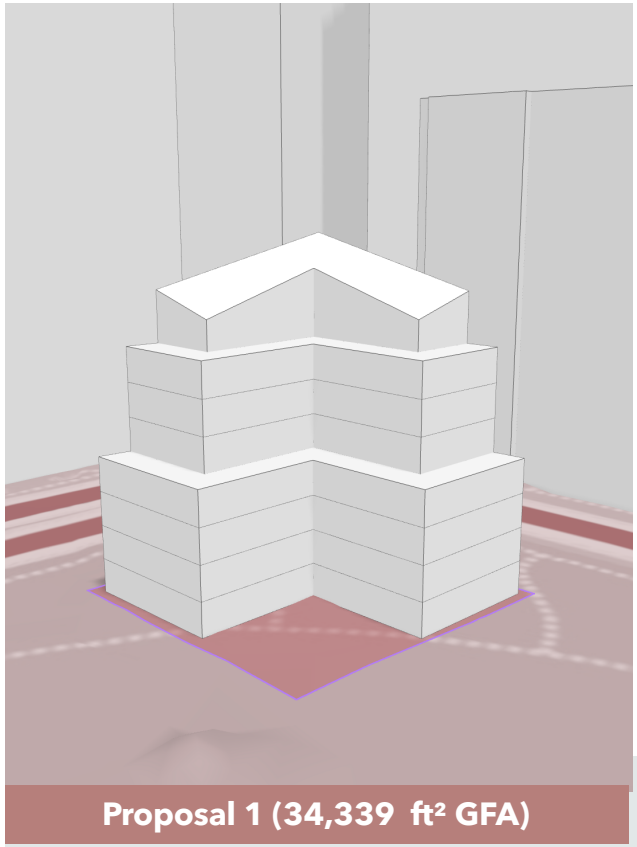
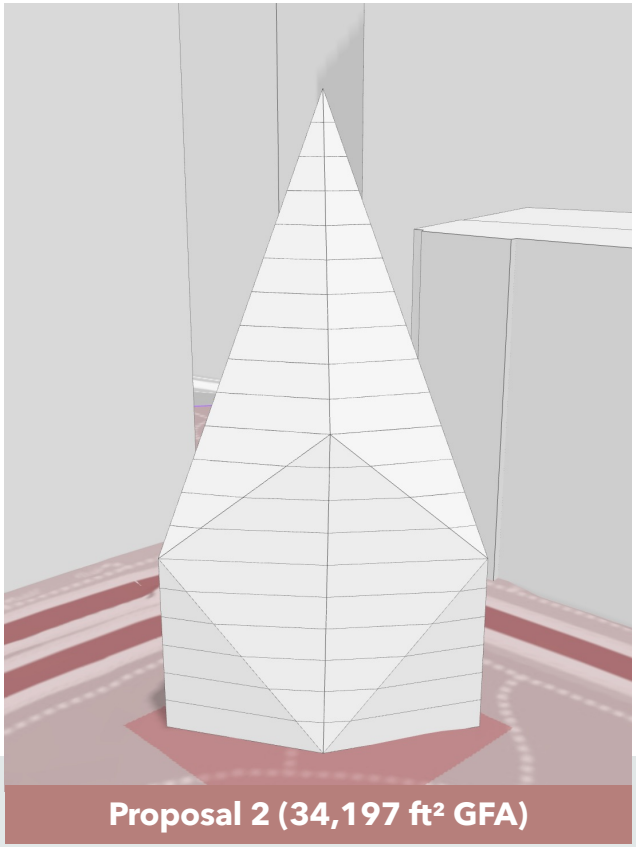
Week 3

Before I present my three design proposals for a waterfront building in New York, **I want to share some of the factors that guided my design process. The site is located in New York**, ZIP code 10004, and has the following characteristics:

