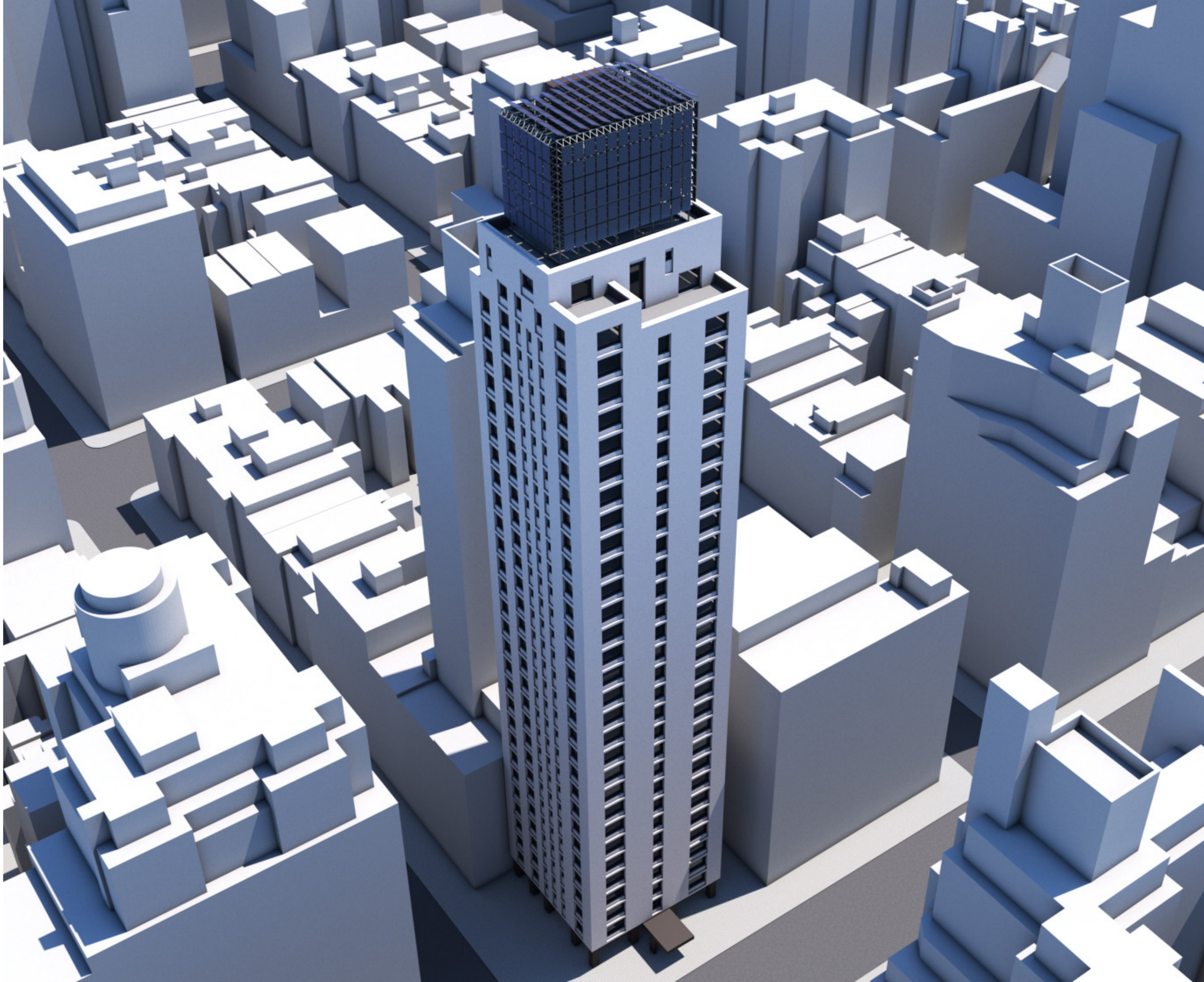
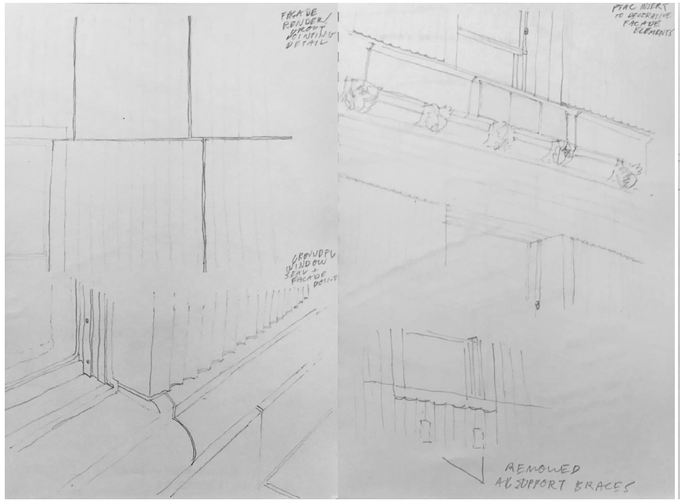
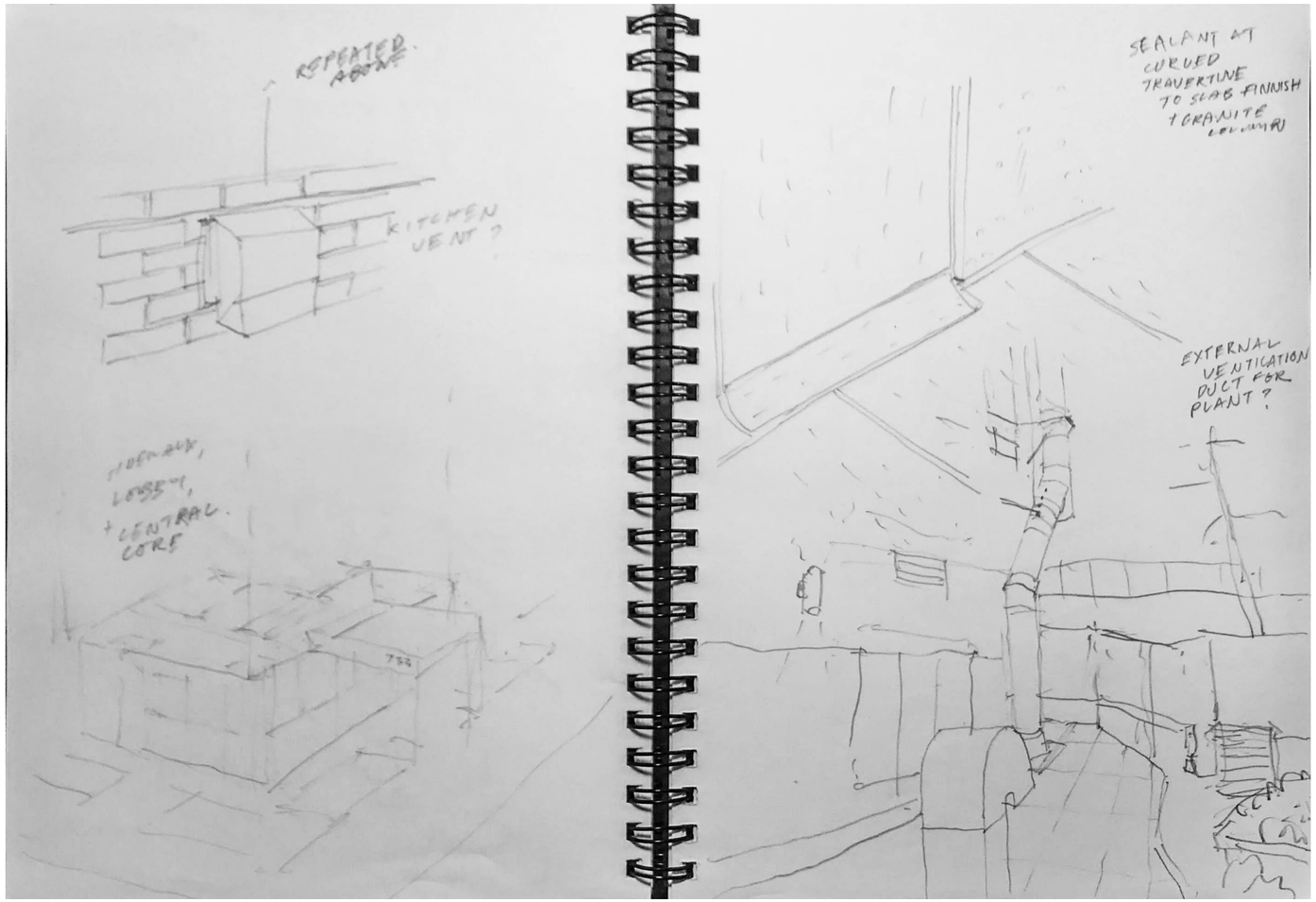
Net Zero Housing Fall 2021
733 Park Avenue project booklet

Maxim Kolbowski-Frampton

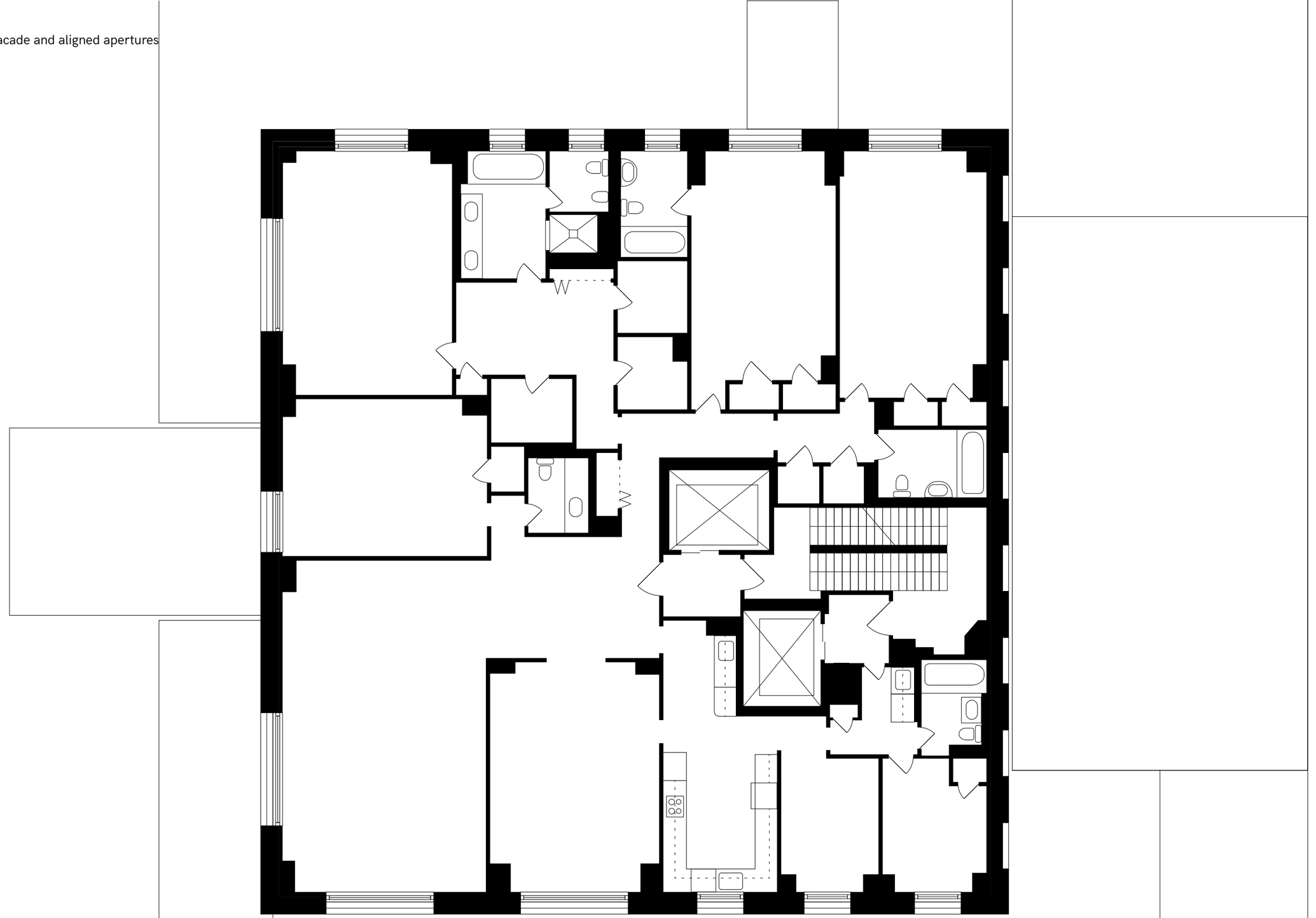


Detail sketches 740 and 733 Park ave.





