



Final Project: Seoul, South Korea
SUN ROOM IN SEOUL

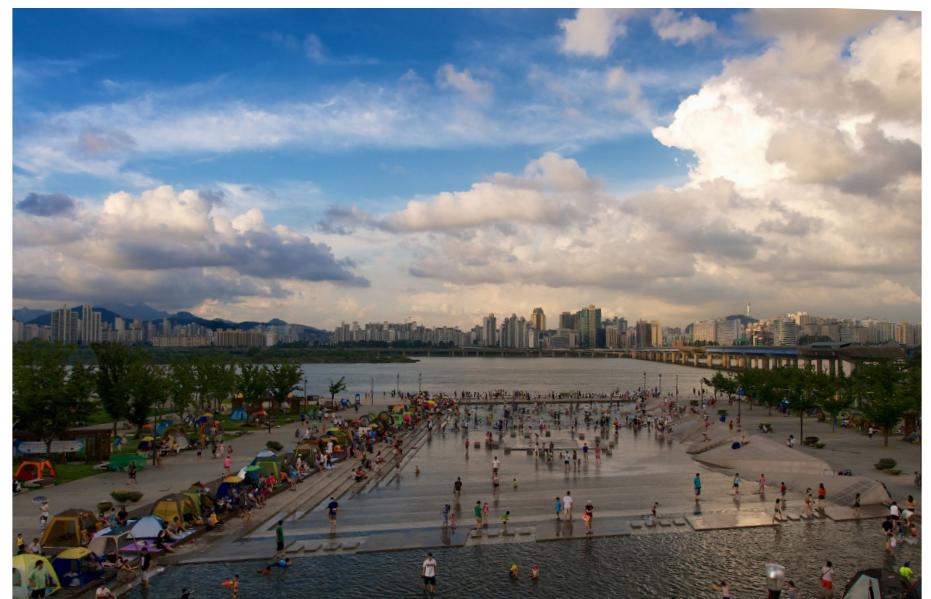
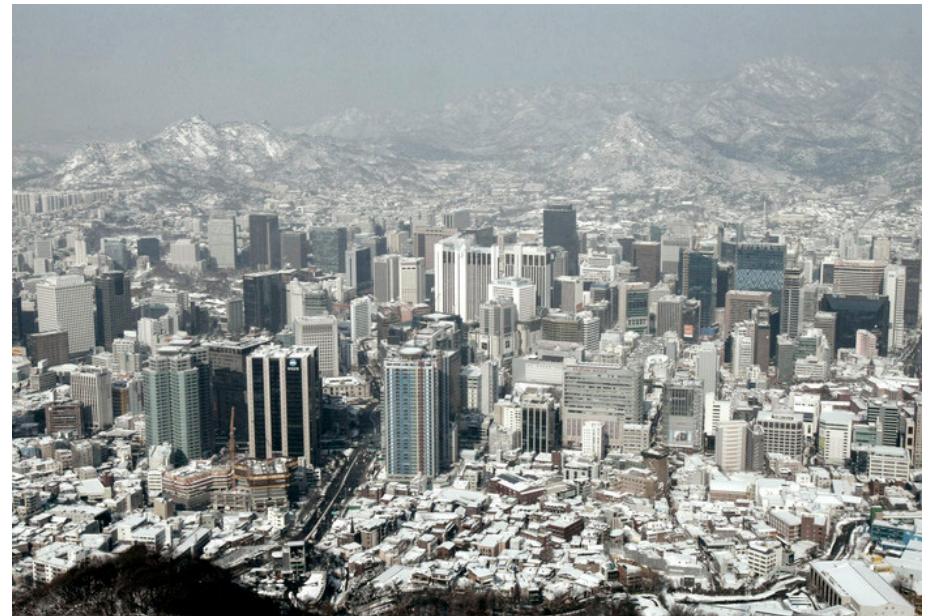
by Rajika Maheshwari | Arch 753

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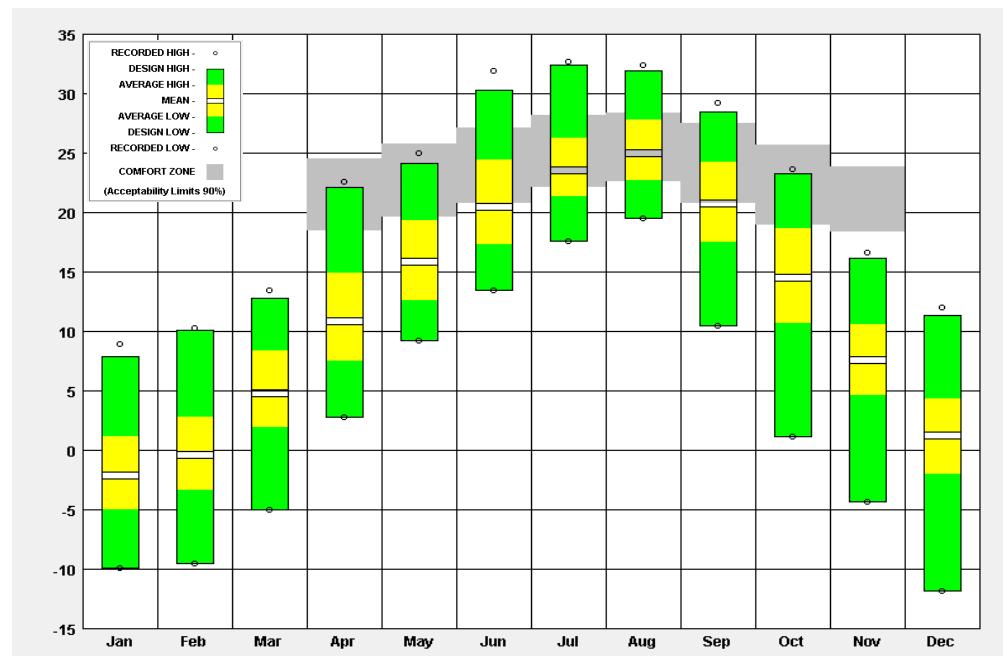
Location & Project Information

- Seoul is the capital of the Republic of Korea and occupies the southern portion of the Korean Peninsula in Asia
- This mountainous peninsula is flanked by the Yellow Sea to the west, and Sea of Japan to the east
- South Korea has humid continental climate and a humid subtropical climate
- It is affected annually by the East Asian monsoon, with precipitation heavier in summer during a short rainy season in June and July.
- The building will be a mixed use medium scale in the heart of Seoul's Yeongdeungpo neighborhood.
- We are designing for offices and residential units