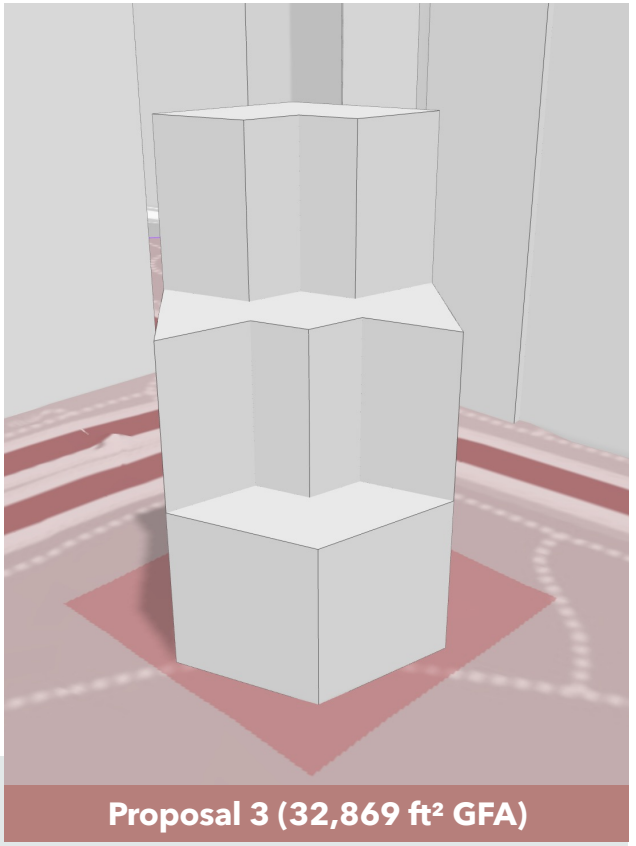
- The building is going to be surrounded by **skyscrapers on the rear side** and have an **open view of the waterfront on the front side**.
- My design will require a balance between height and energy efficiency, as the building should **not be too short to fit in with the urban skyline**, **nor too tall to consume excessive EUI**.
- My design would benefit from an **open shape**, such as an L**, that maximizes the exposure to the waterfront** and creates a sense of openness and connection with the natural environment.
- My design should have a **modern and elegant design** that reflects both the urban context and the natural scenery, using materials, colors, and forms that harmonize with the surroundings.



Proposal 1 (34,339 ft² GFA)



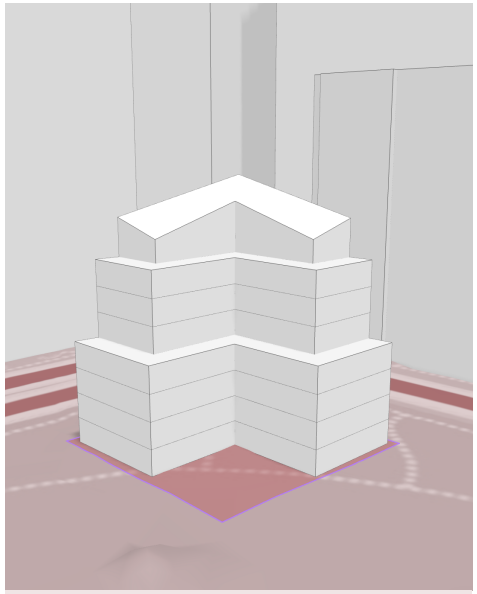
Proposal 2 (34,197 ft² GFA)



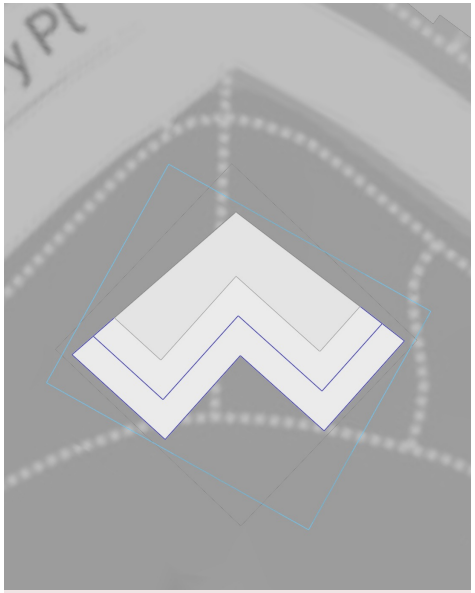
Proposal 3 (32,869 ft² GFA)