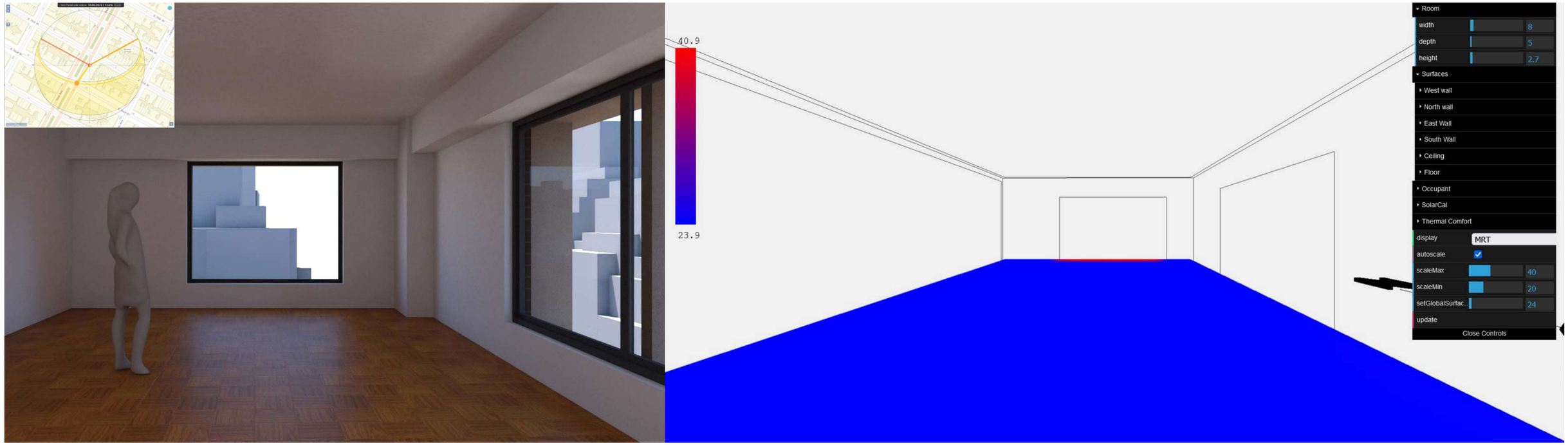
733 Park ave. | typical floor with thickened facade and aligned apertures



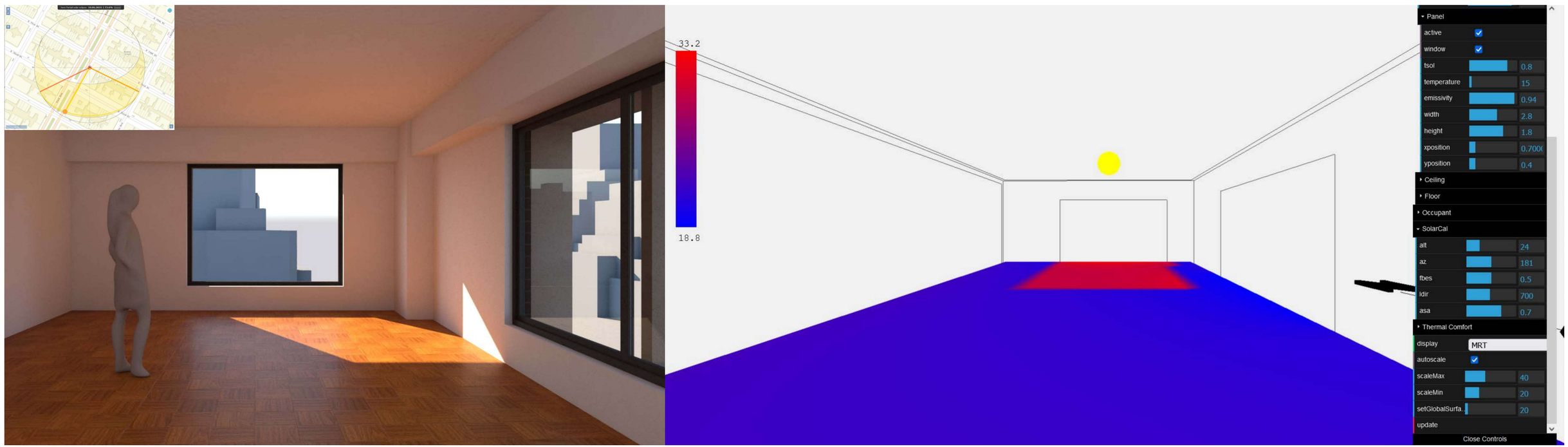
5′ 10′ 20′ 30′ 40′

SCALE 1′ = 1/16″

Summer solstice



Winter solstice



CBE Thermal Comfort Tool

ASHRAE-55 | EN-16798 | Compare | Ranges | Upload | Fans heatwaves | PHS | Help | Other CBE tools

Inputs

Select method: PMV method

Air temperature: 23.9 °C — Use operative temp

Mean radiant temperature: 23.8 °C

Air speed: 0.1 m/s — With local control

Relative humidity: 79.25 % — Relative humidity

Metabolic rate: 1 met — Seated, quiet: 1.0

Clothing level: .65 clo — Typical winter indoor cloth

Create custom ensemble

Dynamic predictive clothing

Solar gain on occupants

Set pressure | SI/IP

Local discomfort | Globe temp

Reset | Save | Reload | Share

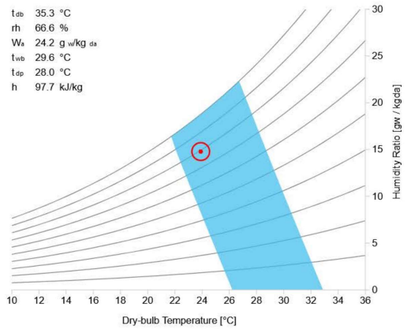
Documentation

✔ Complies with ASHRAE Standard 55-2020

PMV = -0.23 PPD = 6 %

Sensation = Neutral SET = 24.5 °C

Psychrometric (air temperature)



NOTE: In this psychrometric chart the abscissa is the dry-bulb temperature, and the mean radiant temperature (MRT) is fixed, controlled by the inputbox. Each point on the chart has the same MRT, which defines the comfort zone boundary. In this way you can see how changes in MRT affect thermal comfort. You can also still use the operative temperature button, yet each point will have the same MRT.

Limits of Applicability: This standard is only applicable to healthy individuals. This standard does not apply to occupants: a) whose clothing insulation exceed 1.5 clo; b) whose clothing is highly impermeable; or c) who are sleeping, reclining in contact with bedding, or able to adjust blankets or bedding.

The CBE comfort tools automatically calculates the relative air speed and the dynamic clothing insulation .

PSYCHROMETRY:

DATA MAPPING

Load EPW... | Load CSV...

Select Display Metric...

Show Distributed Grid

Show Date Range Selector

Year | Month | Day

Snapshot | Regions

COMFORT OVERLAY

ASHRAE 55-2017

Show Predicted Mean Vote

Air Velocity: 0.10 m/s
Unnoticeably still.

Clothing Level: 0.60 clo
Trousers, business shirt, shoes.

Metabolic Rate: 1.00 met
Seated with sedentary activity.

Mean Radiant Temp.: 23.9 °C
Normal room temperature.

Reset | Options

PROCESS LINES

CHART METRICS

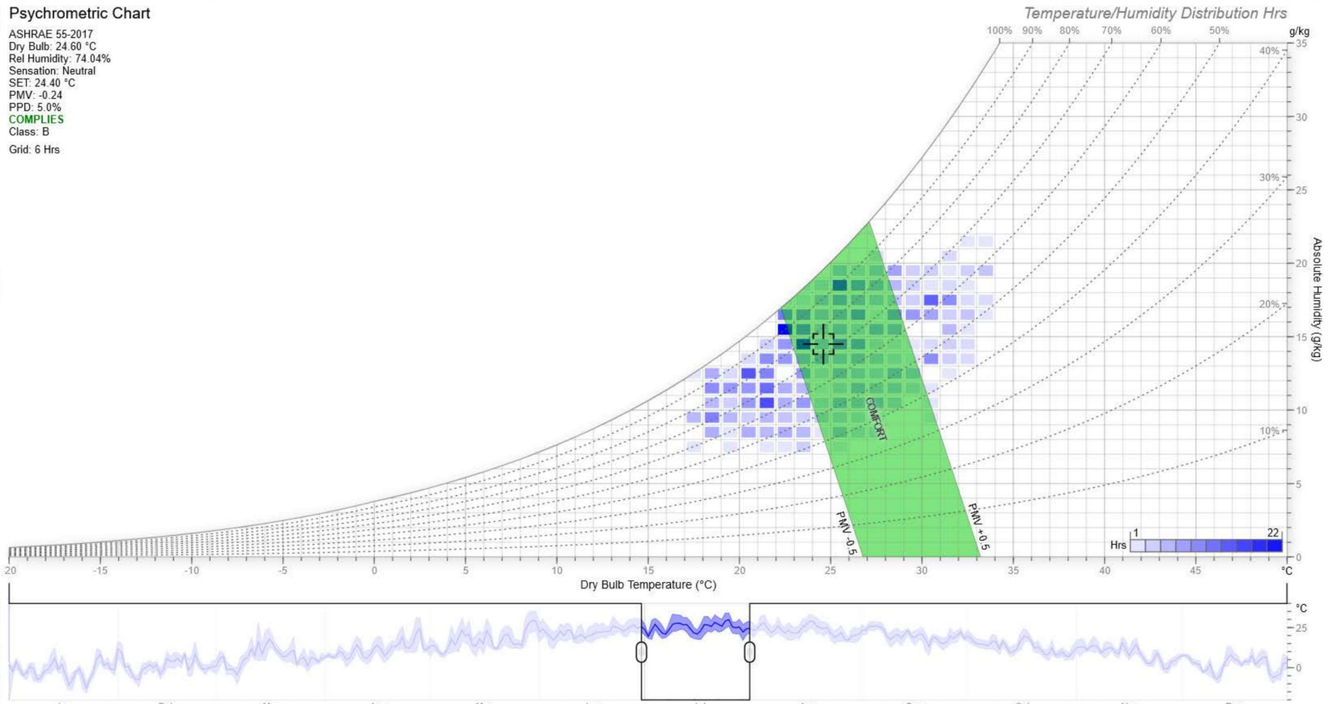
WEATHER STATION

UNITS

Psychrometric Chart

ASHRAE 55-2017
Dry Bulb: 24.60 °C
Rel Humidity: 74.04%
Sensation: Neutral
SET: 24.40 °C
PMV: -0.24
PPD: 5.0%
COMPLIES
Class: B