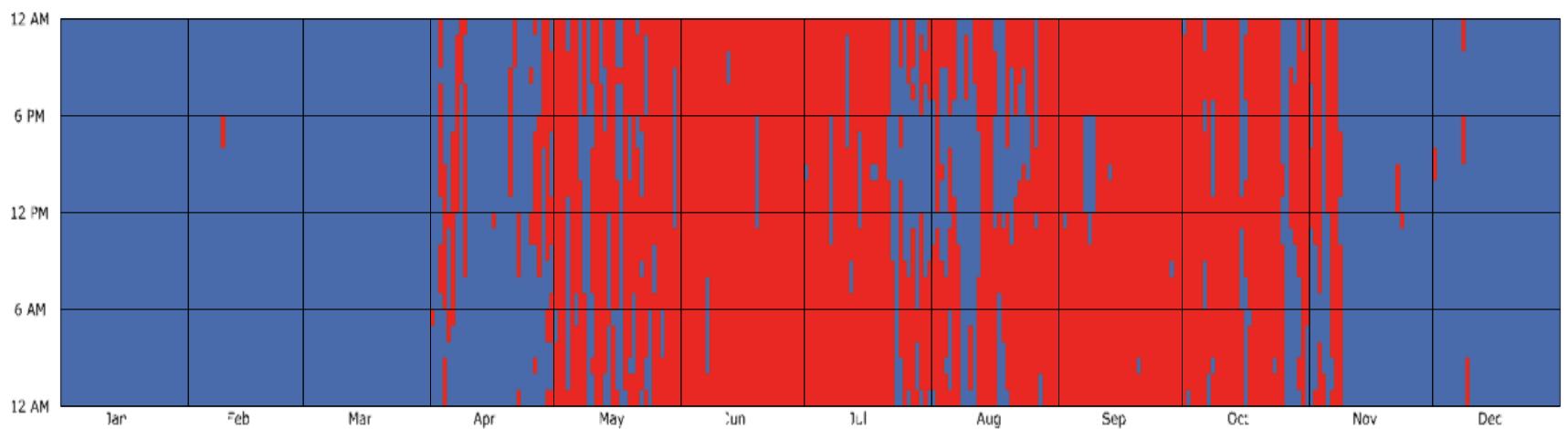


Temperature & Outdoor Comfort

- Winters can be extremely cold, in Seoul the average January temperature range is -6 to 3 °C
- Summer can be uncomfortably hot and humid, the average August temperature range is 22 to 30 °C.
- November-April will require additional heating to reach the comfortable indoor temperatures
- Peak summer months of July and August will require cooling to maintain comfortable.



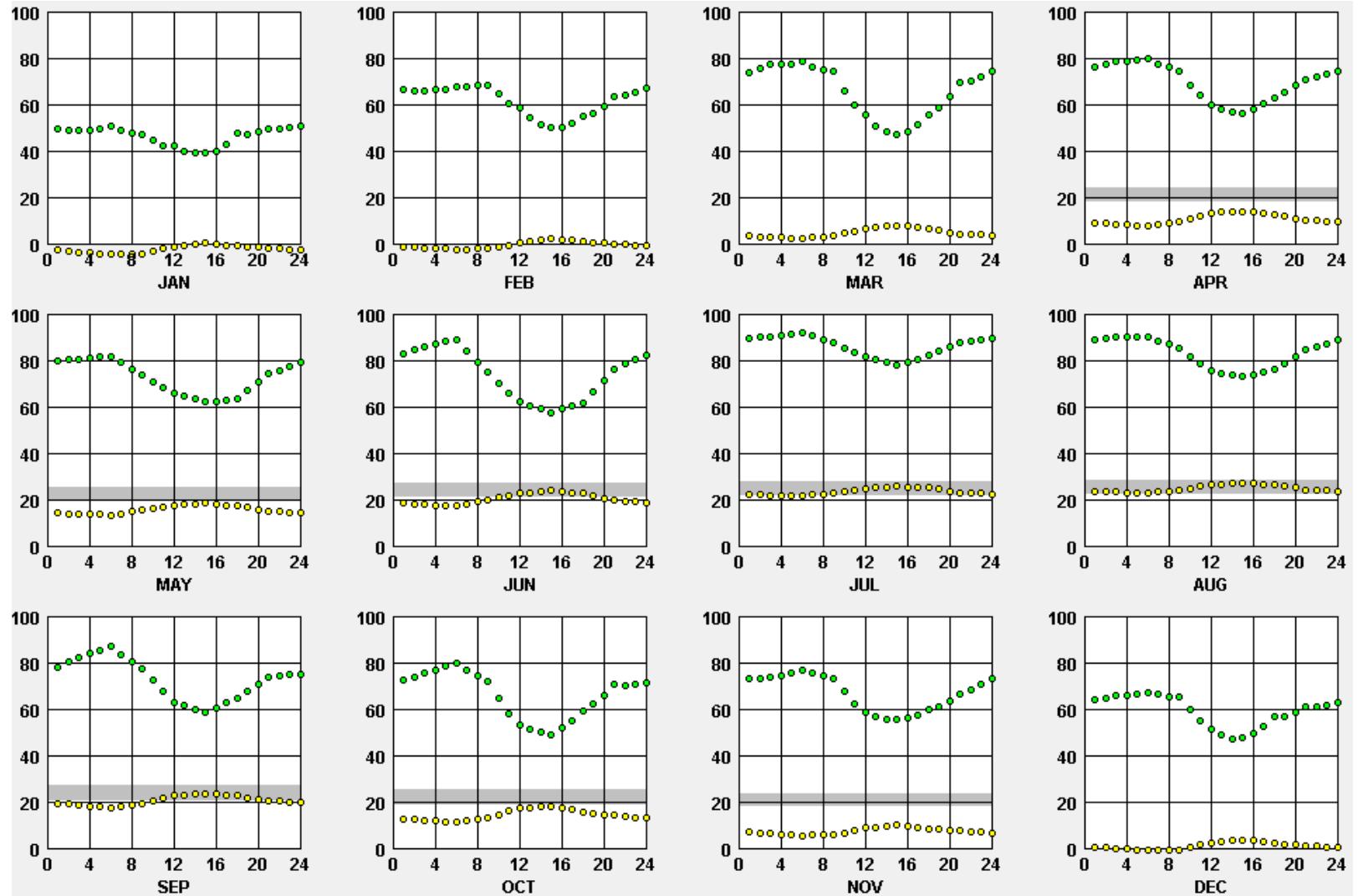
Comfortable or Not ?



