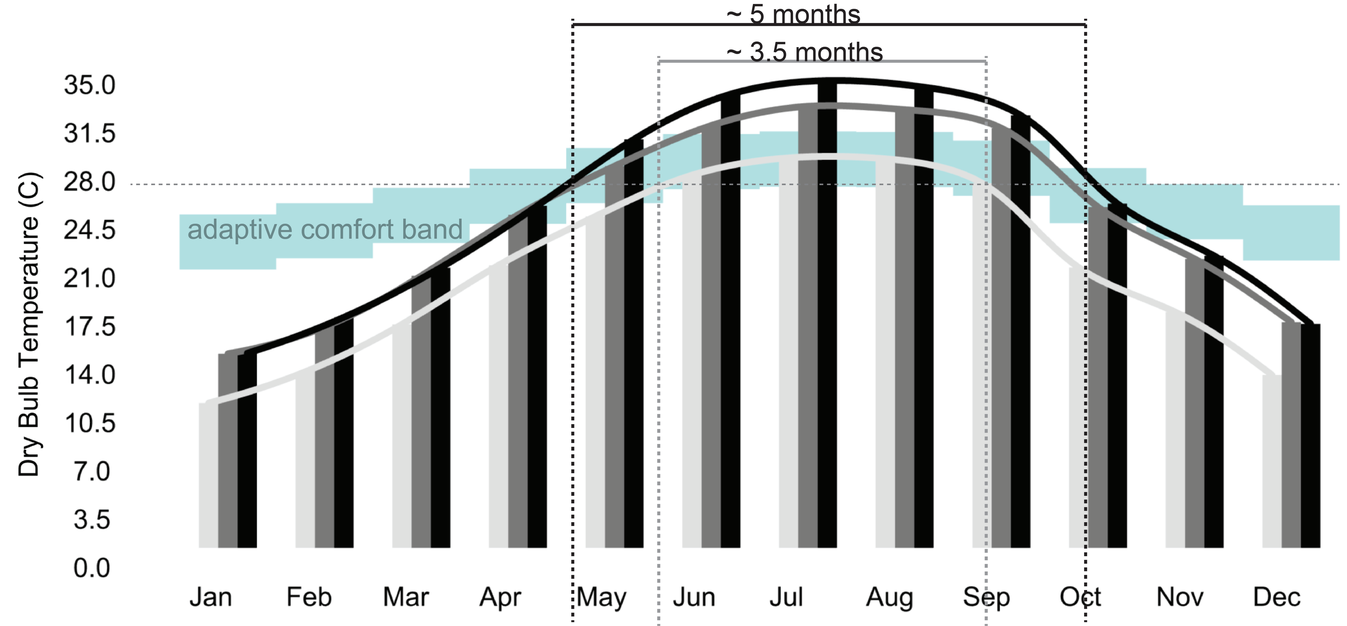
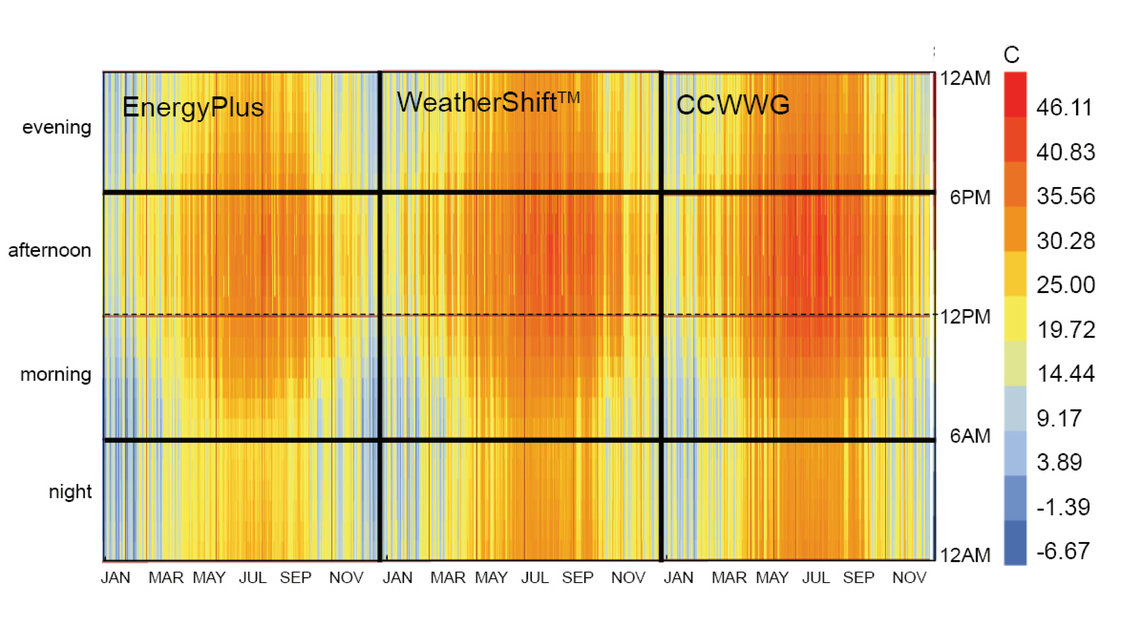
RESILIENT BUILDINGS