My Three Design Proposals for Massing

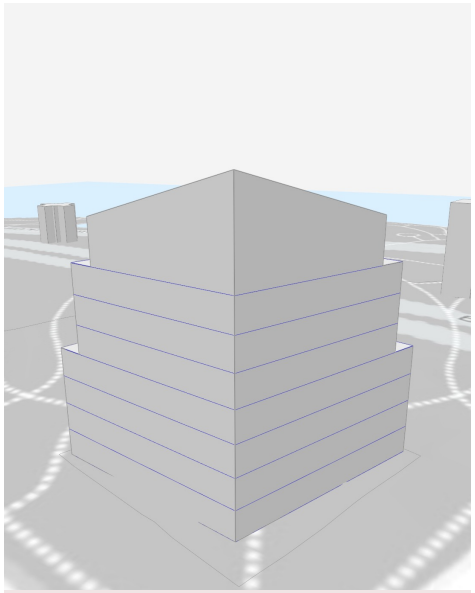
Proposal 1



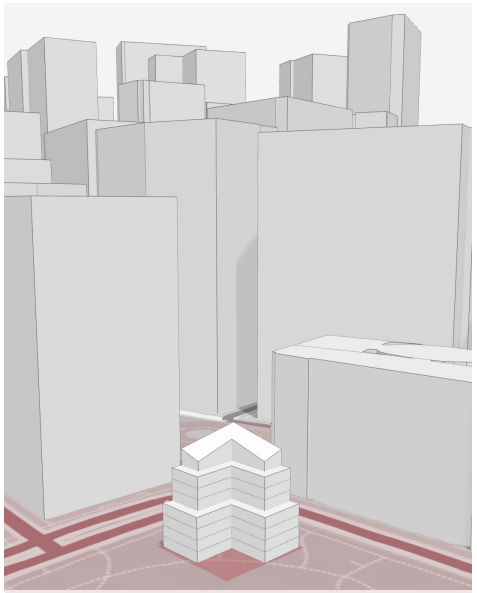
Front View - Zoom



Top View - Zoom



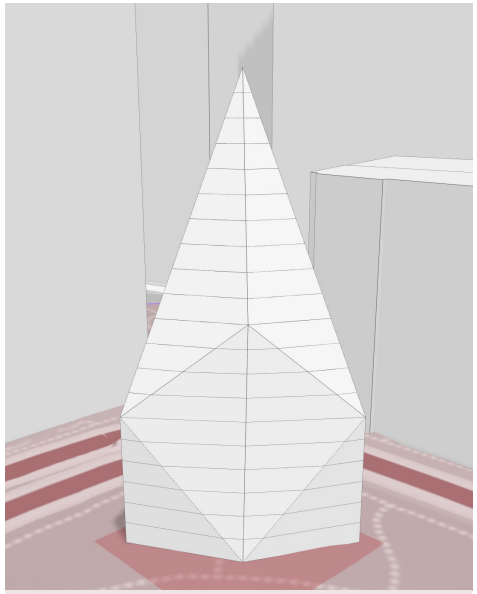
Rear View - Zoom



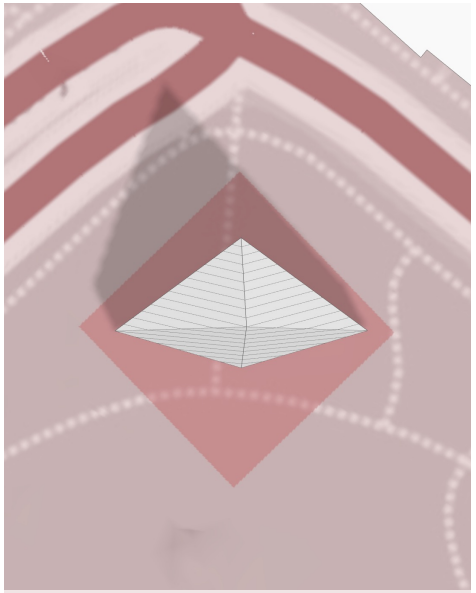
Overview + Surroundings

Proposal 1 is an L-shaped exhibition center that combines sustainability and innovation in its design. **The building's alignment optimizes natural illumination and airflow, while its shape creates a striking and unique visual impact. The top floor, with its soaring ceiling, offers a versatile and multifunctional space that can host a variety of activities and exhibitions**, from large-scale presentations and gatherings, to dining and entertainment options, to panoramic views of the landscape, all customized to suit the different purposes and preferences of various events and conventions.