Humidity

- Average annual humidity in Seoul is 68.7%, getting as high as 95% in the summer months.
- Dehumidification will be required in the summer

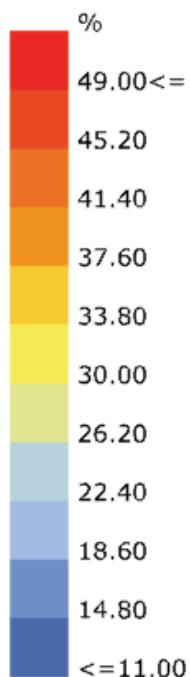
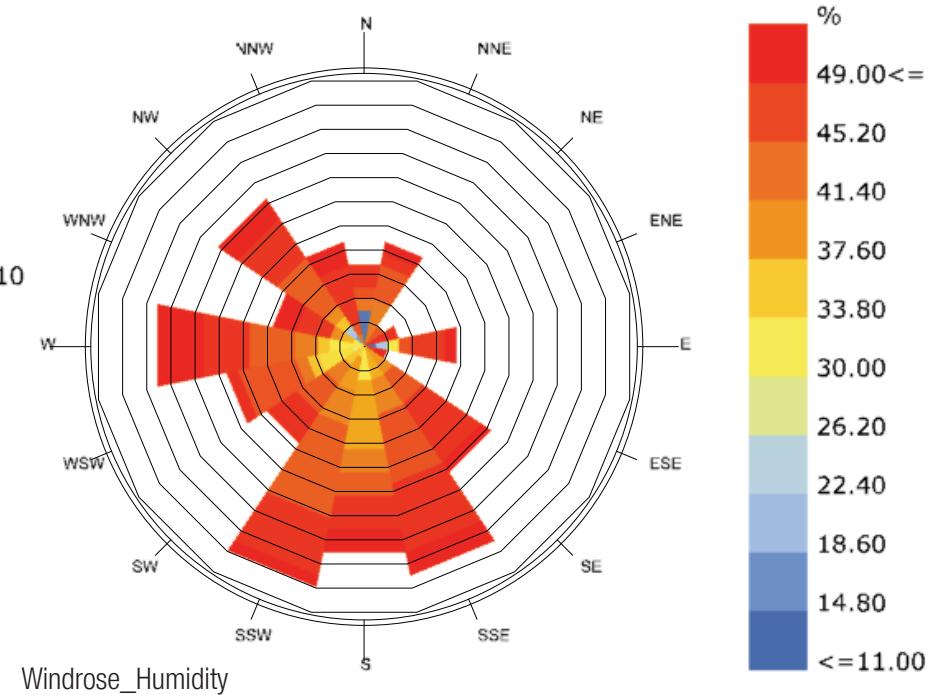
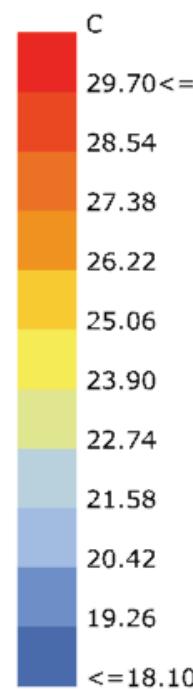
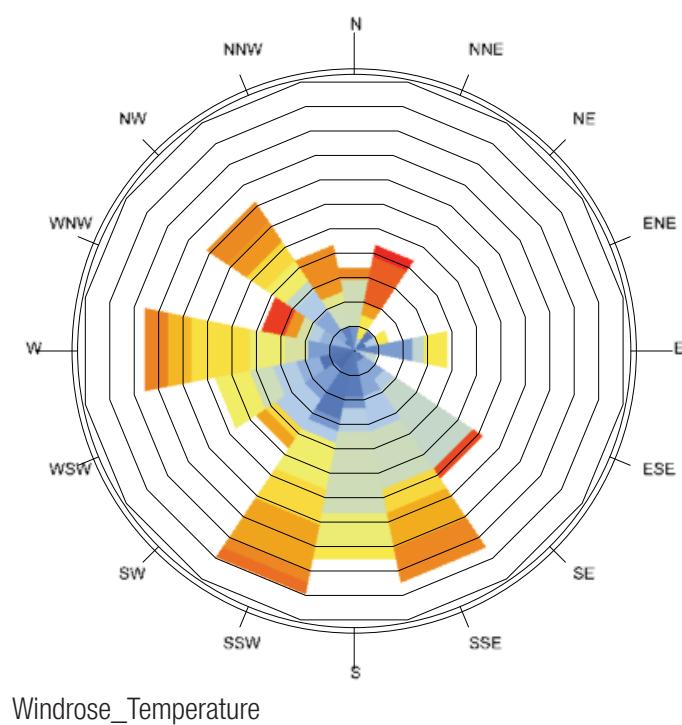
Dry Bulb
Humidity
Comfort Zone



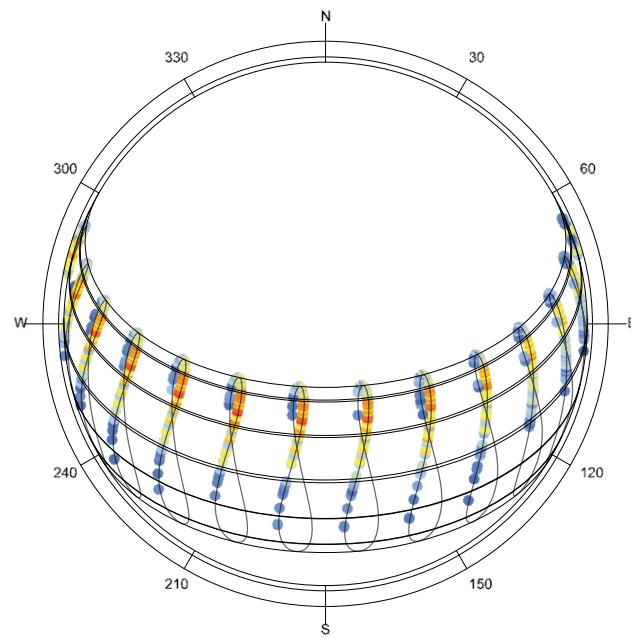


Wind & Ventilation

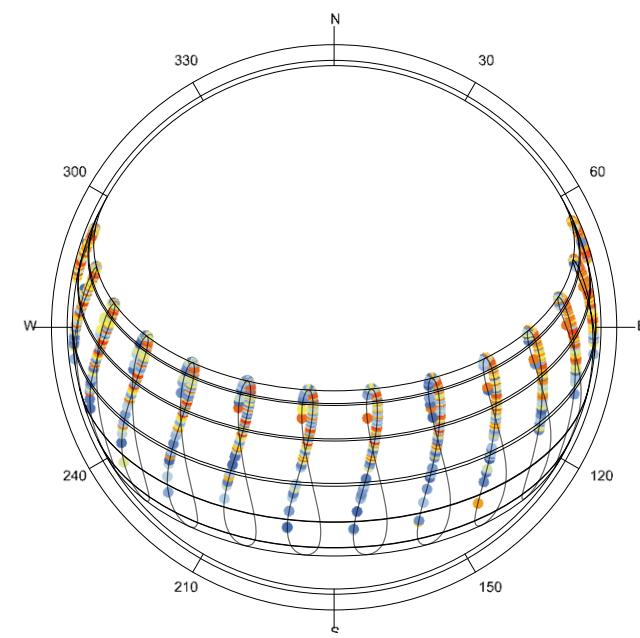
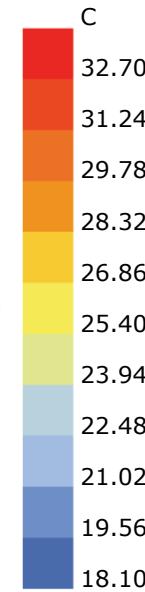
- Seoul experiences strong, cool winds from the South in the summer and hot humid wind in the winter.