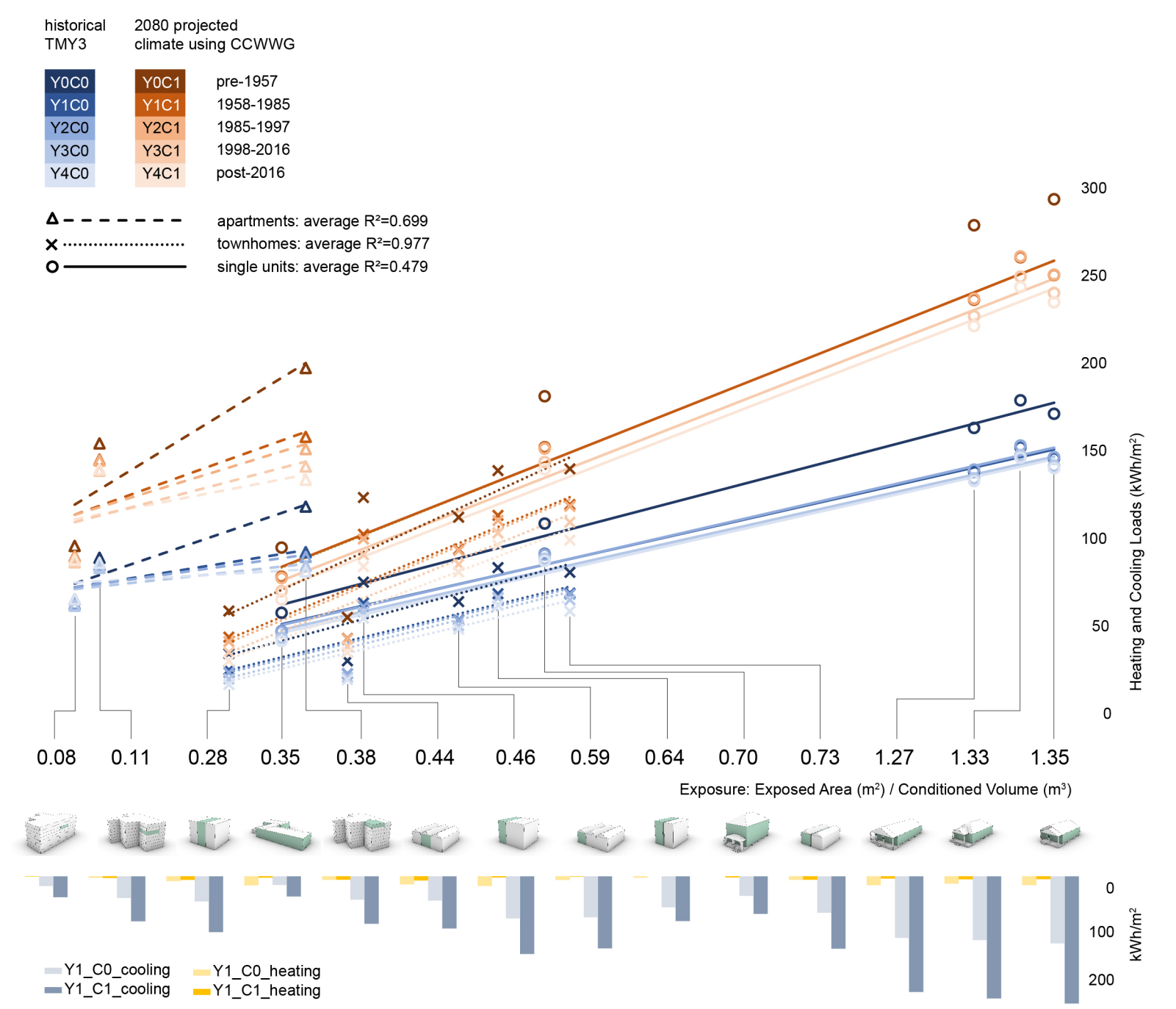
Resilient Residential Building
in Houston

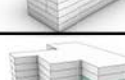
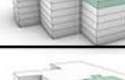
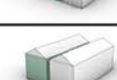
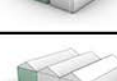

~ 5 months
~ 3.5 months
35.0
31.5
28.0
24.5
21.0
17.5
14.0
10.5
7.0
3.5
0.0
Dry Bulb Temperature (C)
adaptive comfort band
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


C
46.11
40.83
35.56
30.28
25.00
19.72
14.44
9.17
3.89
-1.39
-6.67
EnergyPlus
WeatherShift™
CCWWG
evening
afternoon
morning
night
12AM
6PM
12PM
6AM
12AM
JAN MAR MAY JUL SEP NOV JAN MAR MAY JUL SEP NOV JAN MAR MAY JUL SEP NOV