Grid: 6 Hrs



CBE Thermal Comfort Tool

ASHRAE-55 | EN-16798 | Compare | Ranges | Upload | Fans heatwaves | PHS | Help | Other CBE tools

Inputs

Select method: PMV method

Air temperature: 20 °C — Use operative temp

Mean radiant temperature: 21.4 °C

Air speed: 0.1 m/s

Relative humidity: 50 % — Relative humidity

Metabolic rate: 1 met — Seated, quiet: 1.0

Clothing level: 1 clo — Typical winter indoor cloth

Create custom ensemble

Dynamic predictive clothing

Solar gain on occupants

Set pressure | SI/IP

Local discomfort | Globe temp

Reset | Save | Reload | Share

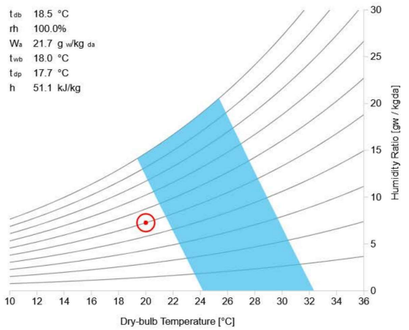
Documentation

✗ Does not comply with ASHRAE Standard 55-2020

PMV = -0.71 PPD = 15 %

Sensation = Slightly Cool SET = 23.2 °C

Psychrometric (air temperature)



NOTE: In this psychrometric chart the abscissa is the dry-bulb temperature, and the mean radiant temperature (MRT) is fixed, controlled by the inputbox. Each point on the chart has the same MRT, which defines the comfort zone boundary. In this way you can see how changes in MRT affect thermal comfort. You can also still use the operative temperature button, yet each point will have the same MRT.

Limits of Applicability: This standard is only applicable to healthy individuals. This standard does not apply to occupants: a) whose clothing insulation exceed 1.5 clo; b) whose clothing is highly impermeable; or c) who are sleeping, reclining in contact with bedding, or able to adjust blankets or bedding.

The CBE comfort tools automatically calculates the relative air speed and the dynamic clothing insulation .

PSYCHROMETRY:

DATA MAPPING

Load EPW... | Load CSV...

Select Display Metric...

Show Distributed Grid

Show Date Range Selector

Year | Month | Day

Snapshot | Regions

COMFORT OVERLAY

ASHRAE 55-2017

Show Predicted Mean Vote

Air Velocity: 0.10 m/s
Unnoticeably still.

Clothing Level: 1.00 clo
Business suit or casual with sweater.

Metabolic Rate: 1.00 met
Seated with sedentary activity.

Mean Radiant Temp.: 21.5 °C
Normal room temperature.

Reset | Options

PROCESS LINES

CHART METRICS

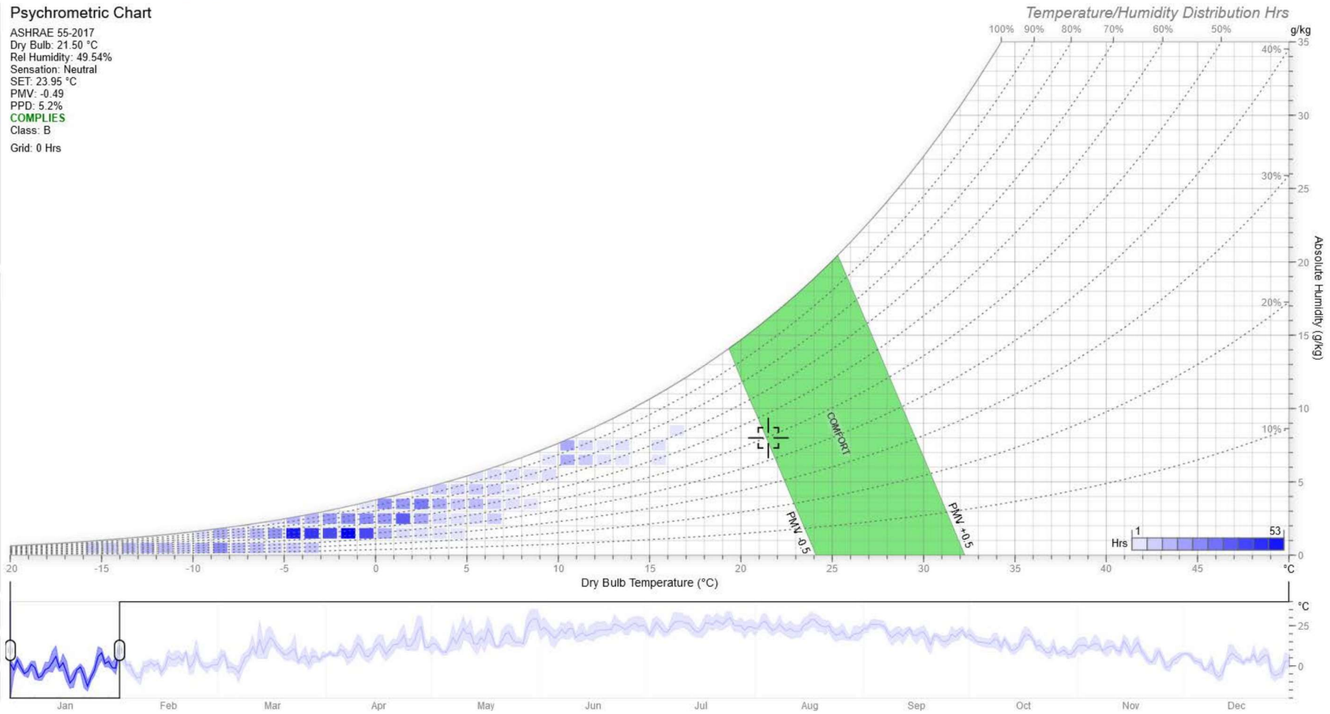
WEATHER STATION

UNITS

Psychrometric Chart

ASHRAE 55-2017
Dry Bulb: 21.50 °C
Rel Humidity: 49.54%
Sensation: Neutral
SET: 23.95 °C
PMV: -0.49
PPD: 5.2%
COMPLIES
Class: B

Grid: 0 Hrs



PSYCHROMETRY:

DATA MAPPING

Load EPW... | Load CSV...

Select Display Metric...

Show Distributed Grid

Show Date Range Selector

Year | Month | Day

Snapshot | Regions ▶

COMFORT OVERLAY

Givoni Bioclimatic Chart

Mean Outdoor Temp.: 19.0 °C

Show Predicted Mean Vote

Reset | Options ▶

PROCESS LINES

CHART METRICS

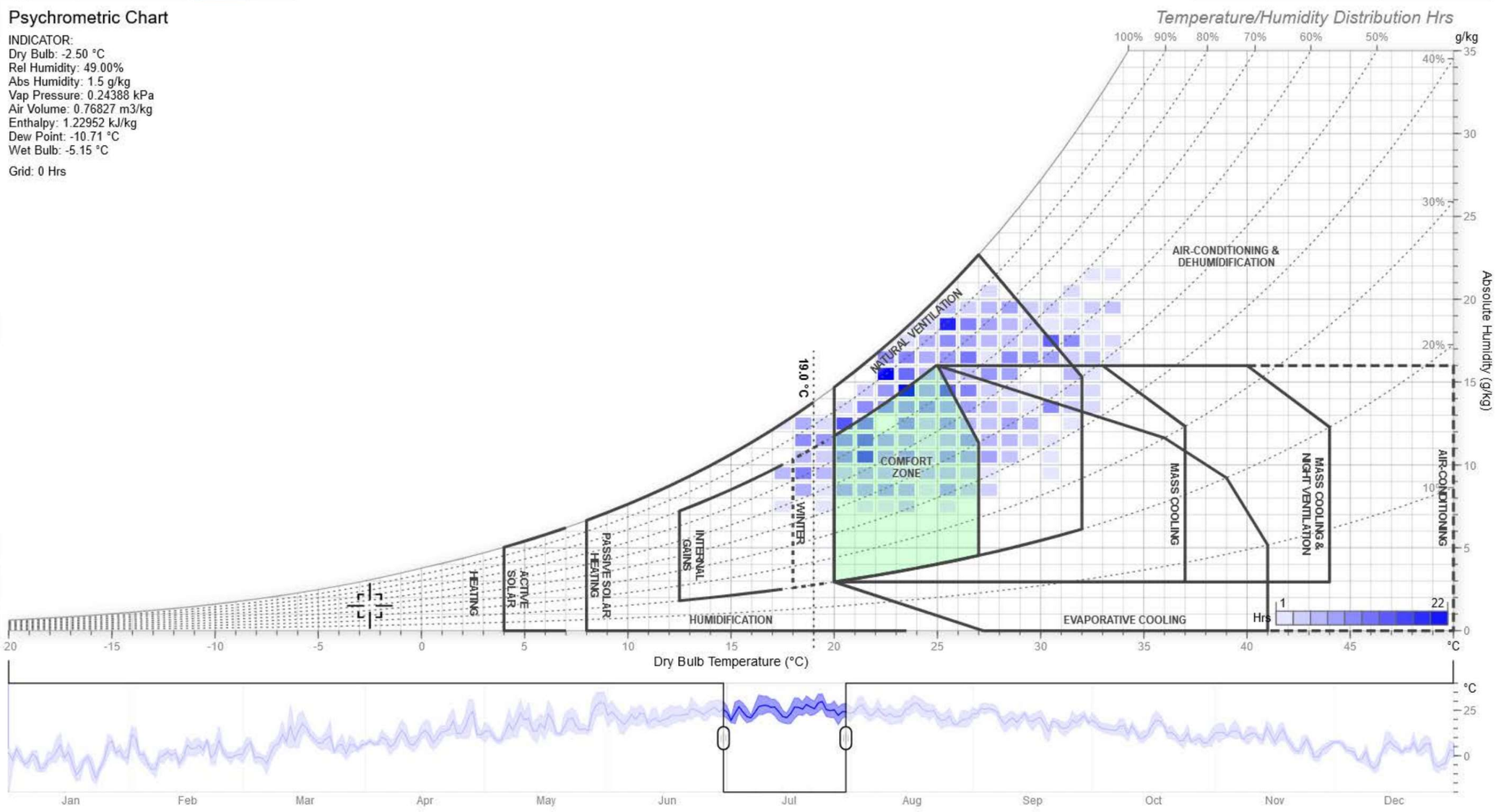
WEATHER STATION

Psychrometric Chart

INDICATOR:
Dry Bulb: -2.50 °C
Rel Humidity: 49.00%
Abs Humidity: 1.5 g/kg
Vap Pressure: 0.24388 kPa
Air Volume: 0.76827 m3/kg
Enthalpy: 1.22952 kJ/kg
Dew Point: -10.71 °C
Wet Bulb: -5.15 °C