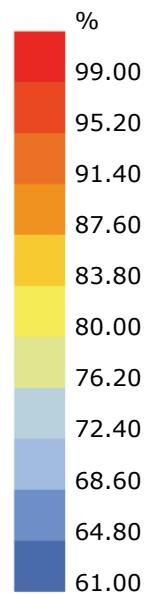
Sun Charts



Sun Chart_Temperature

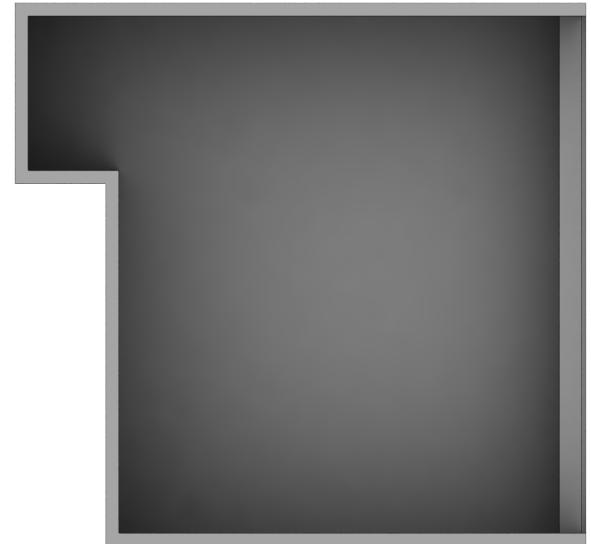
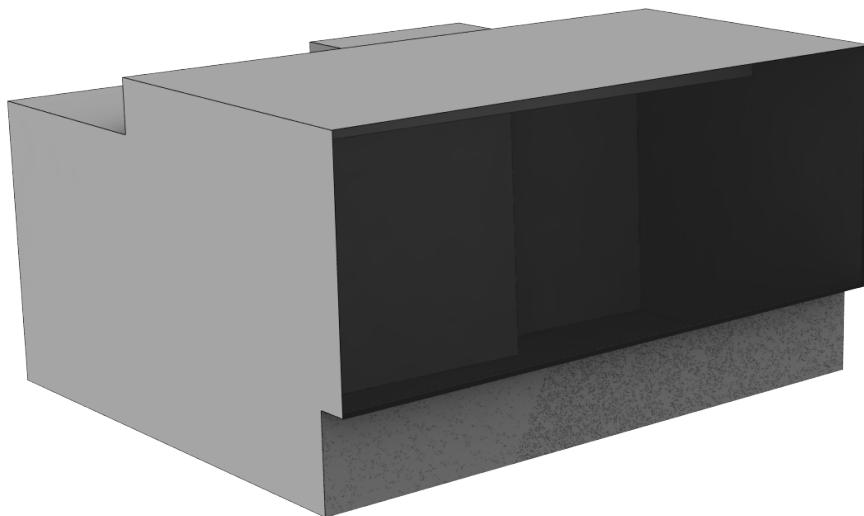


Sun Chart_Humidity

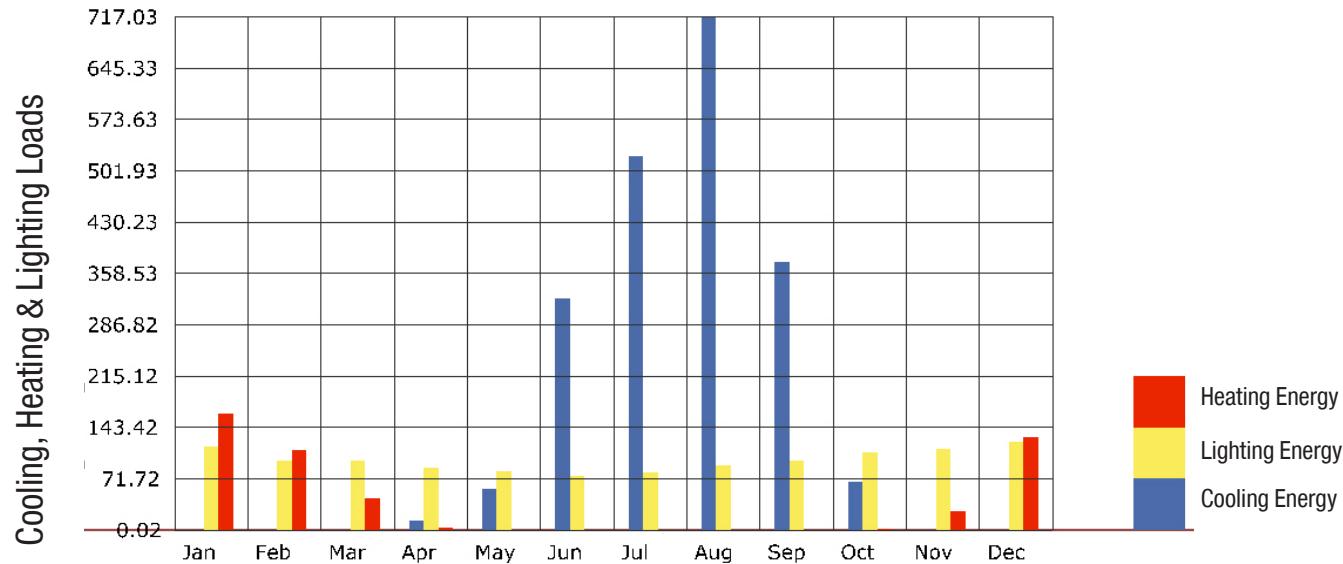


Base Case Design

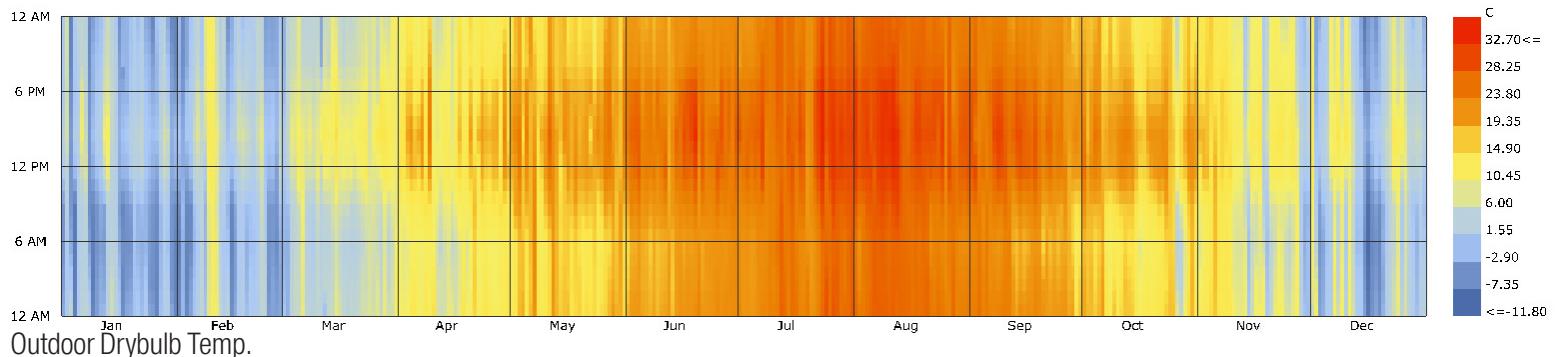
- The test site is an approximately 30 sq m. studio apartment with the SE wall composed of 60% glazing.
- A series of base case energy and lighting studies will be shown to see which passive design strategies can be employed to both lower energy use as well as provide a comfortable indoor lighting environment.