RESIDENTIAL BUILDINGS IN HOUSTON

The impact of building exposure, envelope insulation and increasing temperatures



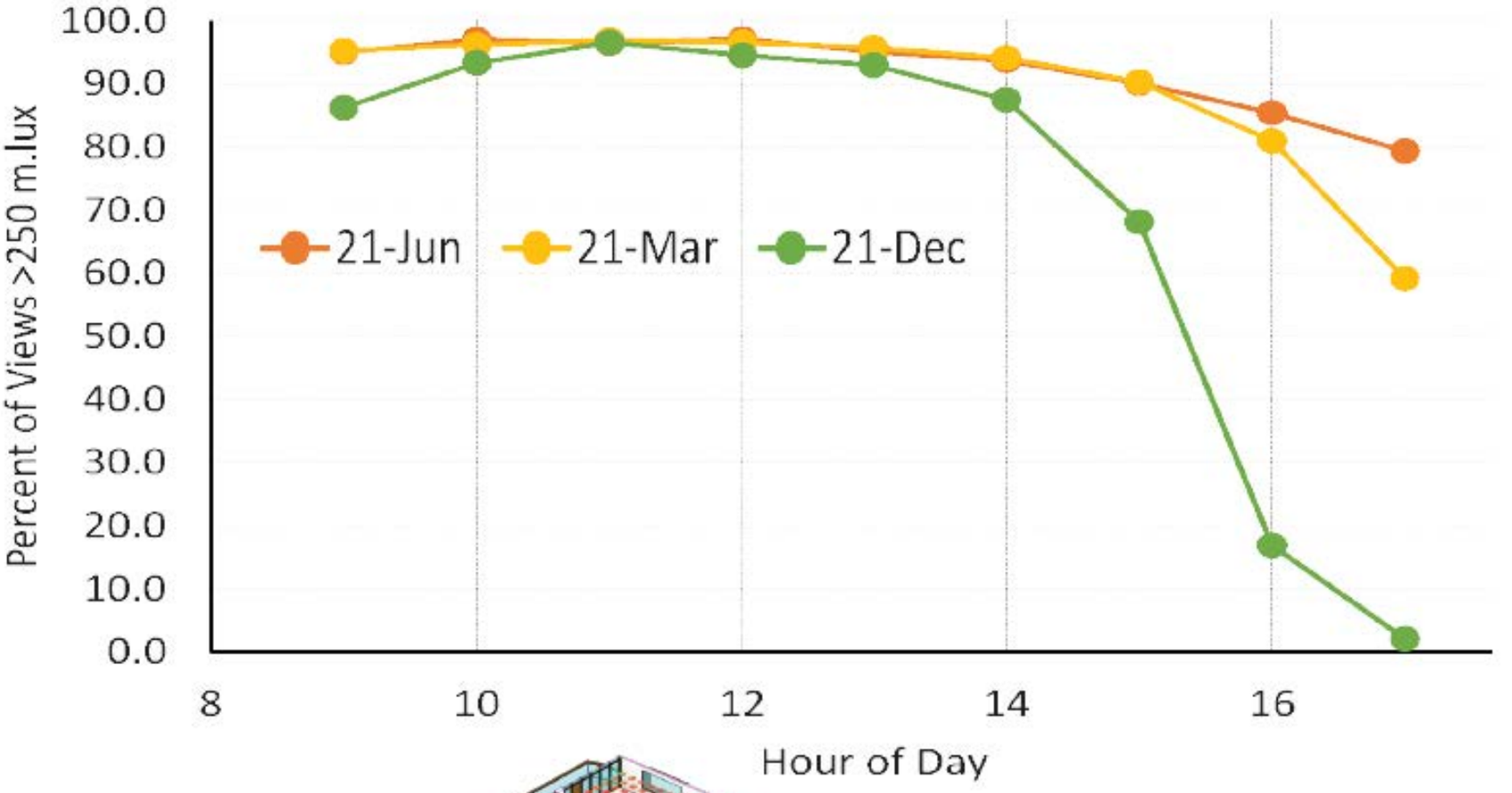
Description	Living Space m^2(sqft)	Total Volume m^3(/cft)	Conditioned Volume (m^3/cft)	Exposed Area (m^2/sqft)	Exposure* (m^2/m^3)	Simulation Identifier	North direction	Model: Conditioned area in green
Shotgun with attic and hipped roof	80(866)	272(9605)	202(7145)	269(2899)	1.33(0.4058)	T0		
Bungalow with attic and gable roof	81(867)	276(9762)	203(7159)	275(2955)	1.35(0.4128)	T1		
Bungalow with attic and gable roof	117(1255)	400(14134)	293(10357)	372(4009)	1.27(0.3871)	T2		
Ranch House two stories with attic and hipped roof	269(2900)	1022(36075)	862(30450)	604(6506)	0.7(0.2137)	T3		
Mansion	2020(21738)	16700(589740)	15325(541187)	5399(58109)	0.35(0.1074)	T4		
Mid-Rise Apartment (Interior Unit, Middle Floor)	209(2246)	763(26957)	763(26957)	60(641)	0.08(0.0238)	T5		
Mid-Rise Apartment (Corner Unit, Middle Floor)	297(3192)	1085(38301)	1085(38301)	120(1294)	0.11(0.0338)	T6		
Mid-Rise Apartment (Corner Unit, Top Floor)	297(3192)	1085(38301)	1085(38301)	417(4486)	0.38(0.1171)	T7		
Detached Four Stories Townhouse no attic	356(3827)	1138(40186)	1138(40186)	727(7827)	0.64(0.1948)	T8		
Attached Four Stories Townhouse no attic (Corner)	356(3827)	1138(40186)	1138(40186)	524(5643)	0.46(0.1404)	T9		
Detached Four Stories Townhouse no attic (Middle)	356(3827)	1138(40186)	1138(40186)	321(3459)	0.28(0.0861)	T10		
Detached Two Stories Townhouse with attic	255(2745)	972(34320)	855(30202)	628(6760)	0.73(0.2238)	T11		
Attached Three Stories Townhouse with attic (Corner)	255(2745)	972(34320)	855(30202)	502(5402)	0.59(0.1789)	T12		
Attached Three Stories Townhouse with attic (Middle)	255(2745)	972(34320)	855(30202)	376(4045)	0.44(0.1339)	T13		