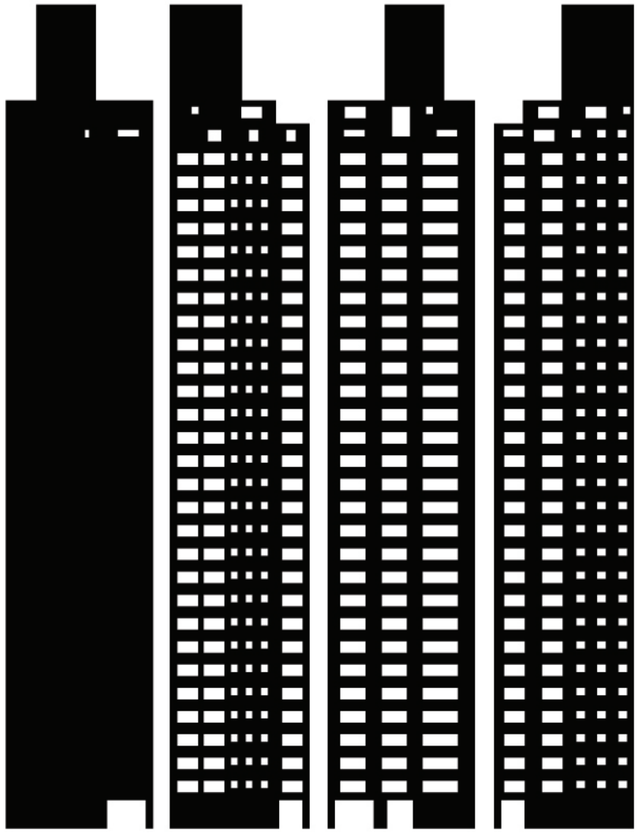
Grid: 0 Hrs

UNITS



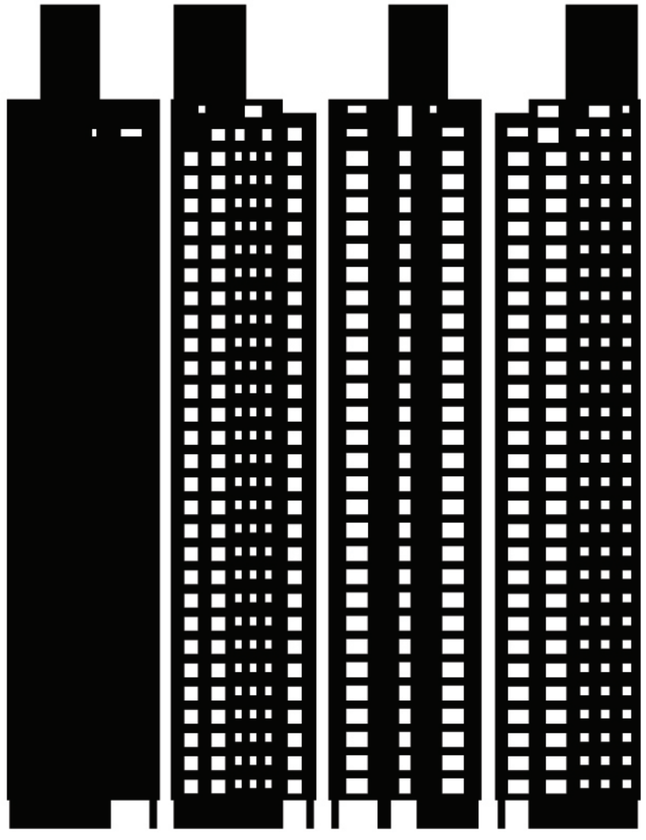
733 Park ave. / existing and modified facade figure ground