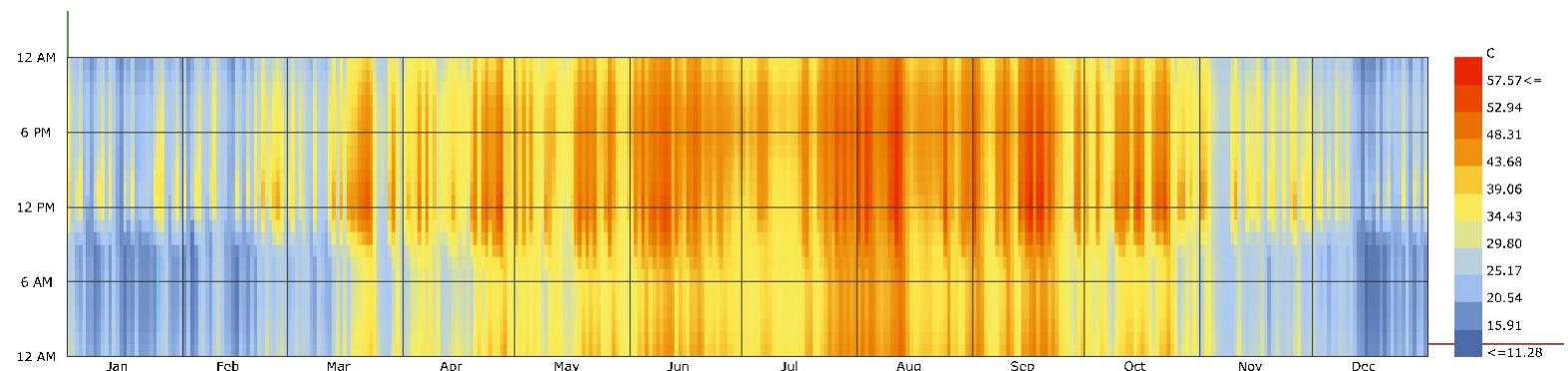
Energy Analysis_Base Case



Outdoor vs Indoor Temp

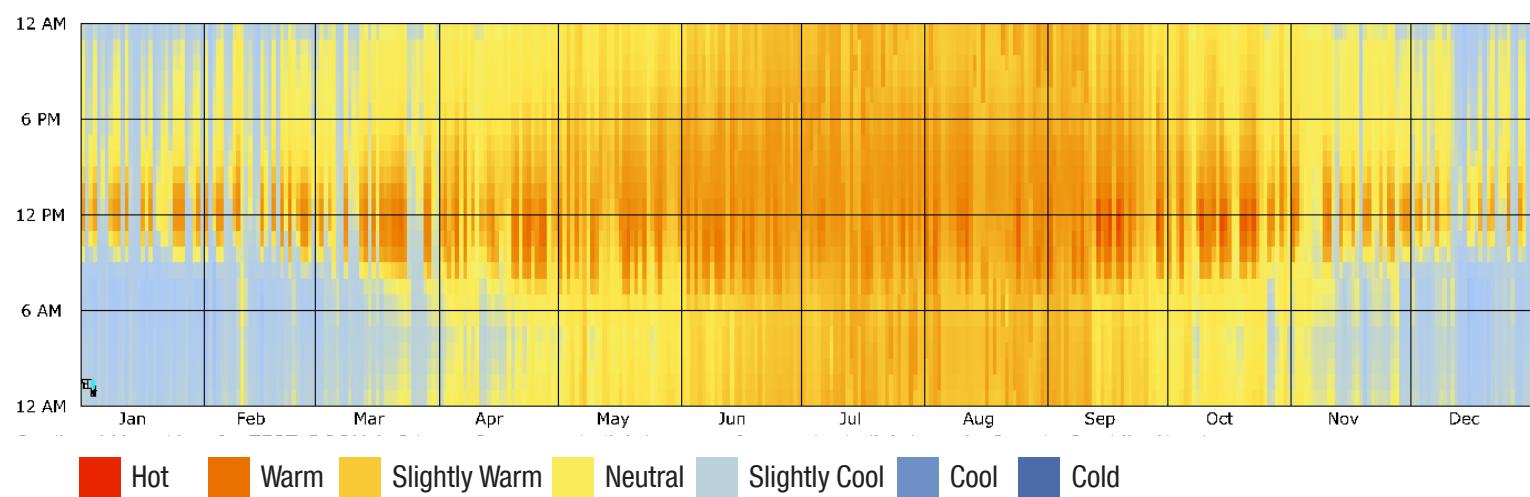


Outdoor Drybulb Temp.

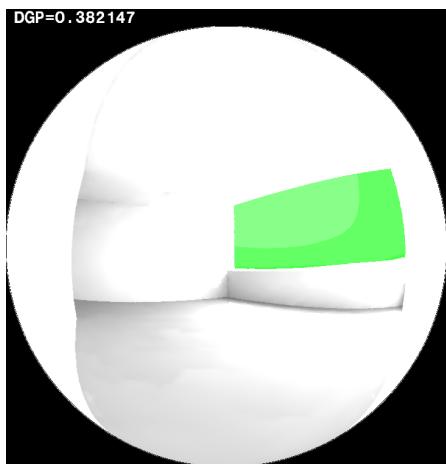


Indoor Air Temp.