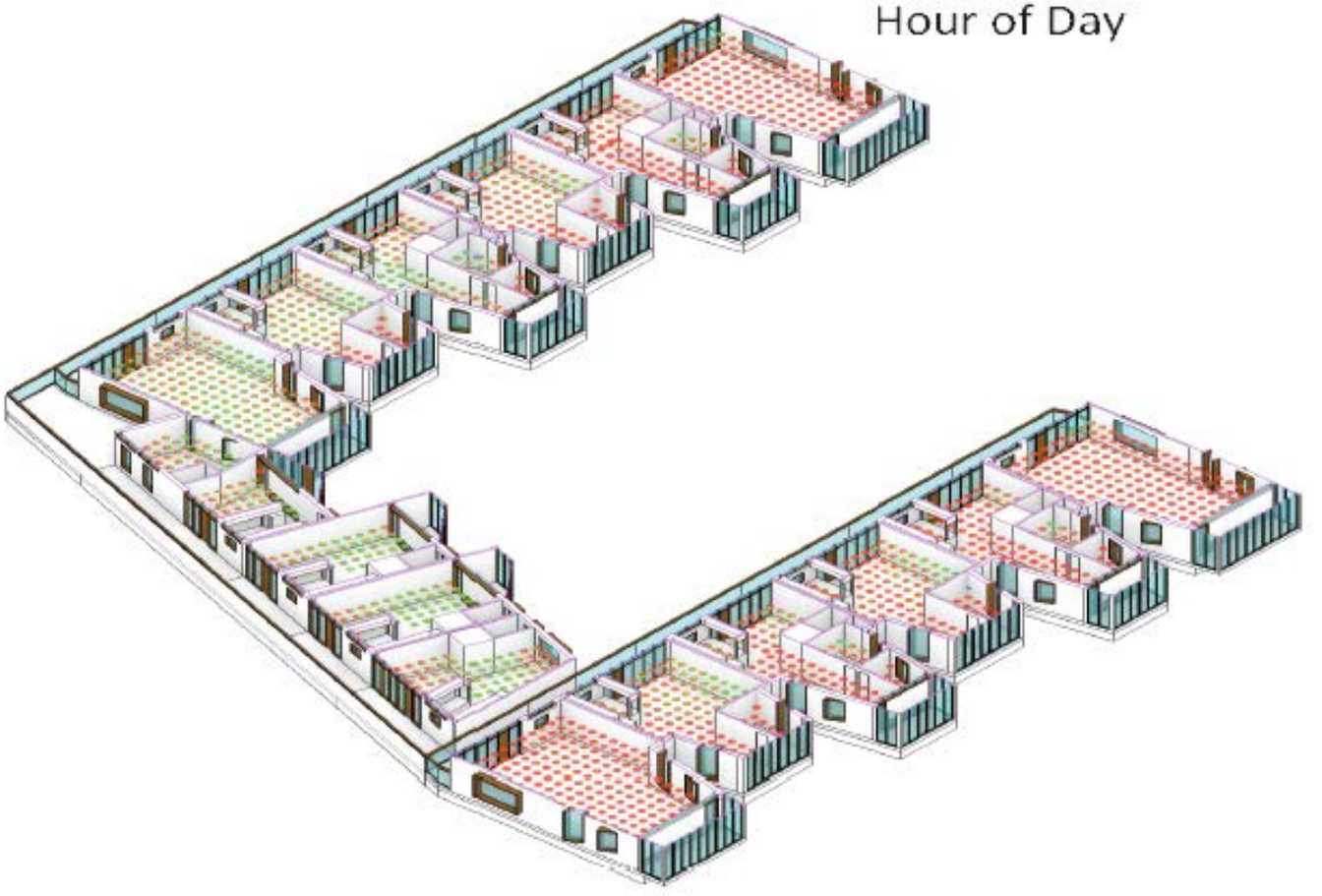
RESILIENT BUILDINGS

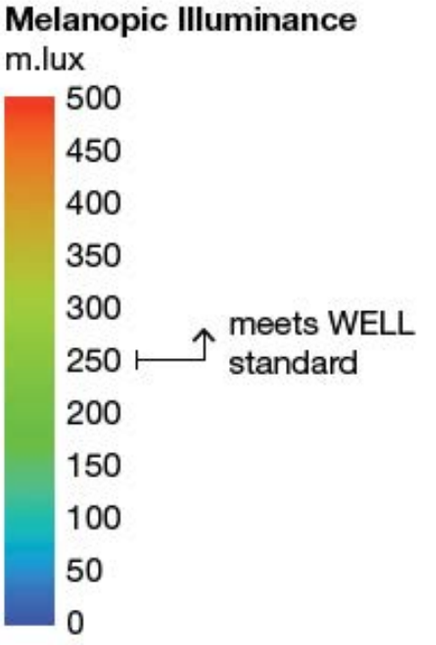
Mixed Use Net Positive Design

This building achieves **net zero** energy and operational carbon!