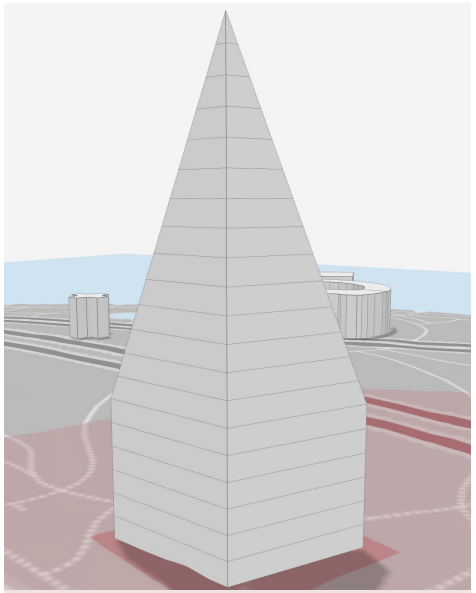
Proposal 2



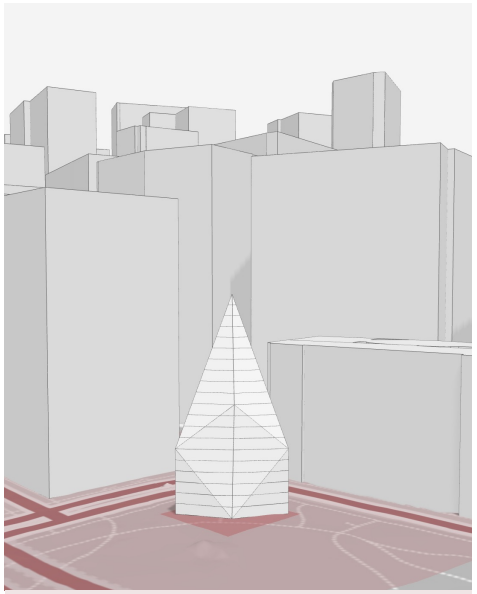
Front View - Zoom



Top View - Zoom



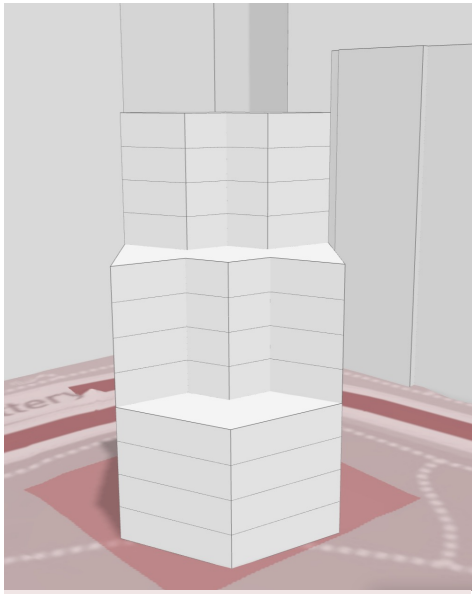
Rear View - Zoom



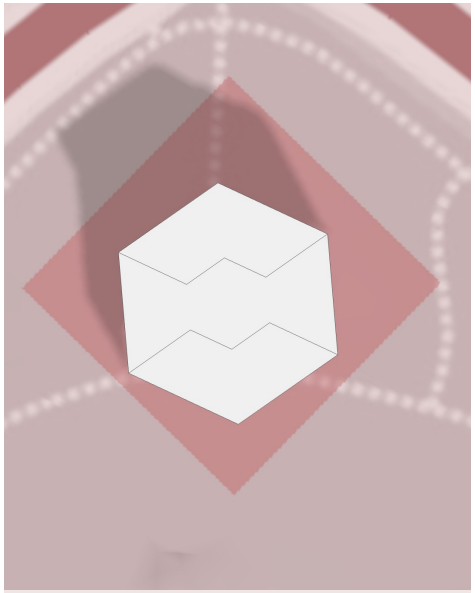
Overview + Surroundings

Proposal 2 is a diamond-shaped exhibition center that harmonizes sustainability and aesthetics in its design. **The building's orientation maximizes natural lighting, while its shape creates a stunning and original visual effect.** The building's height matches the surrounding skyscrapers, making Proposal 2 a distinctive feature of the city's skyline, while also offering a practical and eco-friendly space for events and conventions. Moreover**, the (potential) use of glass walls enables natural light to penetrate the building from both sides, thanks to the slender structure that allows light from the front to reach the back.**