existing figure ground

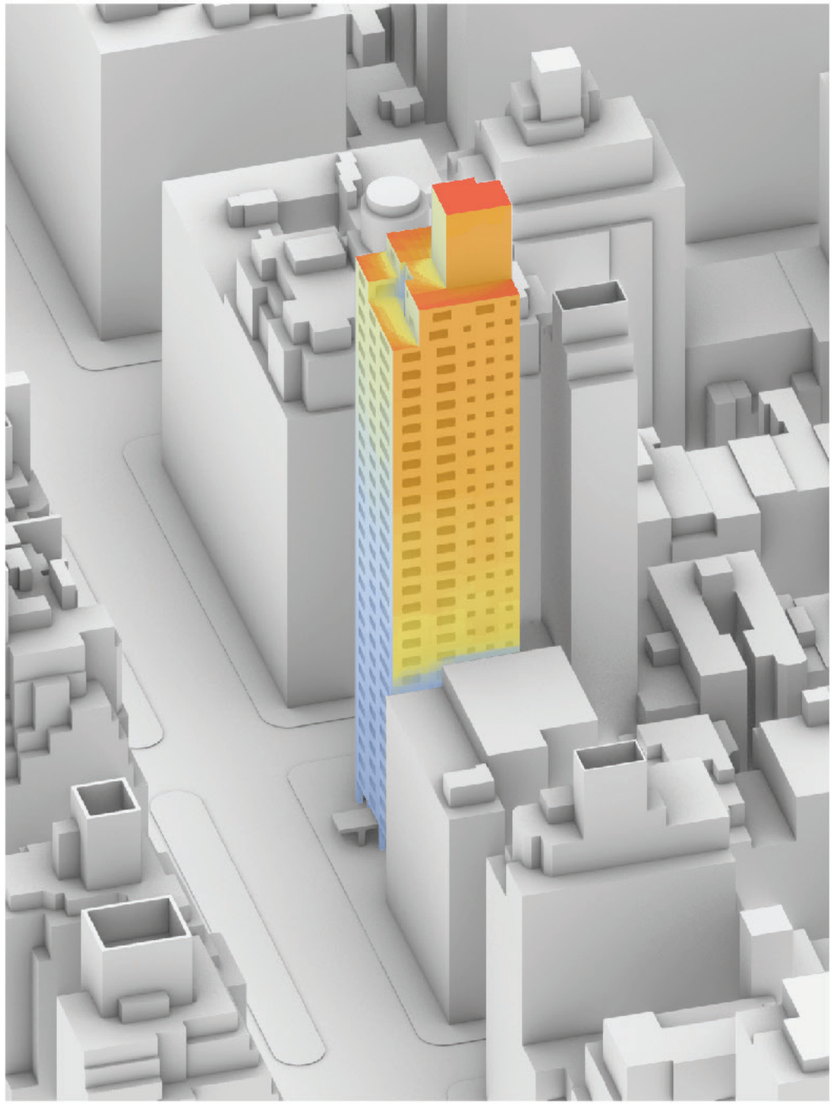


ESE NNE WNW SSW

modified figure ground

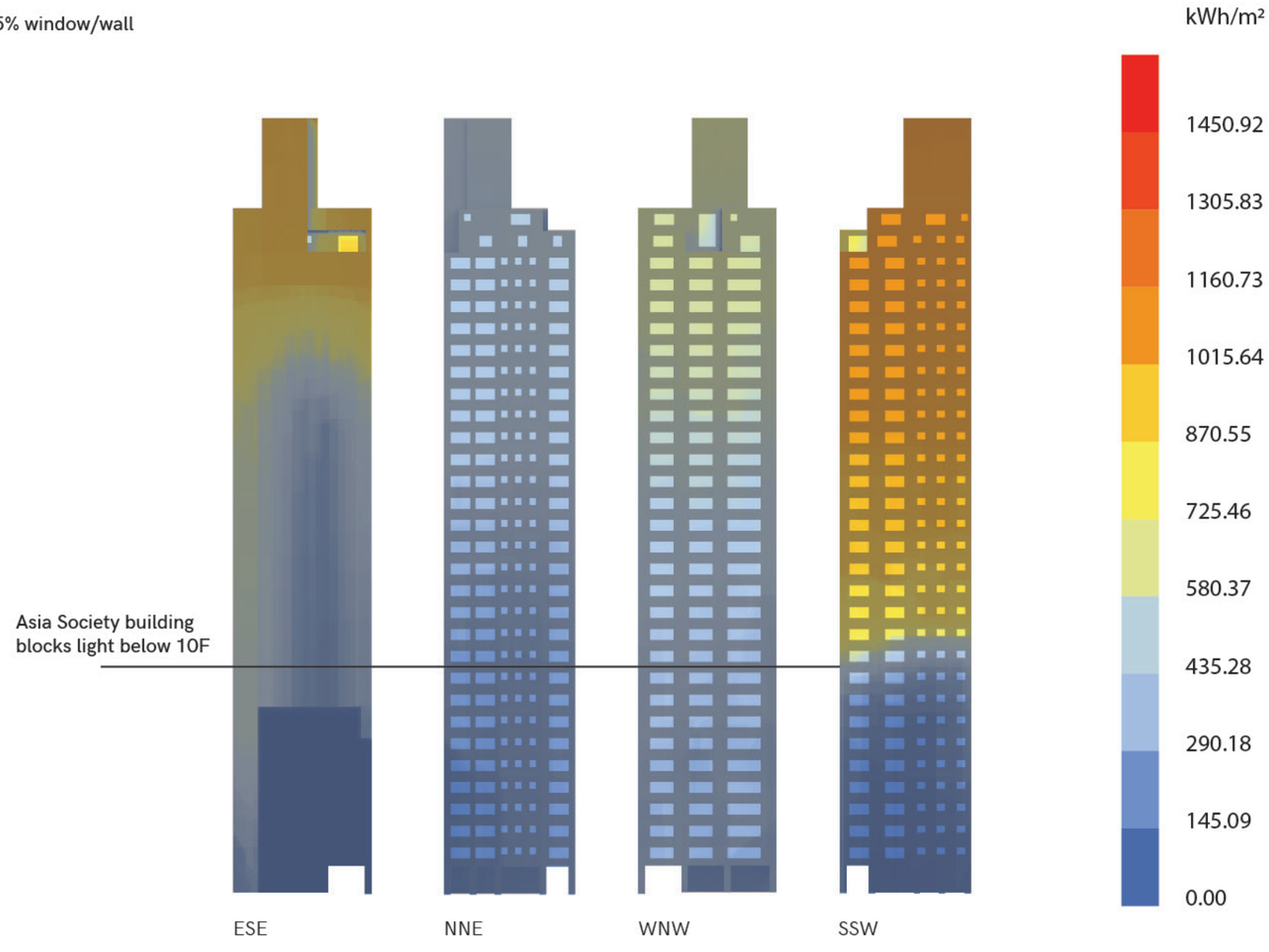


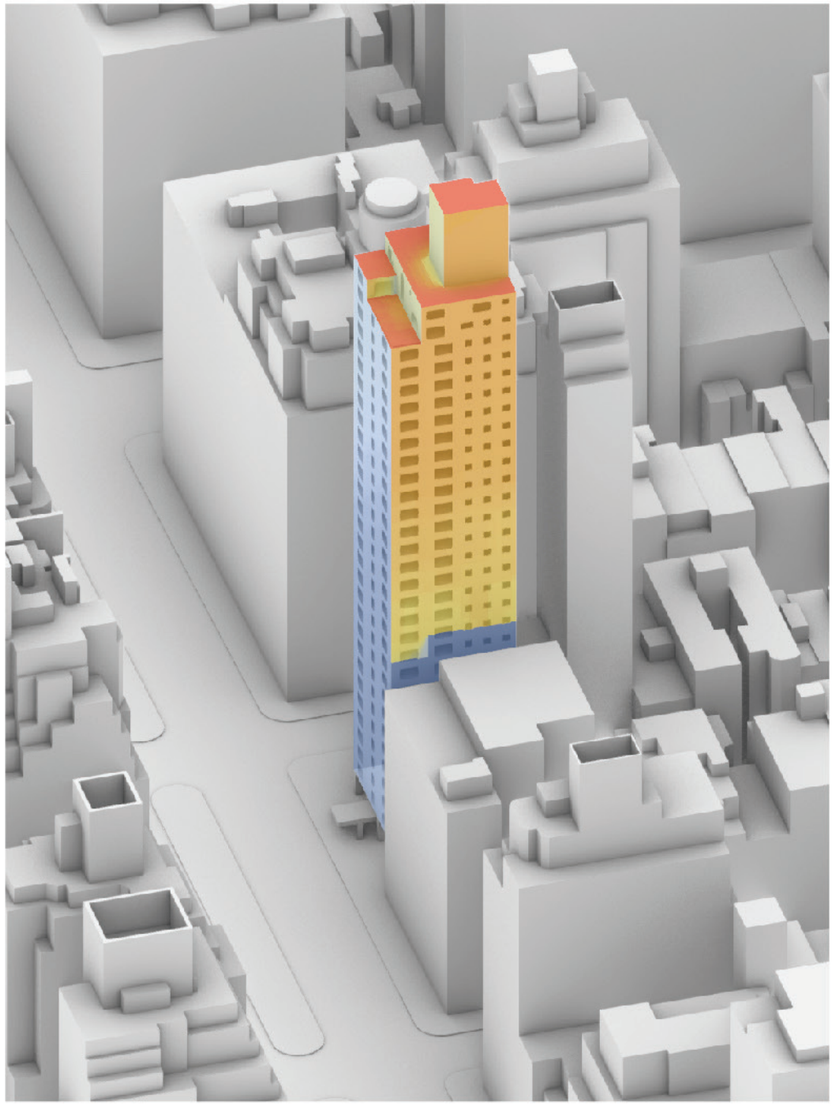
ESE NNE WNW SSW



14,143 ft²
/ 55,510 ft²
=
0.254

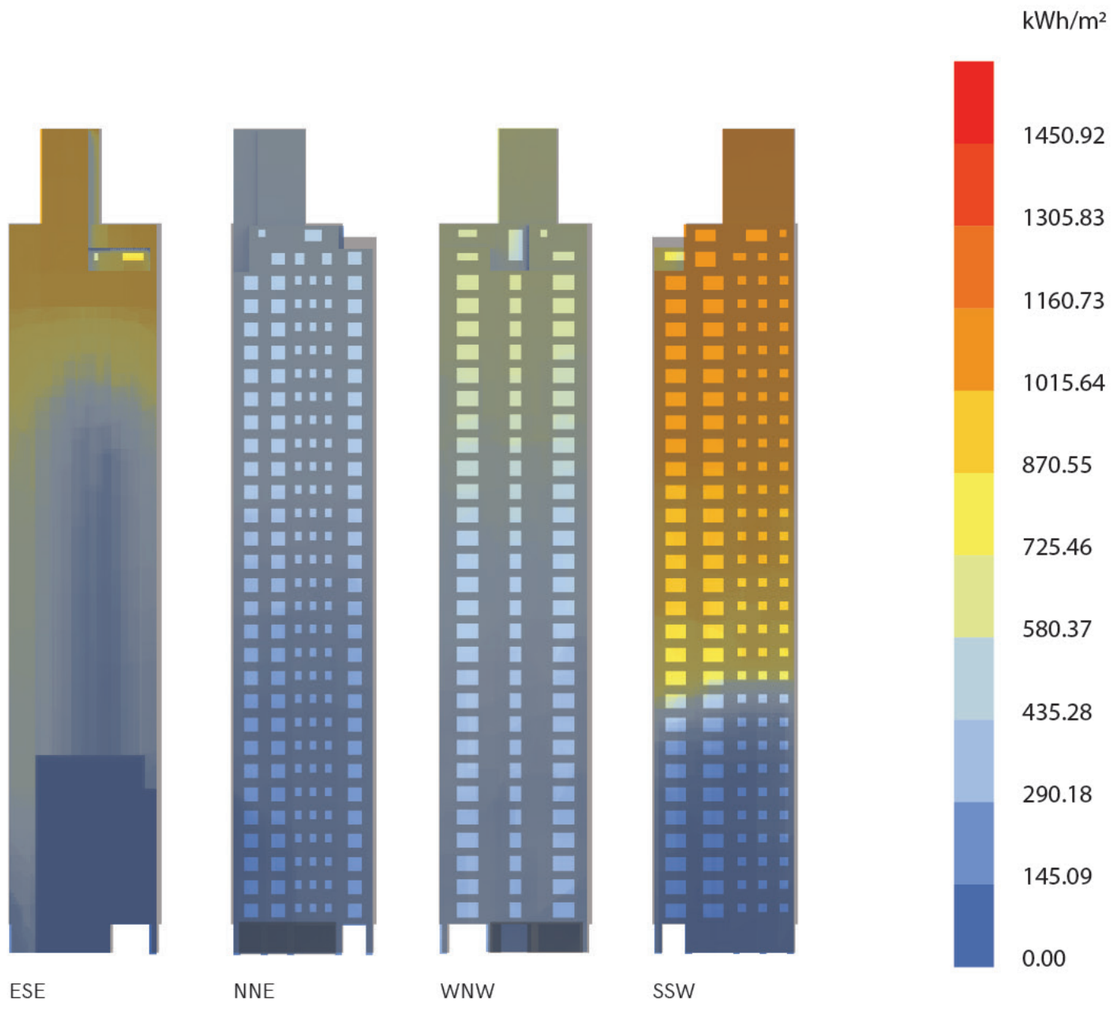
25% window/wall



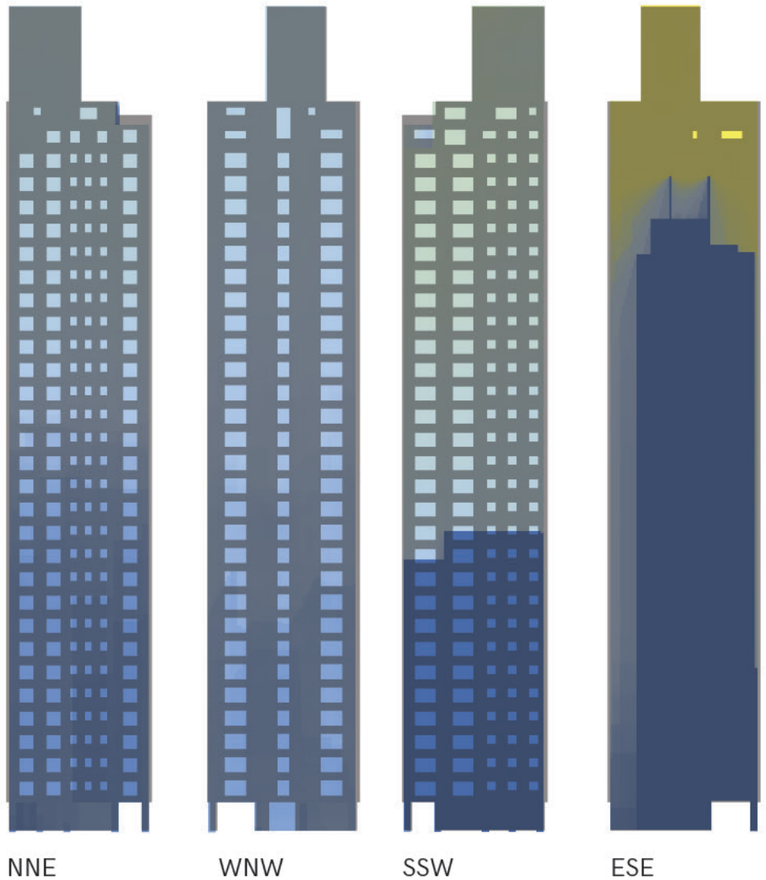


13,272 ft² window area
/ 56,381 ft² wall area
=
0.235

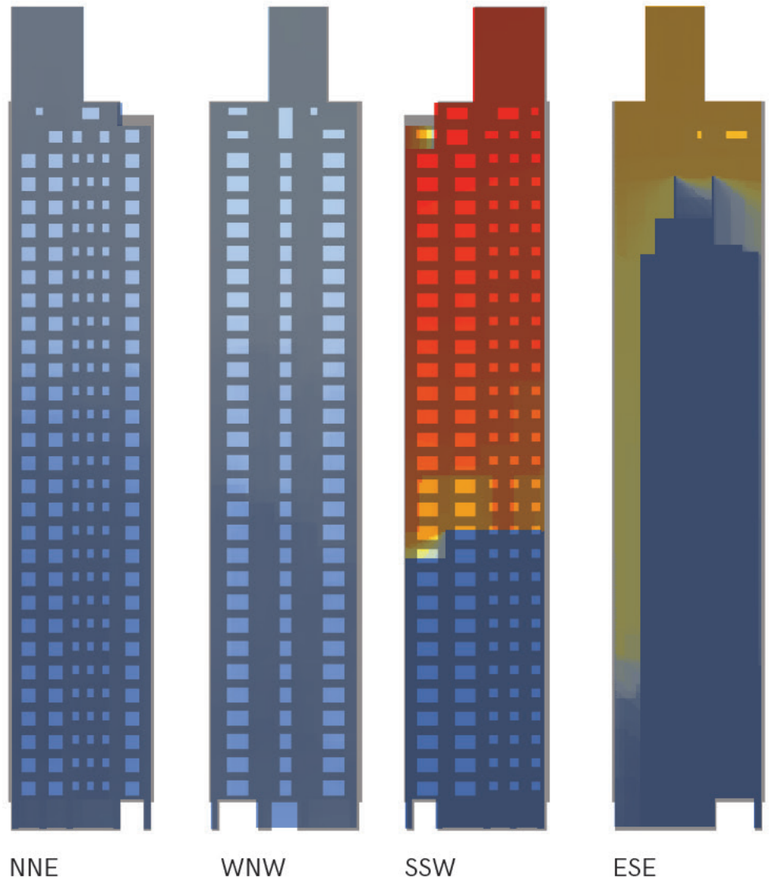
24% window/wall

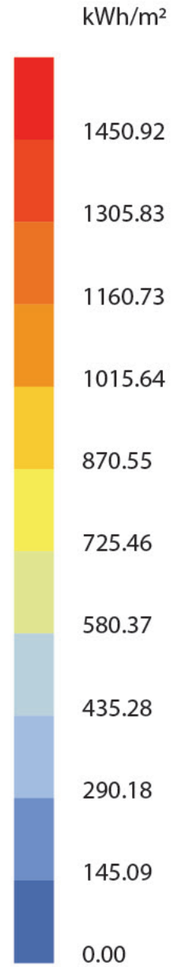


Summer solstice



Winter solstice





OPAQUE 3.0 BETA 1(Build 6, Sep 25, 2021)

File Project Scheme Plot Editor Help

PROJECT: My Project
SCHEME: Exterior Wall

LOCATION: New York Central Prk Obs Belv, NY, USA
LATITUDE: 40.78° North

Wall Section Properties

Orientation (Degrees from South):	0.0
Tilt (Degrees from Horizontal):	90.0
Surface Absorptivity (%):	26.0
Ground Reflectance (%):	20.0
Total Thickness (mm):	748.03
Total R Value:	6.47
Total U Value:	0.155
Decrement Factor:	0.0
Time Lag:	5.55

Material	mm	R Value
Inside Air Film (wall)	0.0	0.12
Stucco	25.4	0.04
Gypsum Board	15.875	0.1
Studs (steel)	101.6	0.03
Mineral Wool	101.6	2.61
Concrete Block (8 in.)	203.2	0.18
Brick	101.6	0.11
Studs (wood)	300.355	2.31
Cellulose (Blown)	300.355	7.6
Outside Air Film	0.0	0.04