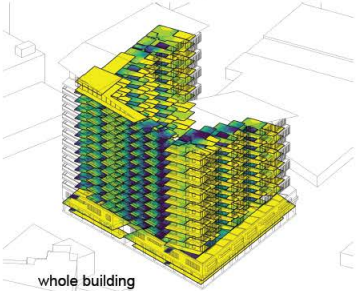
CIRCADIAN LIGHTING MODELING (ALFA)



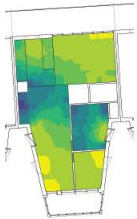




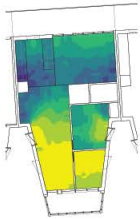
DAYLIGHT MODELING (ClimateStudio)



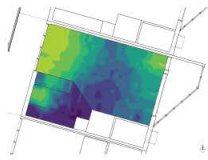
whole building



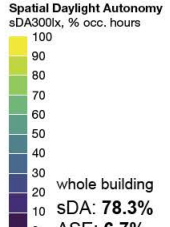
typical north unit

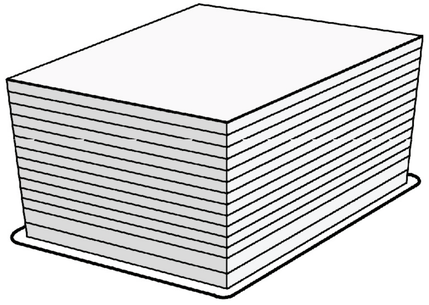


typical south unit

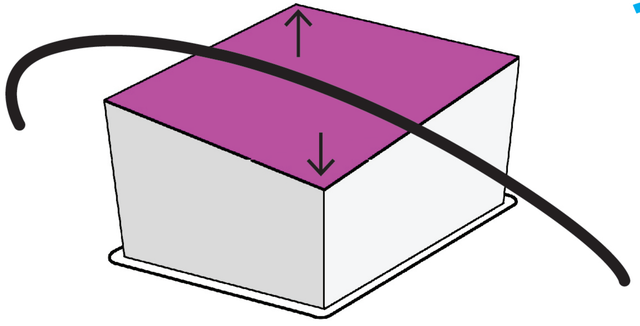


typical west unit

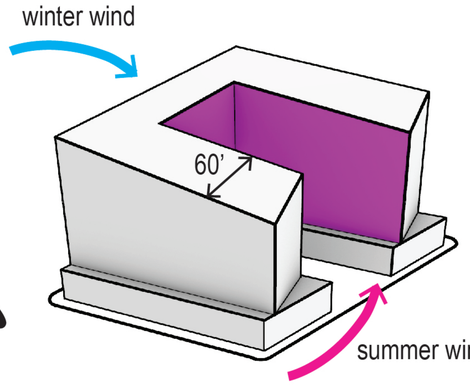




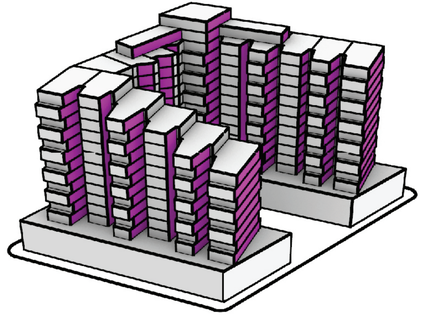
site potential



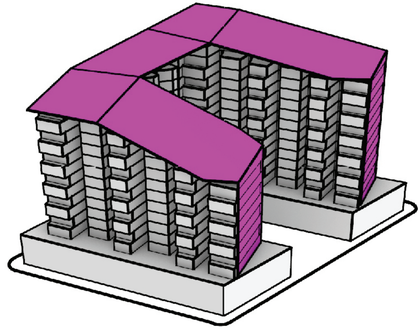
solar responsive massing



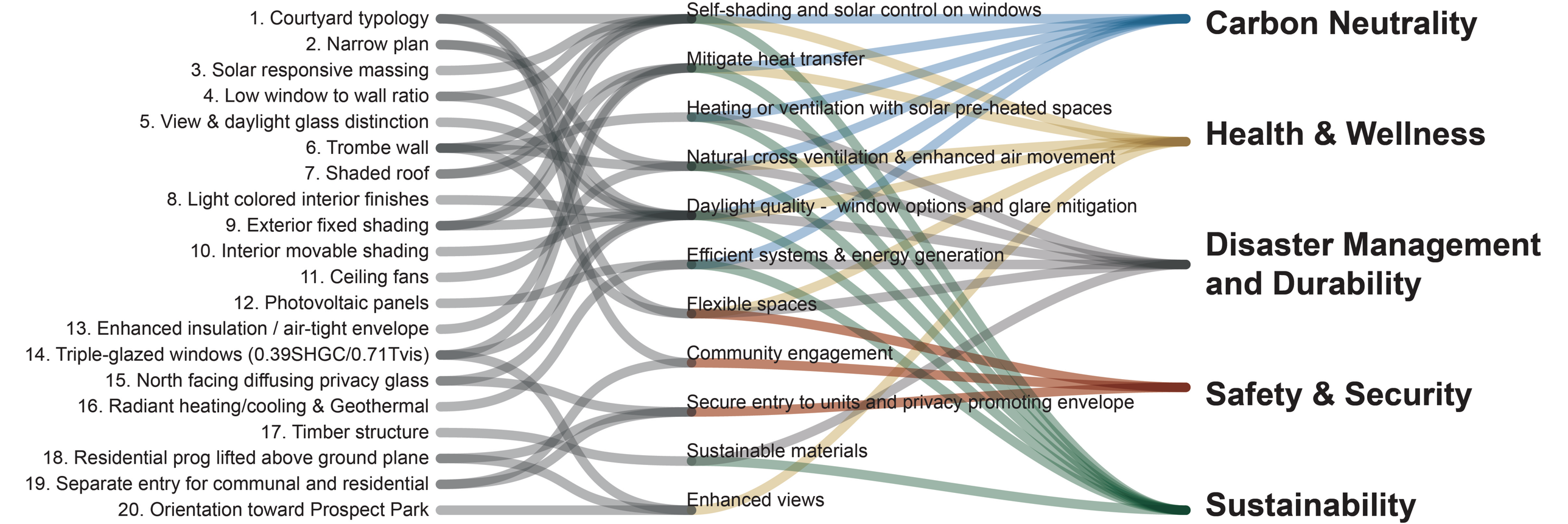