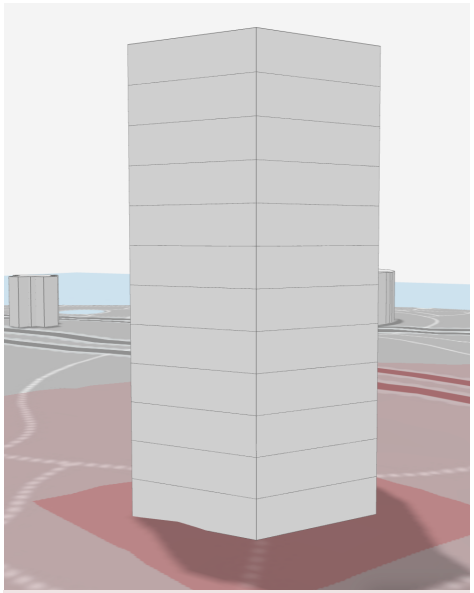
Proposal 3



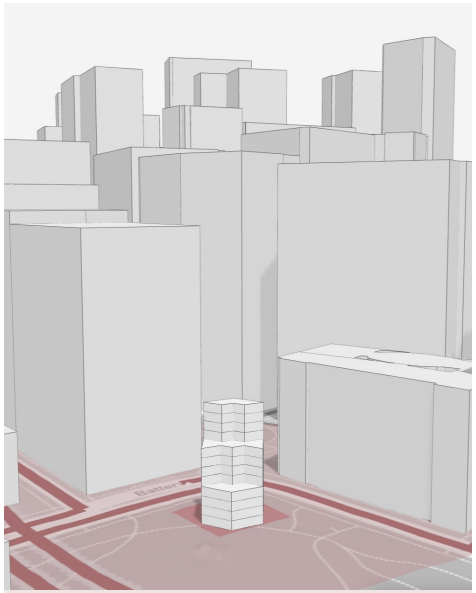
Front View - Zoom



Top View - Zoom



Rear View - Zoom



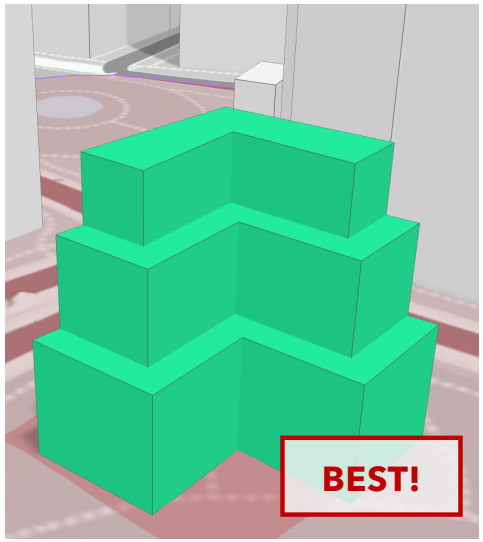
Overview + Surroundings

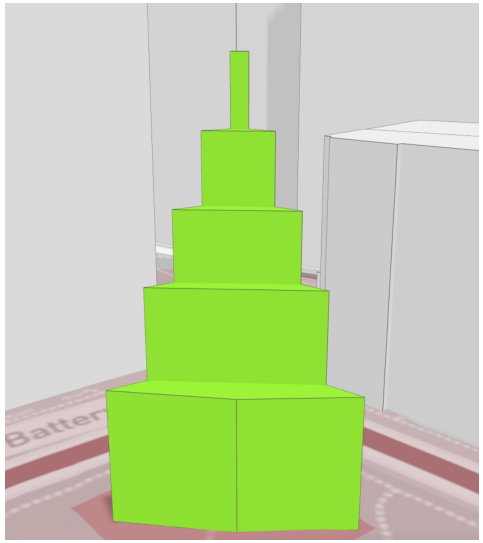
Proposal 3 is a hexagonal exhibition center that showcases the principles of sustainability and harmony with nature. **The building's orientation maximizes natural light and minimizes energy consumption, while its shape reflects the efficiency and elegance of honeycomb structures.** The hexagonal architecture also allows for **flexible and modular spaces that can adapt to different exhibition needs.**

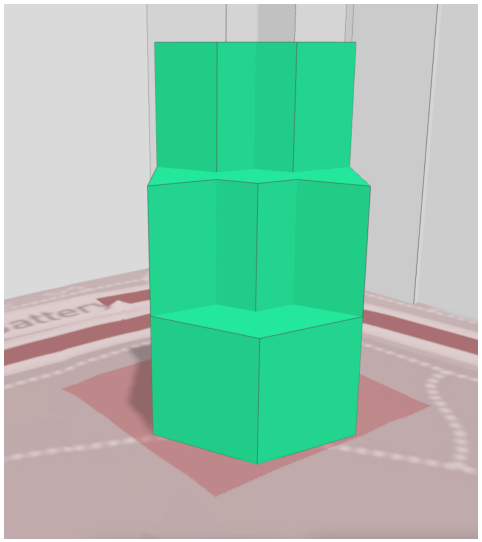
Site EUI Design Analysis

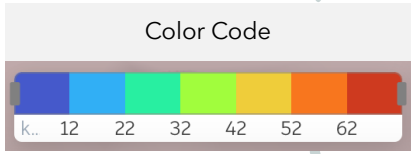
Target: Between 15 and 25 kBtu/sf/yr (47 and 79 kWh/m2/year)

Proposal 1 Site Average	Proposal 2 Site Average	Proposal 3 Site Average
28 kBTU/SF/yr	39 kBTU/SF/yr	31 kBTU/SF/yr









Using the default settings for the Site EUI Design analysis in Forma achieved very high results. Hence, **I have adjusted the settings** on each site as following, reflecting a much **higher level of insulation:**

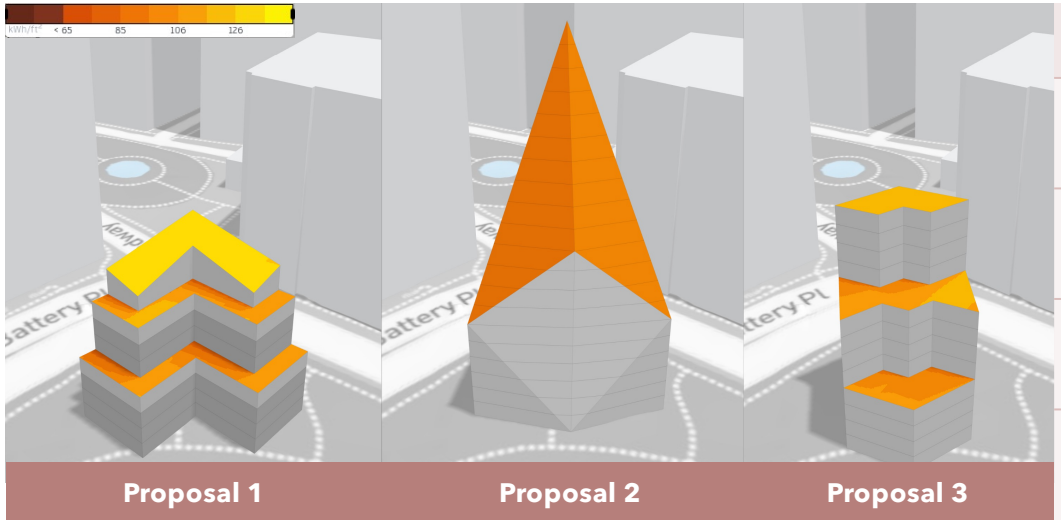
Settings	
Roof construction	Wood: R62.50
Wall construction	14-inch ICF: R90.91
Window construction	Trp LoE
Window-to-wall ratio	40%
Climate zone	Mild, humid