Edit Section | Display Plots

View

Projection

- (•) Axonometric
- ( ) Section

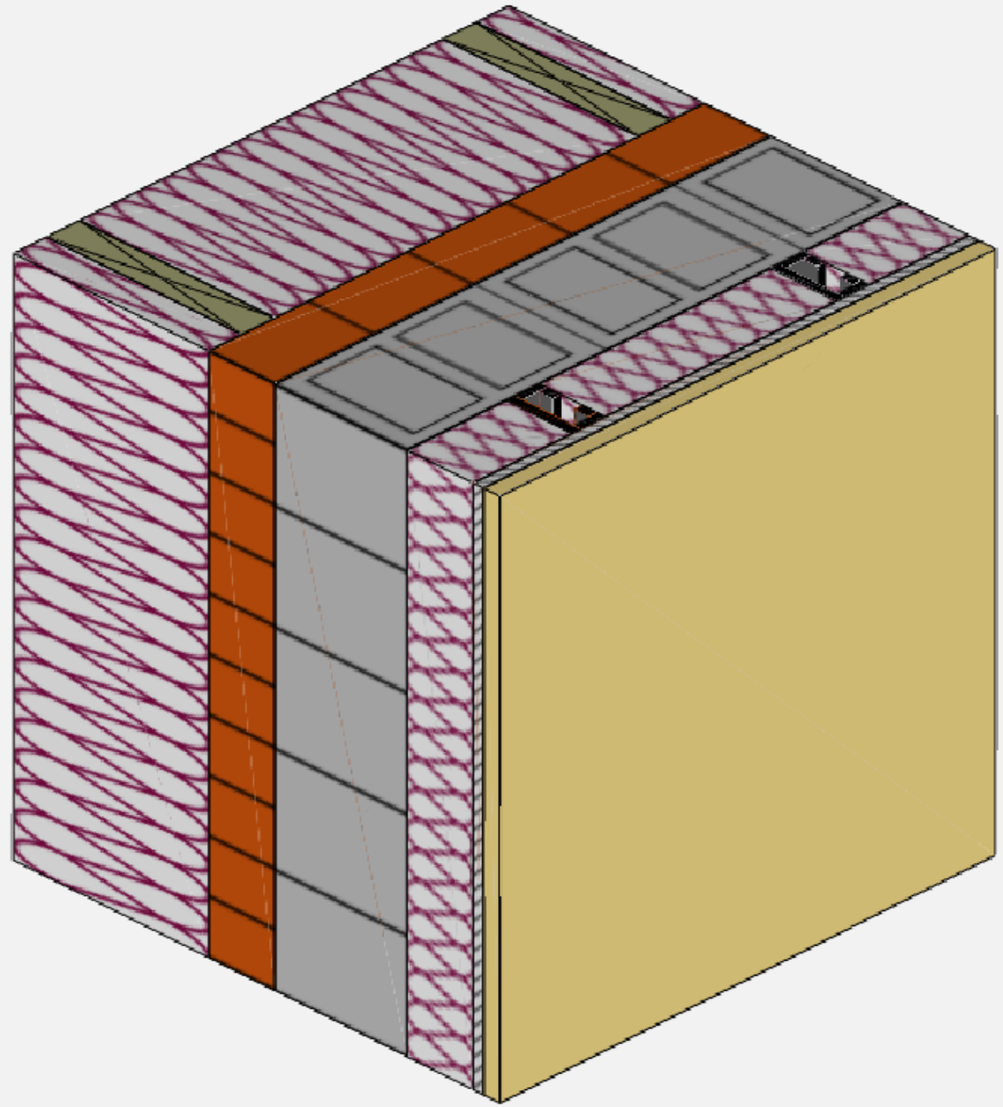
☐ Cutaway

Reset View

Animate

(•) Monthly ( ) Daily — Start

JAN — Month > — Pause



OPAQUE 3.0 BETA 1(Build 6, Sep 25, 2021)

File Project Scheme Plot Editor Help

PROJECT: My Project
SCHEME: Roof

LOCATION: New York Central Prk Obs Belv, NY, USA
LATITUDE: 40.78° North

Roof Section Properties

Orientation (Degrees from South):	0.0
Tilt (Degrees from Horizontal):	0.0
Surface Absorptivity (%):	26.0
Ground Reflectance (%):	20.0
Total Thickness (mm):	422.28
Total R Value:	5.27
Total U Value:	0.19
Decrement Factor:	0.01
Time Lag:	11.97

Material	mm	R Value
Inside Air Film (ceiling)	0.0	0.16
Stucco	25.4	0.04
Studs (wood)	101.6	0.78
Mineral Wool	101.6	2.61
Concrete	152.4	0.11
Fiberboard Sheathing	12.7	0.19
Studs (wood)	101.6	0.78
Extruded Polystrene	101.6	2.9
Plywood	15.875	0.14
Slate or Tile	12.7	0.01
Outside Air Film	0.0	0.04

Edit Section | Display Plots

View

Projection

- (•) Axonometric
- ( ) Section

☐ Cutaway

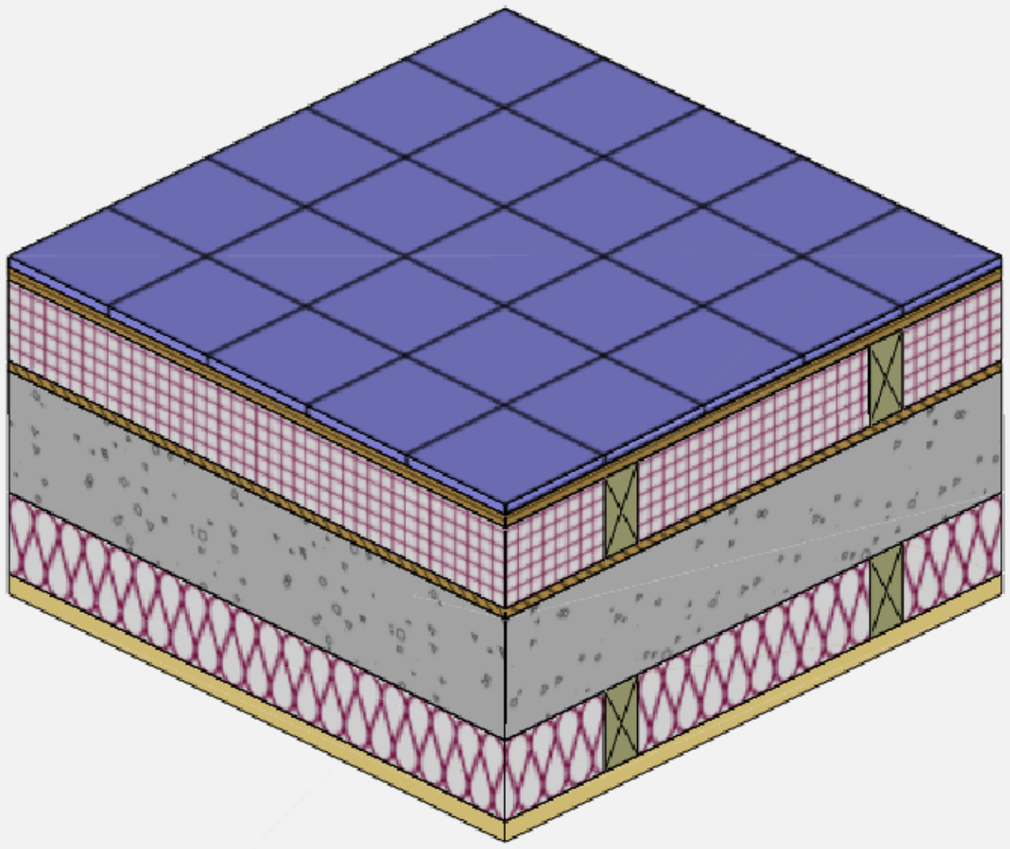
Reset View

Animate

- (•) Monthly
- ( ) Daily

Start

JAN | Month > | Pause



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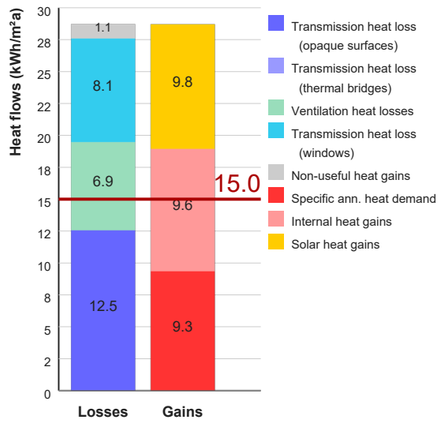
[Language: EN]

Overview | Results | Heat balance | Climate | Vent.+IHG | Areas | U-value editor | Assemblies | Components | Shading

▼ Heat balance



▼ Project overview

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Climate	New York	change
Building type	Dwelling	change
Annual heat demand (Q_h)	9.3 kWh/m²a	details
Treated Floor Area (TFA)	7764 m² (Direct entry)	details
Thermal envelope area	7574 m²	details
Heat Loss Form Factor	0.98	
Projected building footprint	-.-- m²	
Number of windows	414	details
Number of thermal surfaces	25	details
Number of thermal bridges	None defined	details

Thermal envelope checks
The thermal envelope appears to be complete!

Render mode

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Overview | Results | Heat balance | Climate | Vent.+IHG | Areas | U-value editor | Assemblies | Components | Shading

▼ Treated Floor Area

TFA Total
Total from direct user entry **7764.00**

Use direct entry TFA?	Direct entry TFA total
☑	7764.0

▼ Opaque surfaces

expand columns >> | freeze auto names

Select	Area ID	Building element desc.	Assigned to group	Orientation	Total area (m²)	Window areas (m²)	Qty. windows	Net area (m²)	Assem. desc.	U-value	Transmission heat losses (kWh/a)
	1	Roof_001_D	10 - Roof/Ceiling - Ambient	D	182.53	0.00	0	182.53	85ud - PH floor	0.25	2920.52
	2	Wall_002_N	8 - External Wall - Ambient	N	51.37	0.00	0	51.37	90ud - ext wall	0.23	769.28
	3	Wall_003_W	8 - External Wall - Ambient	W	41.35	12.33	1	29.03	90ud - ext wall	0.23	434.73
	4	Wall_004_W	8 - External Wall - Ambient	W	6.18	0.00	0	6.18	90ud - ext wall	0.23	92.61
	5	Roof_005_D	10 - Roof/Ceiling - Ambient	D	157.79	0.00	0	157.79	91ud - roof	0.49	4917.98
	6	Wall_006_E	18 - Partition Wall to Neighbour	E	368.79	0.00	0	368.79	87ud - wall_neighbour	0.25	
	7	Wall_007_S	8 - External Wall - Ambient	S	1646.75	404.76	147	1241.99	90ud - ext wall	0.23	18600.05
	8	Wall_008_W	8 - External Wall - Ambient	W	1611.26	403.48	85	1207.79	90ud - ext wall	0.23	18087.81
	9	Wall_009_N	8 - External Wall - Ambient	N	1593.26	380.35	174	1212.91	90ud - ext wall	0.23	18164.55
	10	Wall_010_E	8 - External Wall - Ambient	E	1407.65	0.00	0	1407.65	90ud - ext wall	0.23	21080.90
↓ show more... (15 rows hidden) ↓											
					7942.67	**1233.98**	**414.00**	**6708.69**			**97306.79**