wind & light responsive massing



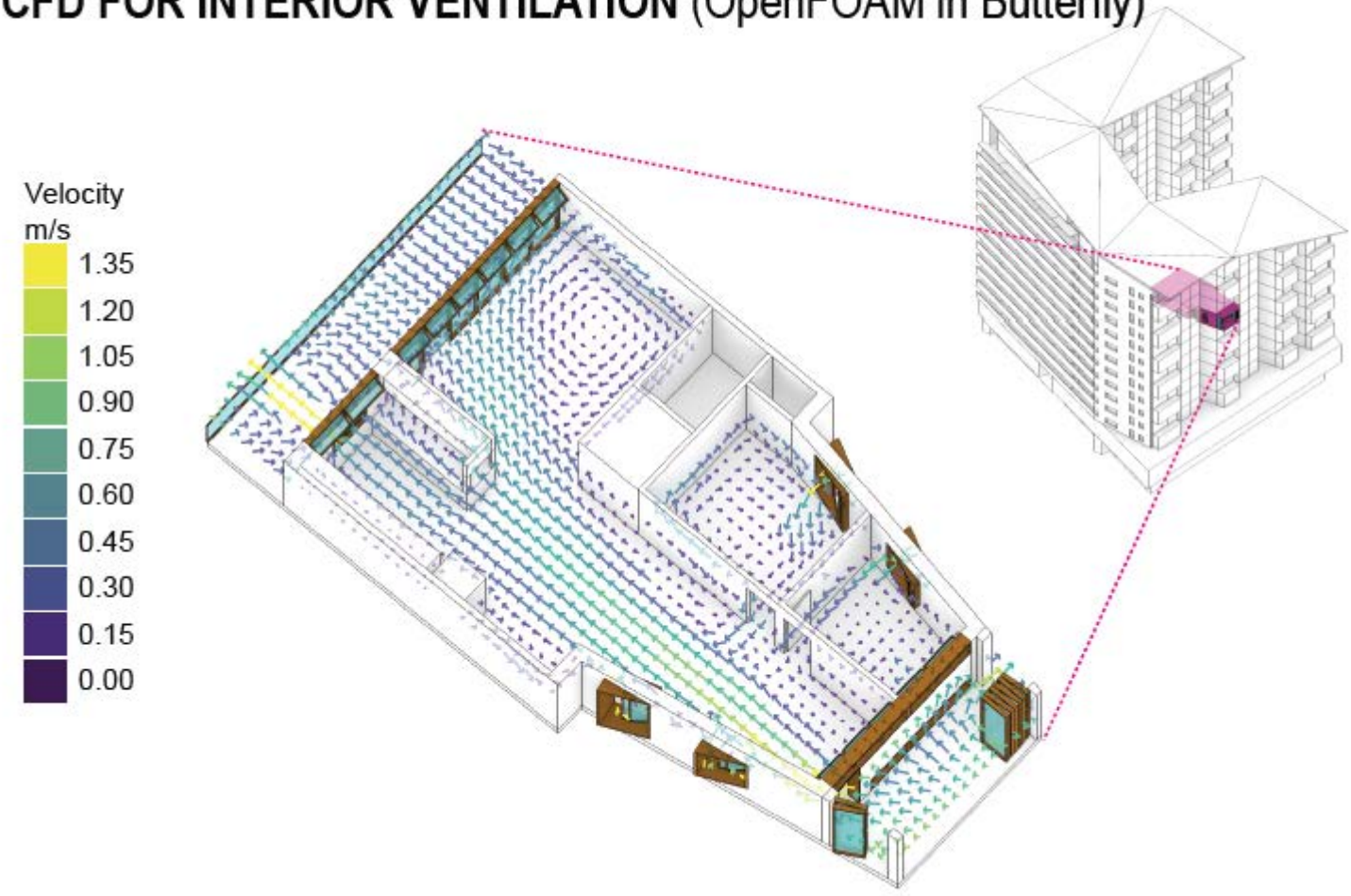
units' optimization



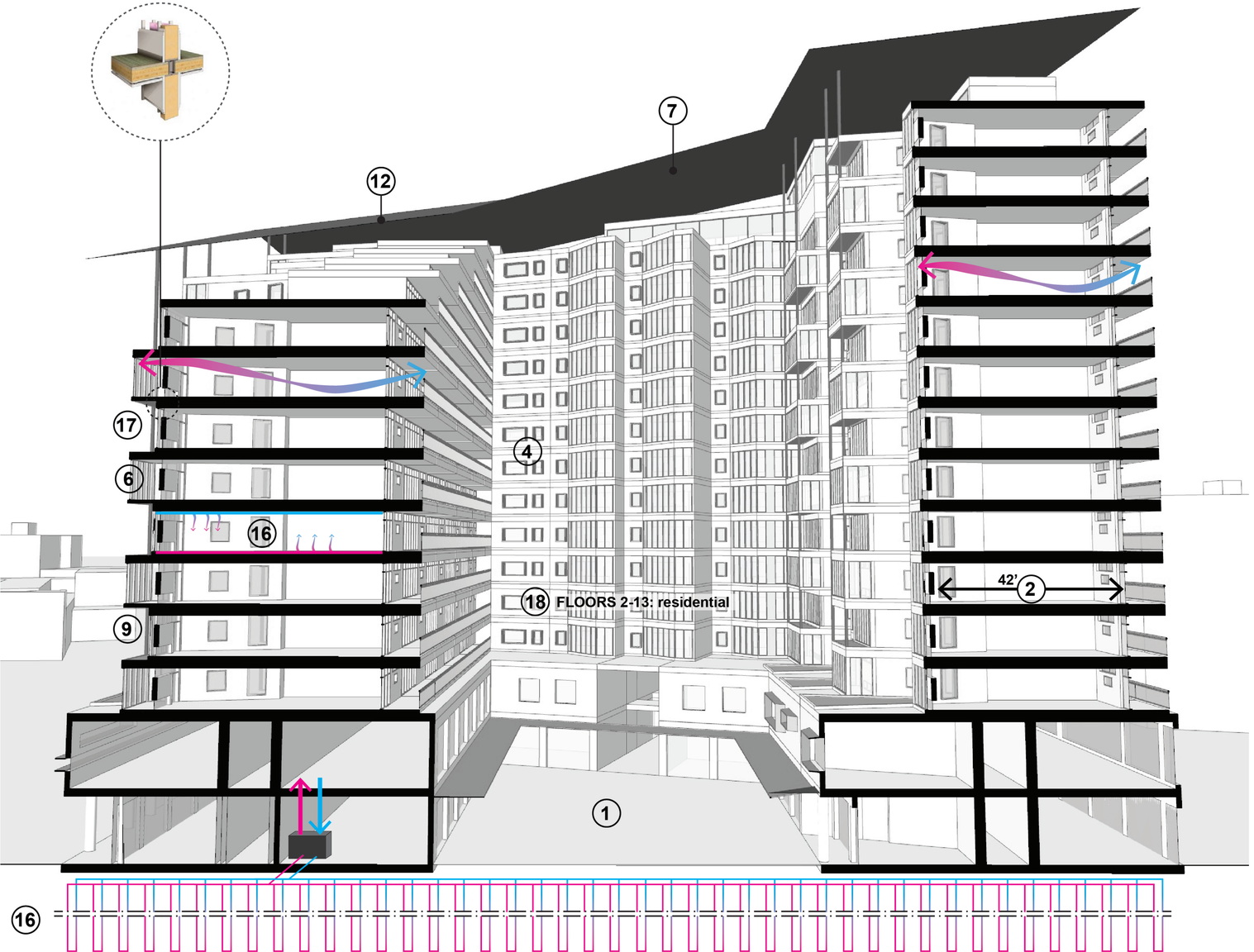
solar collection


1. Courtyard typology
2. Narrow plan
3. Solar responsive massing
4. Low window to wall ratio
5. View & daylight glass distinction
6. Trombe wall
7. Shaded roof
8. Light colored interior finishes
9. Exterior fixed shading
10. Interior movable shading
11. Ceiling fans
12. Photovoltaic panels
13. Enhanced insulation / air-tight envelope
14. Triple-glazed windows (0.39SHGC/0.71Tvis)
15. North facing diffusing privacy glass
16. Radiant heating/cooling & Geothermal
17. Timber structure
18. Residential prog lifted above ground plane
19. Separate entry for communal and residential
20. Orientation toward Prospect Park
Self-shading and solar control on windows
Mitigate heat transfer
Heating or ventilation with solar pre-heated spaces
Natural cross ventilation & enhanced air movement
Daylight quality - window options and glare mitigation
Efficient systems & energy generation
Flexible spaces
Community engagement
Secure entry to units and privacy promoting envelope
Sustainable materials
Enhanced views
Carbon Neutrality
Health & Wellness
Disaster Management and Durability
Safety & Security
Sustainability

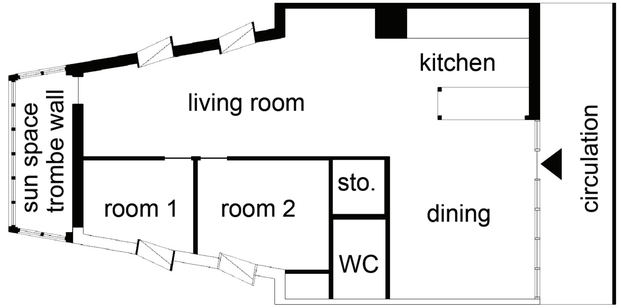
CFD FOR INTERIOR VENTILATION (OpenFOAM in Butterfly)