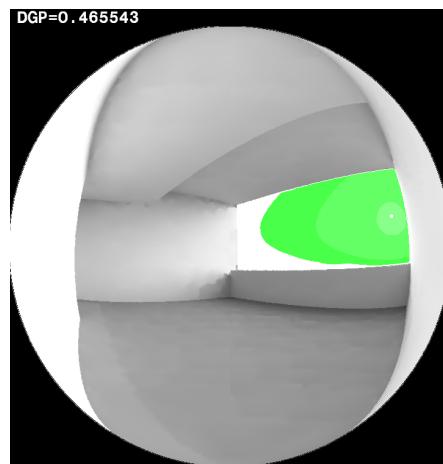
Indoor Thermal Comfort



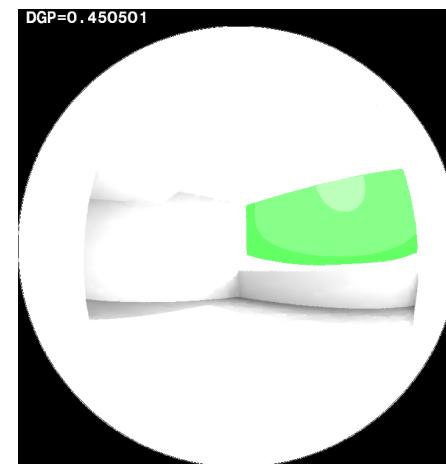
Glare Analysis_Base Case



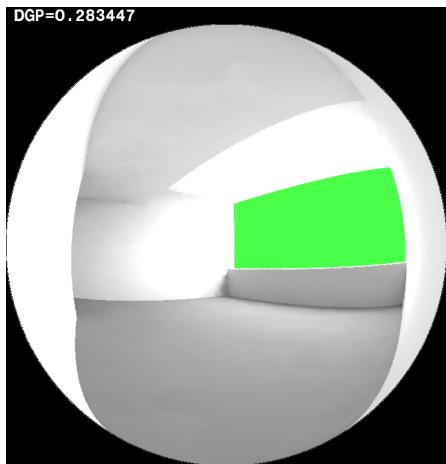
July 21st @ 9am



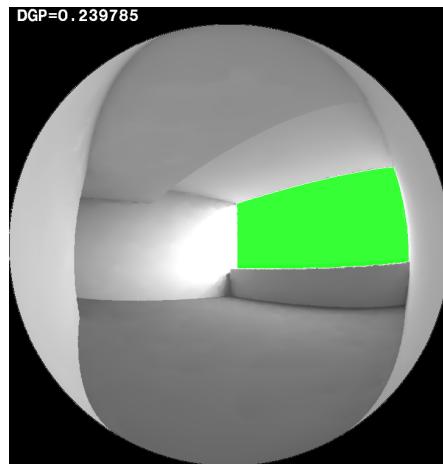
Dec 21st @ 9am



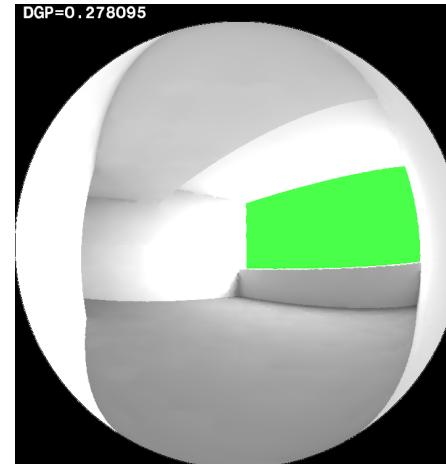
Mar 21st @ 9am



July 21st @ 4pm



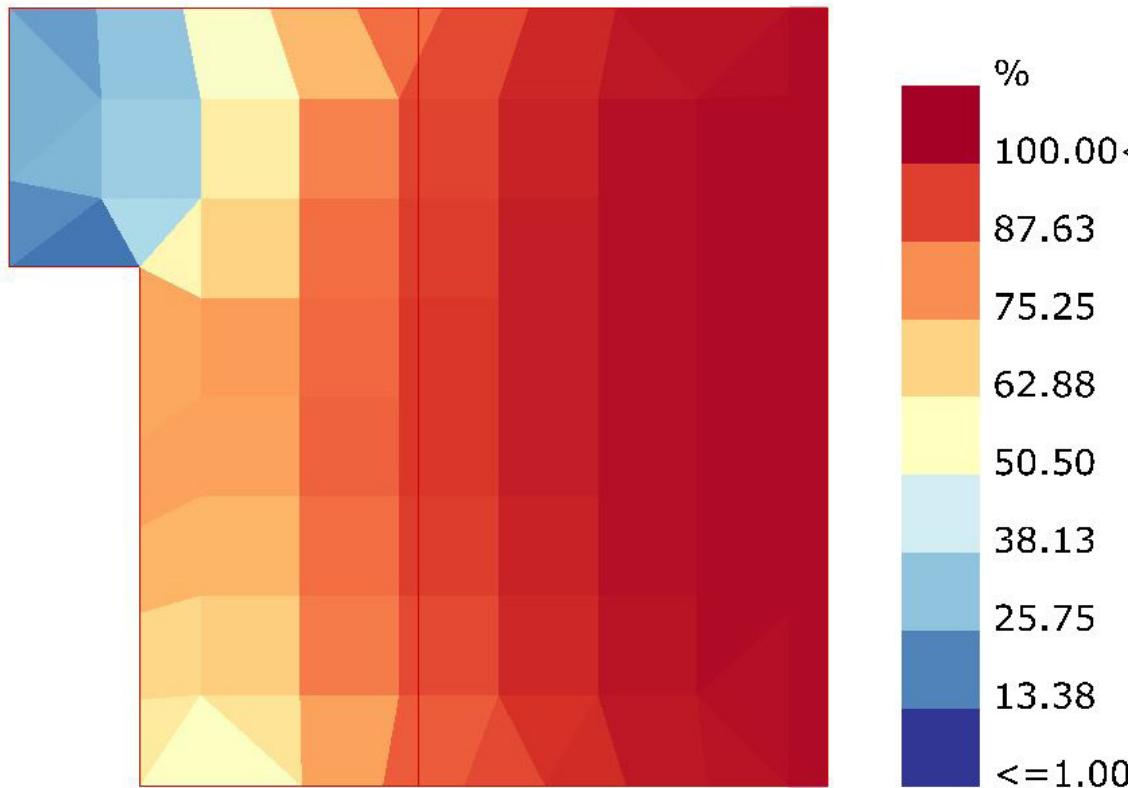
Dec 21st @ 4pm



Mar 21st @ 4pm

Annual Daylight_Base Case

Annual Daylight Autonomy



UDLI 100-2000 lux

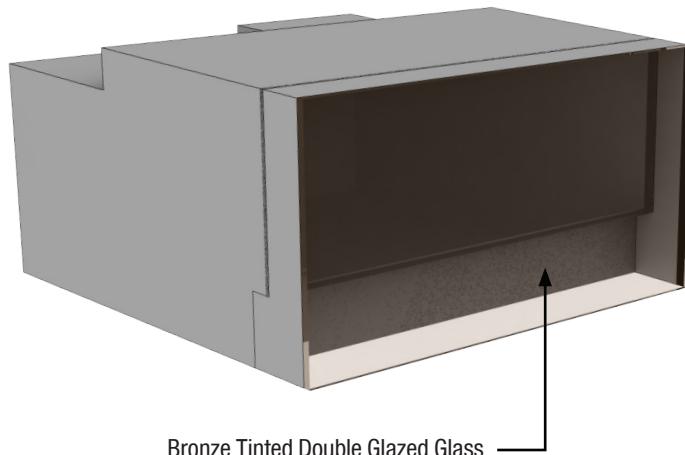
UDLI >2000 lux



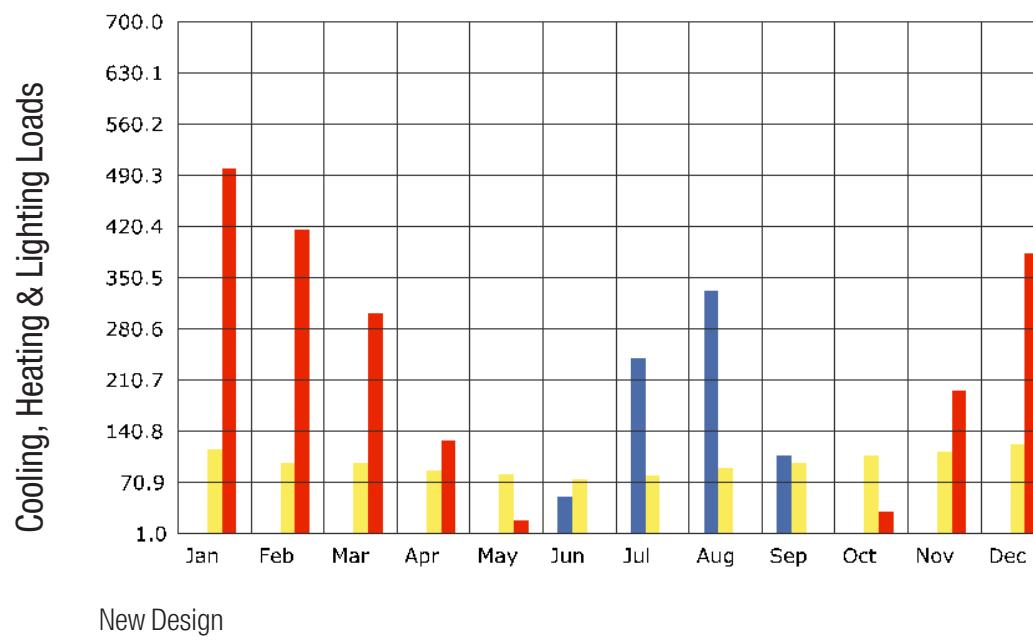
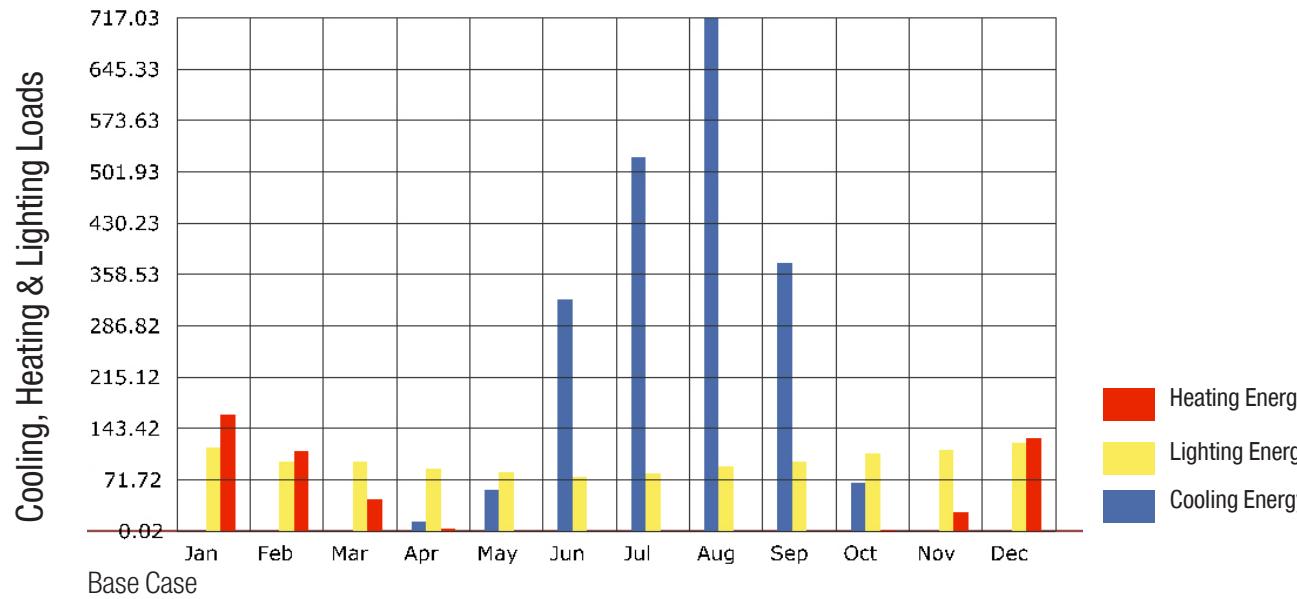
- Upon analyzing the glare report, an annual daylight study was conducted to see that more than half the space can be illuminated with daylight alone for the whole year