▼ Windows

expand columns >> | freeze auto names

Select	Win ID	Window name	Assigned to group	cill_height	Width	Height	Installed in	Glazing type	Frame type	Window area (S/O)	g-value	U-value installed	Transmission heat losses (kWh/a)	Solar heat gains (kWh/a)
	1	Win_001_W	5 - West Windows	0.25	3.37	3.66	Wall_003_W	03ud - ZNC-EAGON Kr	04ud - Intus 1662fx03	12.33	0.33	0.78	617.92	97.24
	2	Win_002_S	4 - South Windows	4.75	2.69	1.83	Wall_007_S	04ud - Supera 83 Passive+ fixed	04ud - Intus 1662fx03	4.92	0.60	0.79	247.31	89.49
	3	Win_003_S	4 - South Windows	4.75	2.69	1.83	Wall_007_S	04ud - Supera 83 Passive+ fixed	04ud - Intus 1662fx03	4.92	0.60	0.79	247.31	92.44
	4	Win_004_W	5 - West Windows	4.75	2.82	1.98	Wall_008_W	03ud - ZNC-EAGON Kr	04ud - Intus 1662fx03	5.59	0.33	0.79	283.50	61.06
	5	Win_005_W	5 - West Windows	4.75	1.53	1.98	Wall_008_W	03ud - ZNC-EAGON Kr	04ud - Intus 1662fx03	3.04	0.33	0.81	156.73	25.71
	6	Win_006_W	5 - West Windows	4.75	2.82	1.98	Wall_008_W	03ud - ZNC-	04ud - Intus 1662fx03	5.59	0.33	0.79	283.50	63.61

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Overview | Results | Heat balance | Climate | Vent.+IHG | **Areas** | U-value editor | Assemblies | Components | Shading

▼ Treated Floor Area

TFA Total

Total from direct user entry **7764.00**

Use direct entry TFA?	Direct entry TFA total
☑	7764.0

▼ Opaque surfaces

expand columns >> | freeze auto names

Select	Area ID	Building element desc.	Assigned to group	Orientation	Total area (m^2)	Window areas (m^2)	Qty. windows	Net area (m^2)	Assem. desc.	U-value	Transmission heat losses (kWh/a)
	1	Roof_001_D	10 - Roof/Ceiling - Ambient	D	182.53	0.00	0	182.53	85ud - PH floor	0.25	2920.52
	2	Wall_002_N	8 - External Wall - Ambient	N	51.37	0.00	0	51.37	90ud - ext wall	0.23	769.28
	3	Wall_003_W	8 - External Wall - Ambient	W	41.35	12.33	1	29.03	90ud - ext wall	0.23	434.73
	4	Wall_004_W	8 - External Wall - Ambient	W	6.18	0.00	0	6.18	90ud - ext wall	0.23	92.61
	5	Roof_005_D	10 - Roof/Ceiling - Ambient	D	157.79	0.00	0	157.79	91ud - roof	0.49	4917.98
	6	Wall_006_E	18 - Partition Wall to Neighbour	E	368.79	0.00	0	368.79	87ud - wall_neighbour	0.25	
	7	Wall_007_S	8 - External Wall - Ambient	S	1646.75	404.76	147	1241.99	90ud - ext wall	0.23	18600.05
	8	Wall_008_W	8 - External Wall - Ambient	W	1611.26	403.48	85	1207.79	90ud - ext wall	0.23	18087.81
	9	Wall_009_N	8 - External Wall - Ambient	N	1593.26	380.35	174	1212.91	90ud - ext wall	0.23	18164.55
	10	Wall_010_E	8 - External Wall - Ambient	E	1407.65	0.00	0	1407.65	90ud - ext wall	0.23	21080.90
↓ show more... (15 rows hidden) ↓											
					7942.67	**1233.98**	**414.00**	**6708.69**			**97306.79**

▼ Windows

expand columns >> | freeze auto names

Select	Win ID	Window name	Assigned to group	cill_height	Width	Height	Installed in	Glazing type	Frame type	Window area (S/O)	g-value	U-value installed	Transmission heat losses (kWh/a)	Solar heat gains (kWh/a)
	1	Win_001_W	5 - West Windows	0.25	3.37	3.66	Wall_003_W	03ud - ZNC-EAGON Kr	04ud - Intus 1662fx03	12.33	0.33	0.78	617.92	97.24
	2	Win_002_S	4 - South Windows	4.75	2.69	1.83	Wall_007_S	04ud - Supera 83 Passive+ fixed	04ud - Intus 1662fx03	4.92	0.60	0.79	247.31	89.49
	3	Win_003_S	4 - South Windows	4.75	2.69	1.83	Wall_007_S	04ud - Supera 83 Passive+ fixed	04ud - Intus 1662fx03	4.92	0.60	0.79	247.31	92.44
	4	Win_004_W	5 - West Windows	4.75	2.82	1.98	Wall_008_W	03ud - ZNC-EAGON Kr	04ud - Intus 1662fx03	5.59	0.33	0.79	283.50	61.06
	5	Win_005_W	5 - West Windows	4.75	1.53	1.98	Wall_008_W	03ud - ZNC-EAGON Kr	04ud - Intus 1662fx03	3.04	0.33	0.81	156.73	25.71
	6	Win_006_W	5 - West Windows	4.75	2.82	1.98	Wall_008_W	03ud - ZNC-	04ud - Intus 1662fx03	5.59	0.33	0.79	283.50	63.61

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Overview | Results | Heat balance | Climate | **Vent.+IHG** | Areas | U-value editor | Assemblies | Components | Shading

Ventilation & Internal Heat Gains - inputs

▼ Ventilation heat losses

Select ventilation type: 1 - Balanced PH ventilation with HR

Select ventilation unit: 97ud - [75.0%] Default: PH minimum efficiency HR

vent_sys_ID	vent_type_ID	Room height, (m)	Air change rate at pressure test, n50 (1/h)
97ud	1	2.7	0.6

Room height, (m)	Treated Floor Area (m^2)	Ventilation volume, V_v (m^3)	Net air volume for pressure test, V_{n50} (m^3)	Air change rate at pressure test, n50 (1/h)	Wind protection coeff., e	Wind protection coeff., f
2.70	7764.00	20962.80	23059.08	0.60	0.07	15.00

Design air flow rate (m^3/h)	V_dot_av	Average air change rate (1/h)	vent_n_v_ex	Heat recovery efficiency	eta_HR_eff
8175.49	6295.13	0.30	0	0.75	0.75

▼ Internal heat gains

Building type: Dwelling

Number of units (dwellings only): 29

Internal heat gain rate (W/m^2): 2.29

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[Language: EN]

Overview | Results | Heat balance | Climate | Vent.+IHG | Areas | U-value editor | **Assemblies** | Components | Shading

▼ Assemblies (default)

Grp. no.	Area group	Assembly no.	Assembly name	Total thickness (m)	U-value (W/m²K)
7	External Door	89ud	external_door	0.05	0.50
8	External Wall - Ambient	83ud	PH external wall	0.46	0.15
9	External Wall - Ground	86ud	PH basement wall	0.41	0.25
10	Roof/Ceiling - Ambient	84ud	PH roof	0.46	0.15
11	Floor slab / Basement ceiling	85ud	PH floor	0.41	0.25
14	Temperature zone X	88ud	Wall to zone X	0.46	0.15
18	Partition Wall to Neighbour	87ud	wall_neighbour	0.41	0.25

▼ Assemblies (user-defined)

ID	Assembly name	Total thickness	U-value (W/m²K)	Internal insulation?
83ud	PH external wall	0.46	0.15	☐
84ud	PH roof	0.46	0.15	☐
85ud	PH floor	0.41	0.25	☐
86ud	PH basement wall	0.41	0.25	☐
87ud	wall_neighbour	0.41	0.25	☐
88ud	Wall to zone X	0.46	0.15	☐
89ud	external_door	0.05	0.5	☐

↓ show more... (10 rows hidden) ↓

▼ Assemblies (user-calculated U-values)

Assembly ID	Assembly name	Thickness	U-value	Internal insulation?
01ud	New assembly	0.00		☐
02ud	New assembly	0.00		☐
03ud	New assembly	0.00		☐
04ud	New assembly	0.00		☐
05ud	New assembly	0.00		☐
06ud	New assembly	0.00		☐
07ud	New assembly	0.00		☐

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Overview | Results | Heat balance | Climate | Vent.+IHG | Areas | U-value editor | Assemblies | **Components** | Shading

▼ Glazing (user-defined)

ID	Description	g-value	U-value (W/m²K)
01ud	PH glazing	0.5	0.8
02ud	ZNC	0.6	0.76
03ud	ZNC-EAGON Kr	0.33	0.76
04ud	Supera 83 Passive+ fixed	0.6	0.75
05ud		0.0	0.0
06ud		0.0	0.0
07ud		0.0	0.0

↓ show more... (8 rows hidden) ↓

▼ Frames (user-defined)

ID	Description	U-frame, Left (W/m²K)	U-frame, Right (W/m²K)	U-frame, Bottom (W/m²K)	U-frame, Top (W/m²K)	Width, Left (m)	Width, Right (m)	Width, Bottom (m)	Width, Top (m)	Psi spacer, Left (W/mK)	Psi spacer, Right (W/mK)	Psi spacer, Bottom (W/mK)	Psi spacer, Top (W/mK)	Psi installation, Left (W/mK)	Psi installation, Right (W/mK)	Insta Bo (W
01ud	PH frame	0.75	0.75	0.75	0.75	0.14	0.14	0.14	0.14	0.04	0.04	0.04	0.04	0.04	0.04	0
02ud	ZNC	0.73	0.73	0.73	0.73	0.11	0.11	0.11	0.11	0.022	0.022	0.022	0.022	0.022	0.022	0.
03ud	ZNC-EAGON Kr	0.73	0.73	0.73	0.73	0.11	0.11	0.11	0.11	0.022	0.022	0.022	0.022	0.022	0.022	0.
04ud	Intus 1662fx03	0.72	0.72	0.72	0.72	0.07	0.07	0.07	0.07	0.019	0.019	0.019	0.019	0.019	0.0	(
05ud		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(
06ud		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(
07ud		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(

↓ show more... (8 rows hidden) ↓

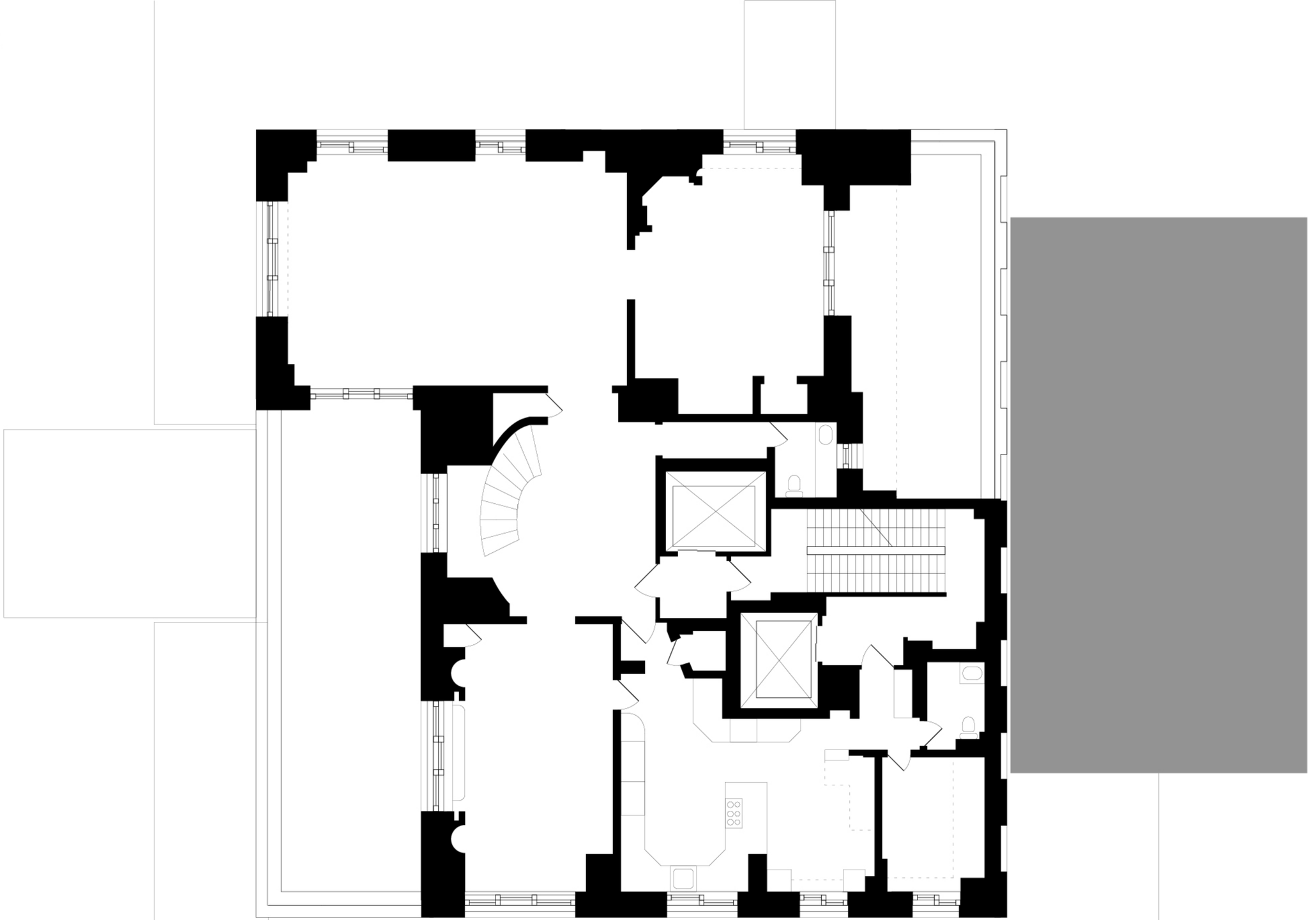
▼ Glazing (certified components)