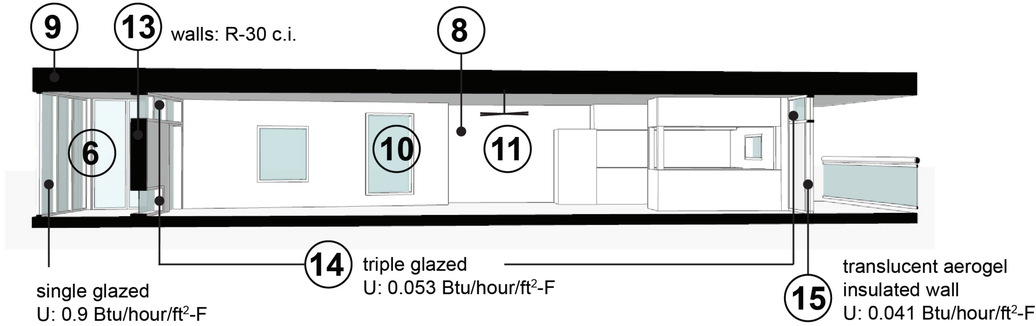

230’
245’
Google Earth

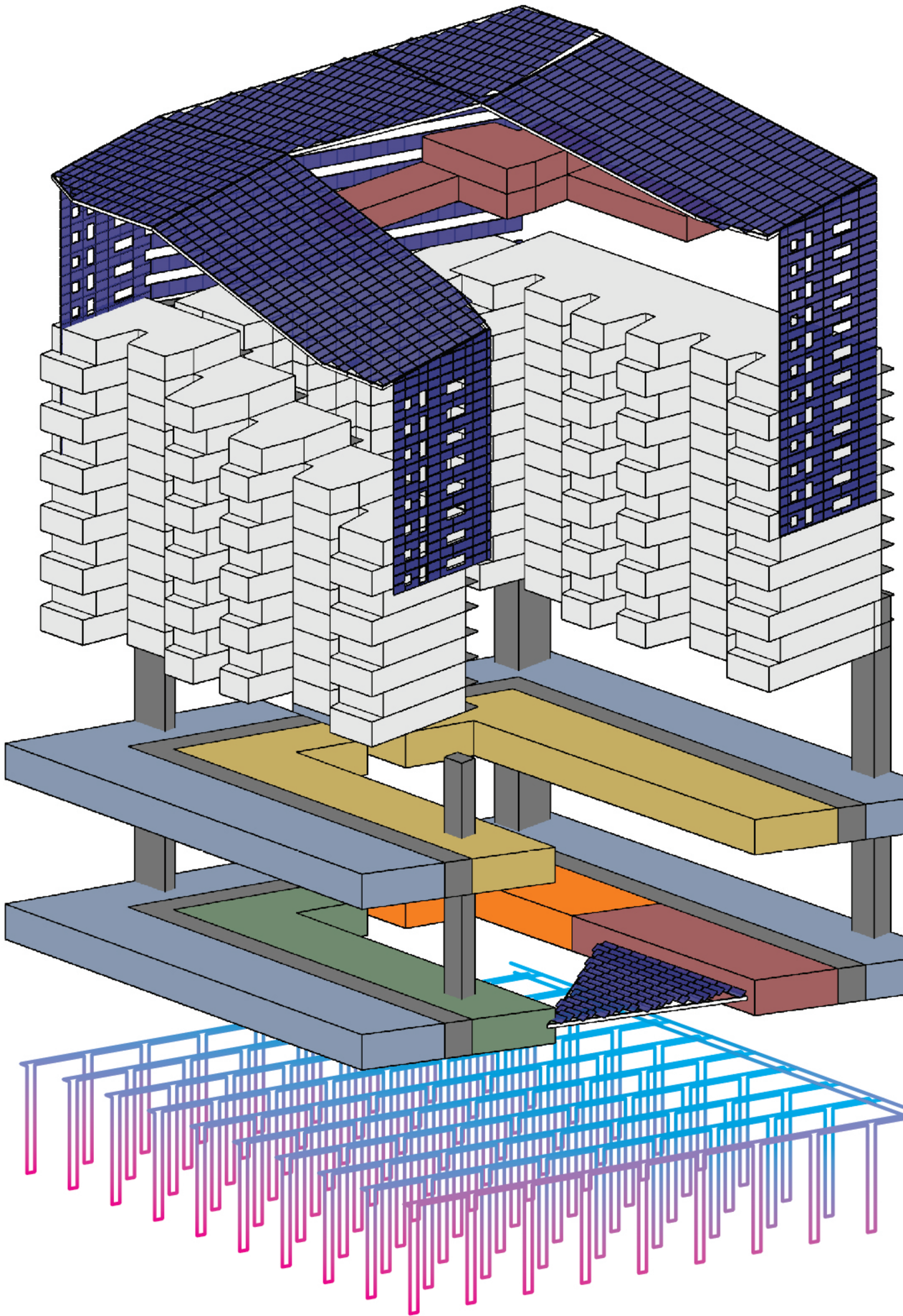


TYPICAL 2-BEDROOM UNIT LAYOUT



TYPICAL 2-BEDROOM UNIT SECTION





- Residential units: 203,700sf
  w/ sun spaces 217,600sf
- Retail: 27,000sf
- Fitness: 5,600sf
- Lobby: 2,800
- Amenities: 11,400sf
- Restaurants: 8,500sf
- Circulation
  - conditioned: 15,000
  - unconditioned: 36,000sf
- Photovolatic panels and BIPV
- Vertical loop for geothermal