 - The area closest to the window is over exposed to daylight and is causing unfavorable glare conditions.
 - We see that most of the light is out of the 100-2000lux comfortable range.

New Design

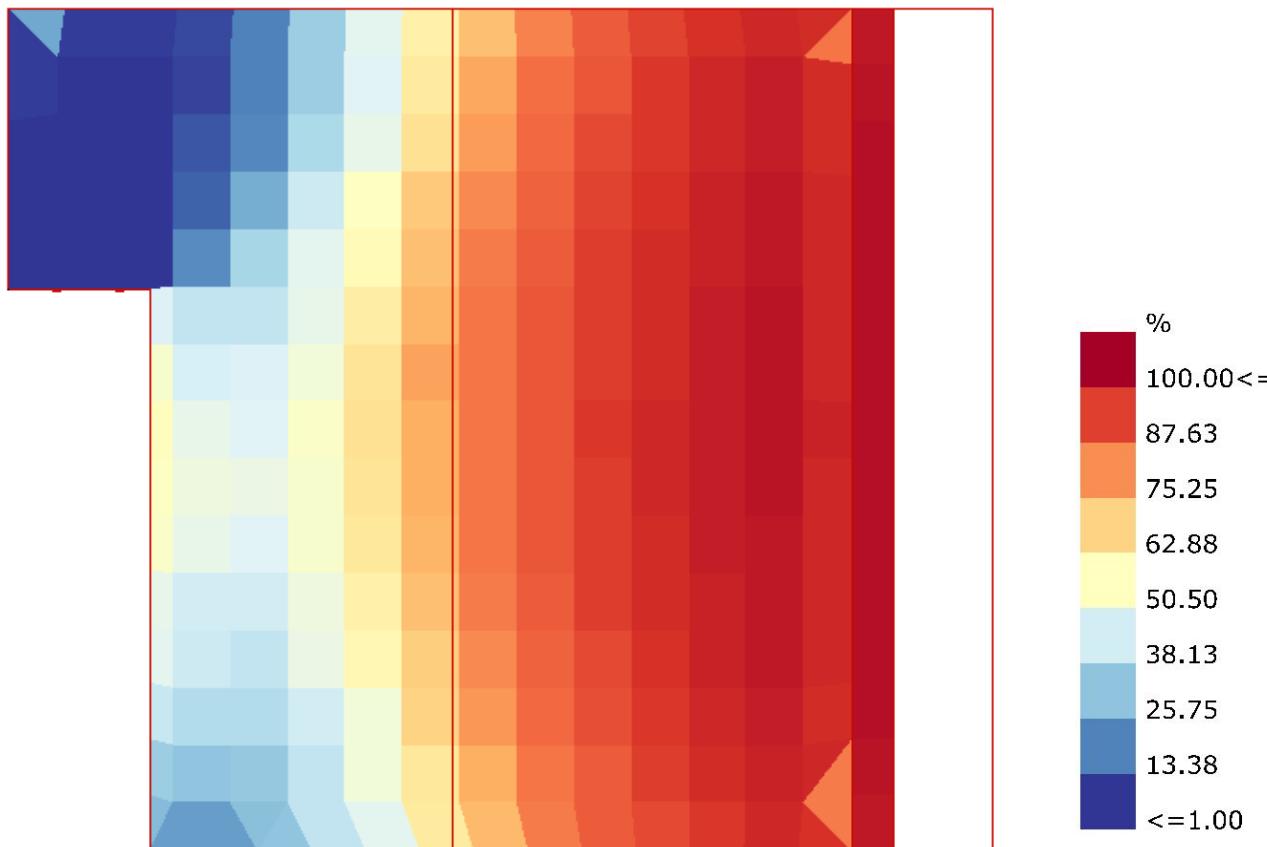
- Climate is pleasant in the spring and fall months but extremely humid and hot in the summer and windy and chilly in the winter months.
- The proposed building should FACE SOUTH to allow sun to penetrate the room in the winter.
- Creating a 1m sun room in front of the window would create extra insulation in the winter from the harsh wind and provide an extra barrier from the sun and glare in the summer.
- The glass used for this sun room will be Bronze Tinted Double Glazed Glass Unit that has VT = .45 SHGC=.5
- Because the air/wind is either really humid or really cold, natural ventilation is not an option