Takeaway: Proposal 1 is the best design in terms of Energy Use Intensity consumption, despite not meeting the target of 15 and 25 kBtu/sf/yr. Given that I have already utilized the maximum type of insulation for the roof, walls, and windows, and I am aiming to maintain a Window-to-Wall Ratio of 40%, the only feasible method to reduce the EUI at this stage of the design would be to decrease the building height. However, this is not a viable option as I intend for the building to blend seamlessly with its surroundings, which predominantly consist of skyscrapers!

Solar Panels Design Analysis (pt 1)

Target: Offset at least 75% of annual energy use with onsite solar PV (either a building integrated or separate onsite array)

First, I evaluated the potential of installing solar PV panels on all available roofs, regardless of my design intent. For each scenario, I used a **surface coverage of 60%** and a **panel efficiency of 15%** (Default Values). The simulation results are displayed in the table below.



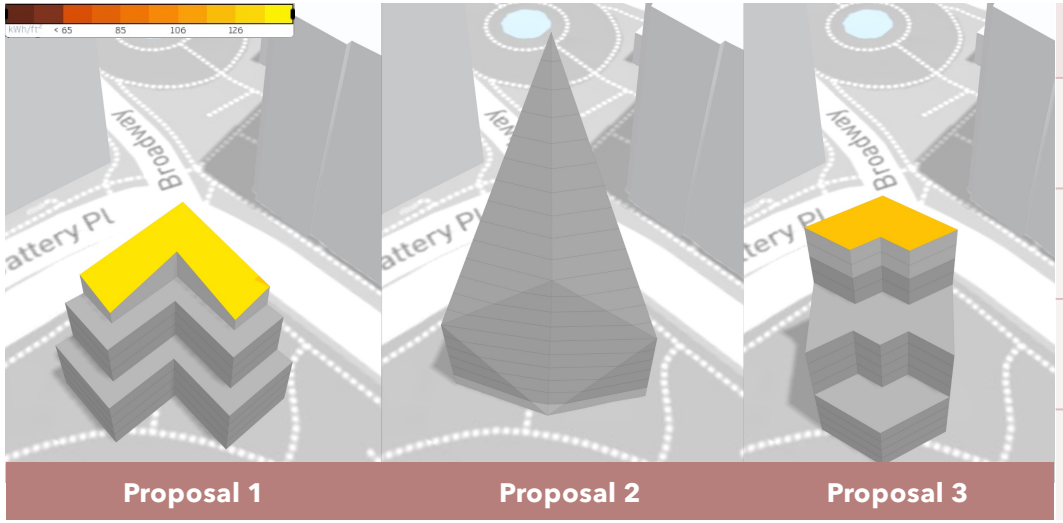
	Proposal 1	Proposal 2	Proposal 3
Panel Placement area (SF)	3572	4091	2614
Total solar energy (kWh)	680380	680103	481284
Average solar energy (kWh/SF)	114	100	110
Annual electrical output (kWh)	49398	49222	34770

It is important to consider that, due to Proposal 2's façade inclination, installing solar PV is not feasible. Additionally, for designs 1 and 3, I would prefer to have roof gardens on the first two terraces/roofs and reserve the last one for PV installation. In the next slide, I have selected only the roofs I wanted and re-run the simulations.

Solar Panels Design Analysis (pt 2)

Target: Offset at least 75% of annual energy use with onsite solar PV (either a building integrated or separate onsite array)

I selected only the roofs where I intended to install solar panels. Additionally, **I discarded the idea of using solar panels on-site for Proposal 2.**
As I reduced the initial area available for the solar panels, I have **increased** the simulation values of **surface coverage** from 60% to **80% (in case there is need for extra space for HVAC)** and **panel efficiency** from 15% to **20%** (considering that most solar panels have efficiencies from 15 to 20%)



	Proposal 1	Proposal 2	Proposal 3
Panel Placement area (SF)	1945	0	994
Total solar energy (kWh)	312356	0	148565
Average solar energy (kWh/SF)	128	0	120
Annual electrical output (kWh)	40602	0	19116

In the next slide, I am going to show the calculations that I have made to decide which is the best design proposal for this analysis. Please note that for this design decision I have considered only the energy generated by panels on-site!