This library is not available in the designPH-EDU version - please see www.passiv.de/komponentendatenbank/en-EN for the database of currently certified components.

▼ Frames (certified components)

This library is not available in the designPH-EDU version - please see www.passiv.de/komponentendatenbank/en-EN for the database of currently certified components.

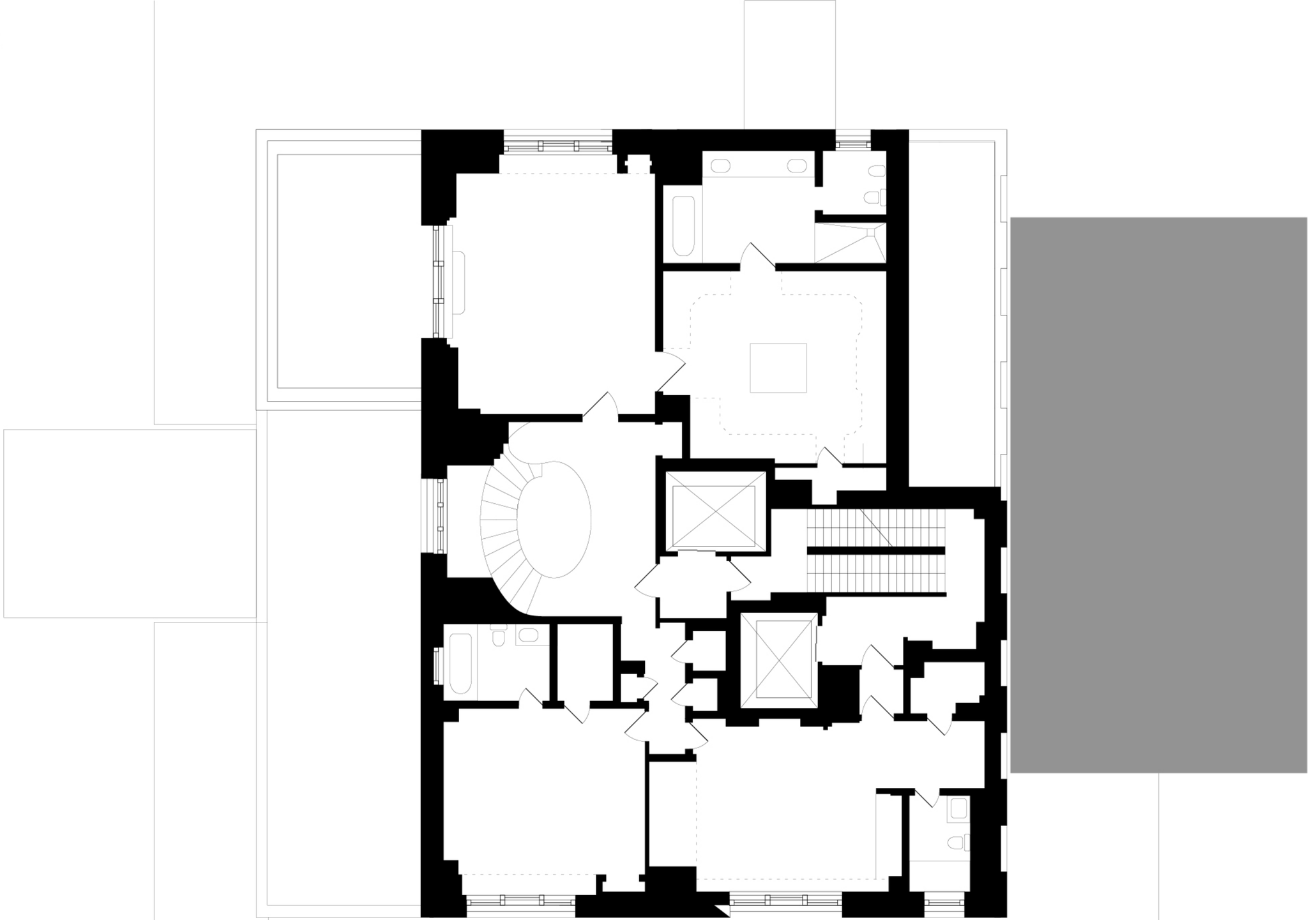
733 Park ave / 29th floor penthouse modified



1′ 5′ 10′ 20′

SCALE 1′ = 1/8″

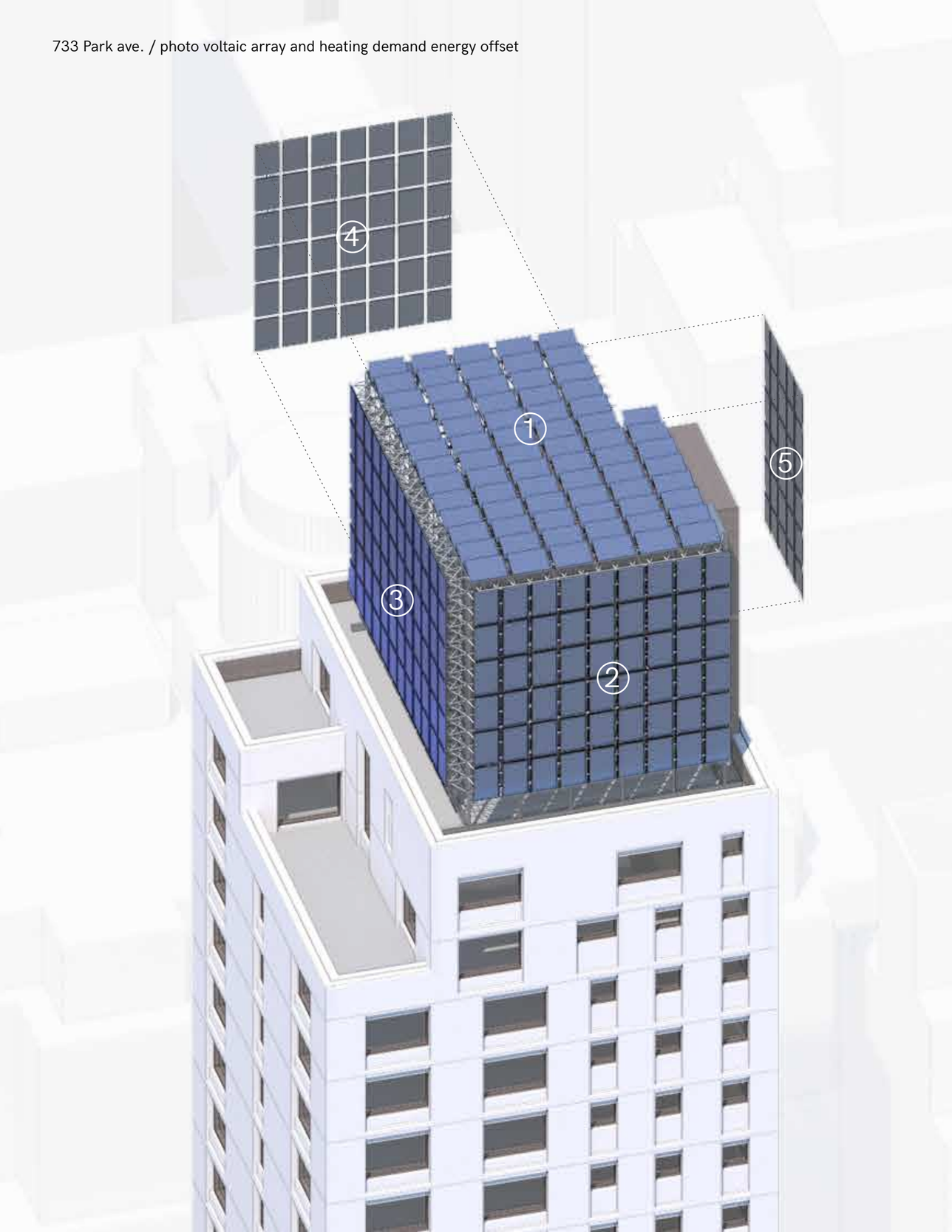
733 Park ave / 30th floor penthouse modified



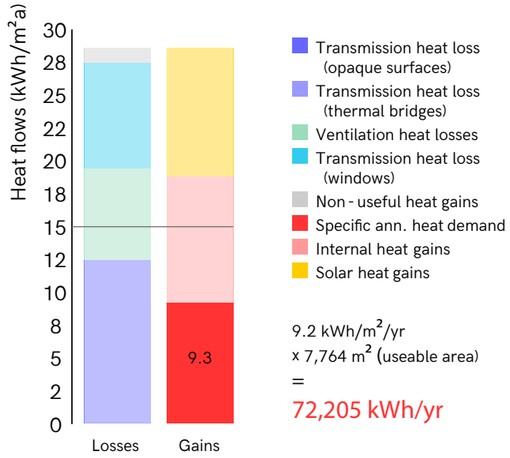
1′ 5′ 10′ 20′

SCALE 1′ = 1/8″

733 Park ave. / photo voltaic array and heating demand energy offset



Heat balance



9.2 kWh/m²/yr
x 7,764 m² (useable area)
=
72,205 kWh/yr

PV Module

Trina Solar Vertex 405+ S

1754mm x 1096mm
21kg
210mm monocrystalline waffer cells
up to 21% efficiency

Output calculation

array	DC system size (kW)*	losses(%)	tilt (deg.)	azimuth (deg.)	output (kWh/yr)
1.	23kW	14%	41°	241°	27,251 kWh/yr
2.	22kW	12%	90°	241°	18,902 kWh/yr
3.	29kW	12%	90°	331°	11,386 kWh/yr
4.	17kW	12%	90°	61°	9,597 kWh/yr
5.	12kW	12%	90°	151°	11,471 kWh/yr
					+
					78,607 kWh/yr

*DC system size (kW) = module nameplate size(W) x total units ÷ 1,000 W/kW