Solar Panels Design Analysis (pt 2)

Target: Offset at least 75% of annual energy use with onsite solar PV (either a building integrated or separate onsite array)

To determine which proposal can offset at least 75% of annual energy use with onsite solar PV, I calculated the amount of solar energy generated by each proposal (excluded proposal 2) and compared it to the annual energy use. The formulas that I have used are, in order:

Annual Energy Use = Site EUI * GFA
Solar Energy Generated = Panel Placement Area * Average Solar Energy
Percentage Offset = Solar Energy Generated / Annual Energy Use * 100%

For **Proposal 1**:

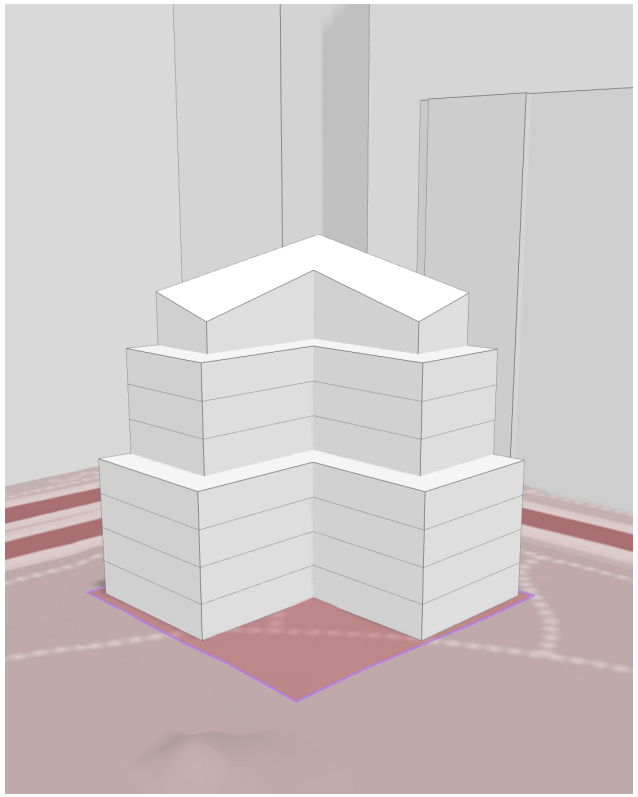
- Annual Energy Use = 28 kBTU/SF/yr * 34,339 SF = 961,492 kBTU/yr = 281,785 kWh/yr
- Solar Energy Generated = 1945 SF * 128 kWh/SF = 248,960 kWh/yr
- Percentage Offset = 248,960 kWh/yr / 281,785 kWh/yr * 100% = **88,35% > 75%!** → **BEST!**

For Proposal 3:

- Annual Energy Use = 31 kBTU/SF/yr * 32,869 SF = 1,018,939 kBTU/yr = 298,621 kWh/yr
- Solar Energy Generated = 994 SF * 120 kWh/SF = 119,280 kWh/yr
- Percentage Offset = 119,280 kWh/yr / 298,621 kWh/yr * 100% = 39.9%

Based on these calculations, **Proposal 1 can offset more than 75% of the annual energy use with onsite solar PV**, which is more than the target. Therefore, Proposal 1 is the best design for this project. Note, that does not have to be my final decision, but **if I later would consider Proposal 2, I would need to install a source of renewable energy, such as solar energy, off-site!**

Conclusions



Design 1 is the winner!

Proposal 1 is the best design for the following reasons:

- Despite falling short of the target EUI range of 15 to 25 kBtu/sf/yr, Proposal 1 stands out with the **lowest consumption among the proposals**. To further enhance energy efficiency, I can later consider incorporating design elements that optimize insulation, lighting, and HVAC systems.
- Proposal 1 demonstrates exceptional sustainability by **offsetting more than 88% of the annual energy use through onsite solar PV**. This surpasses the target threshold of 75%, showcasing a commitment to renewable energy integration.
- The design achieves a commendable **equilibrium between building height and energy efficiency**. Its integration with surrounding skyscrapers maintains aesthetic harmony while aligning with some of the final design targets.
- The unconventional L shape breaks away from the conventional rectangular building form. This not only adds visual interest but also signals a departure from typical structures, contributing to a **unique architectural identity**.

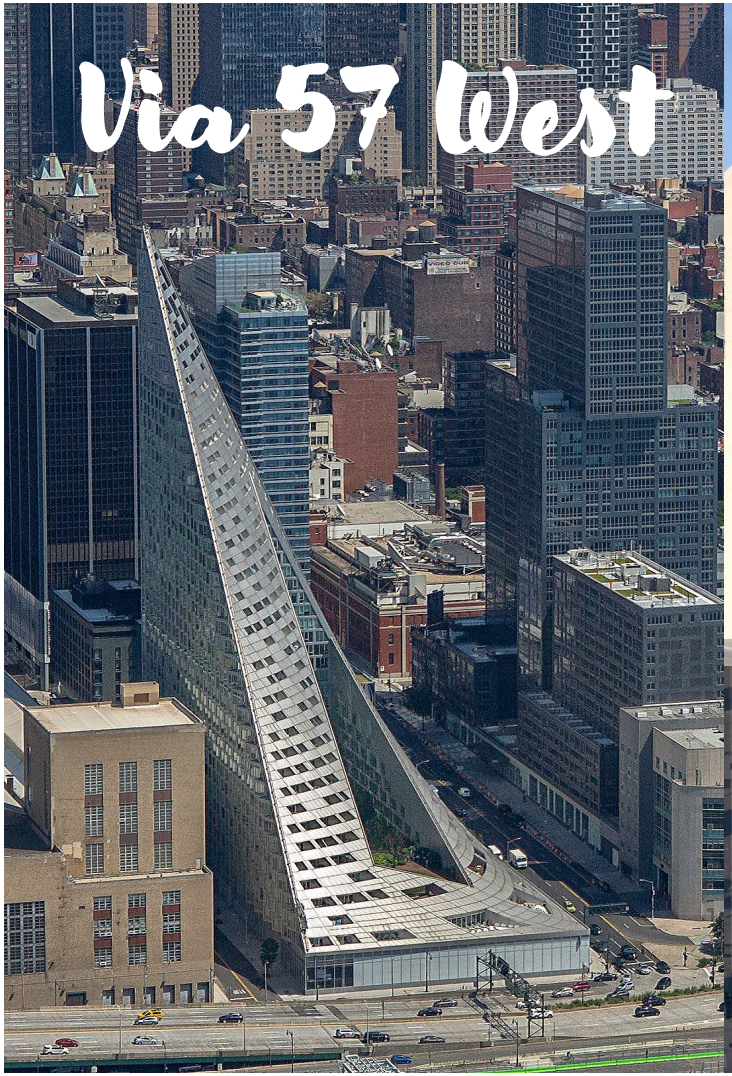
Note: Proposal 1 must not be considered as my final design choice! If, for example, later I would consider Proposal 2, I would need to install a source of renewable energy, such as solar energy, off-site!

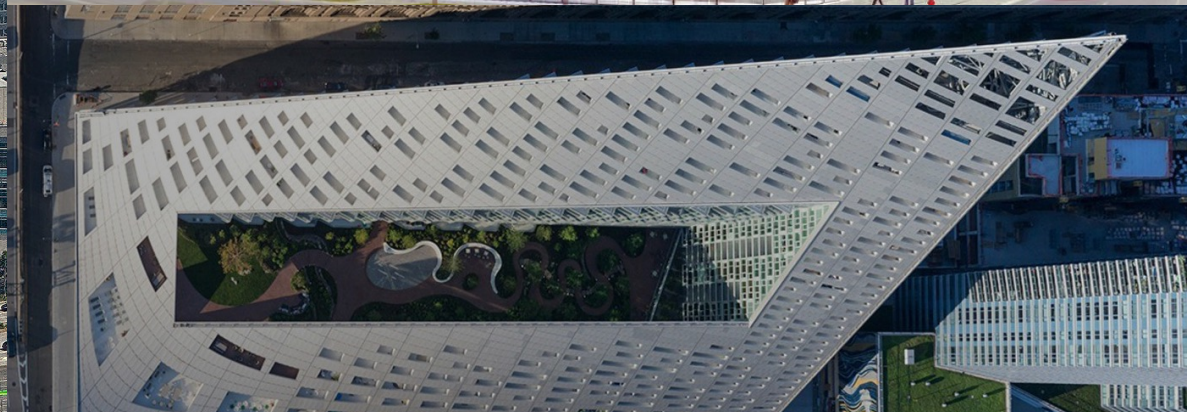
Off-topic: Design Ideas for NYC skyscrapers!

While not required for this specific assignment, I have included upcoming slides to showcase design ideas I stumbled upon online. These visuals can serve as inspiration for future modules and have significantly influenced my designs to this current one! Enjoy!


Via 57 West

Via 57 West






Design Ideas from:
https://www.dezeen.com/2017/06/07/newer-york-hollwich-kushner-art-deco-landmarks-images-usa/

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Design Ideas from:
https://www.oiiostudio.com/#/thebigbend/

Week 4

To be continued...