Energy Analysis_New Design



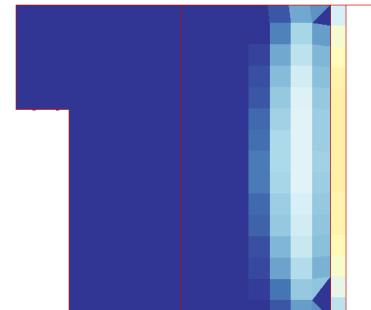
Annual Daylight_New Design



UDLI 100-2000 lux

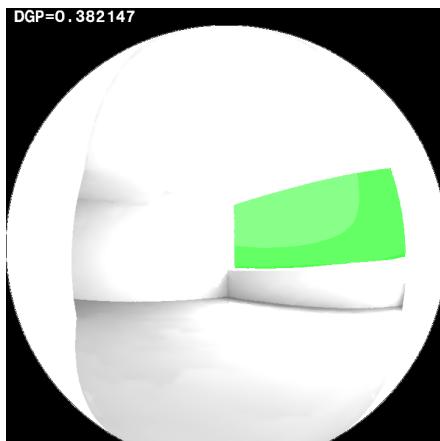


UDLI >2000 lux

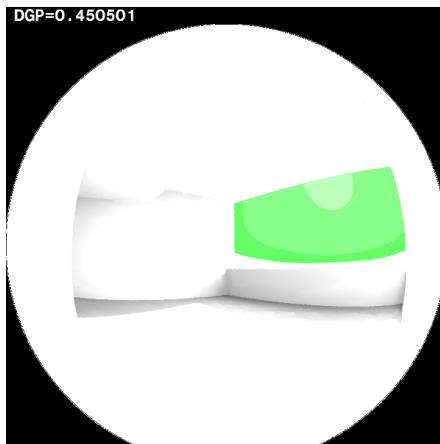


Glare Analysis_New Design

Base Case

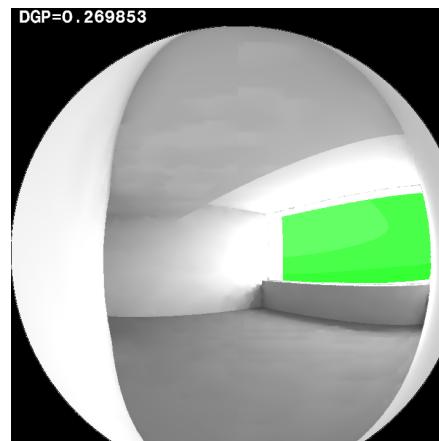


July 21st @ 9am

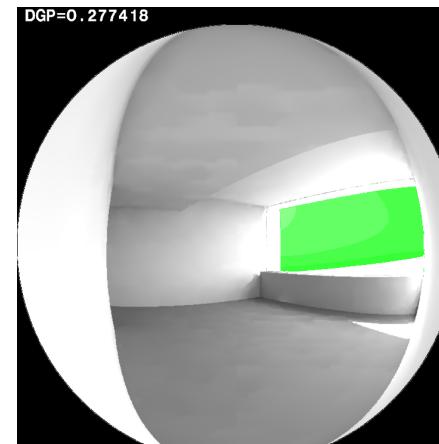


Mar 21st @ 9am

New Design



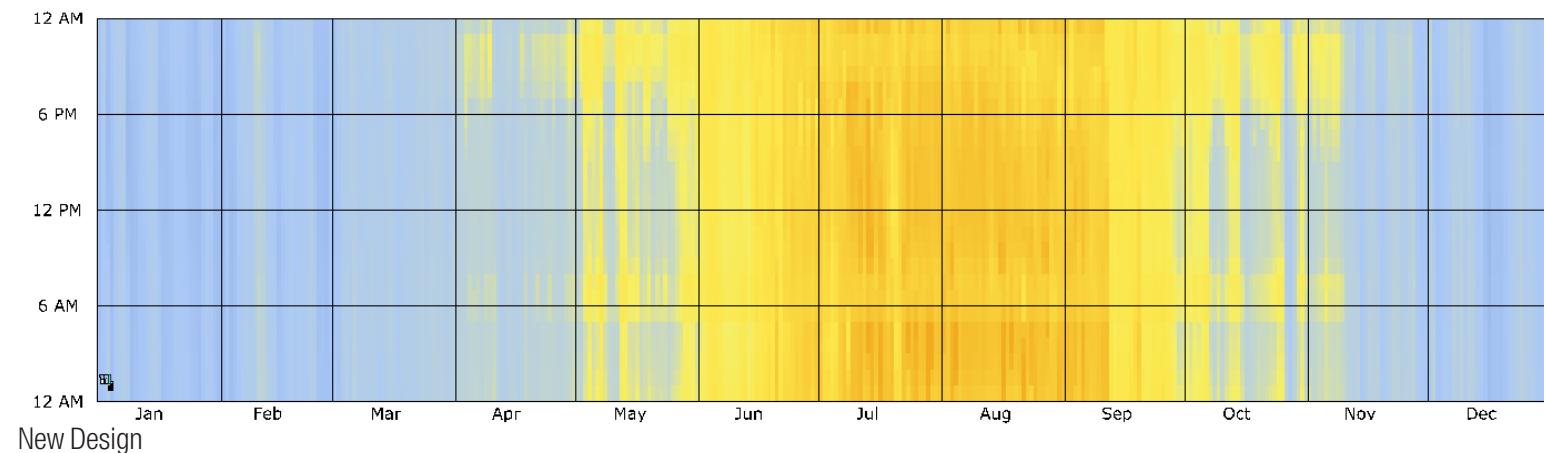
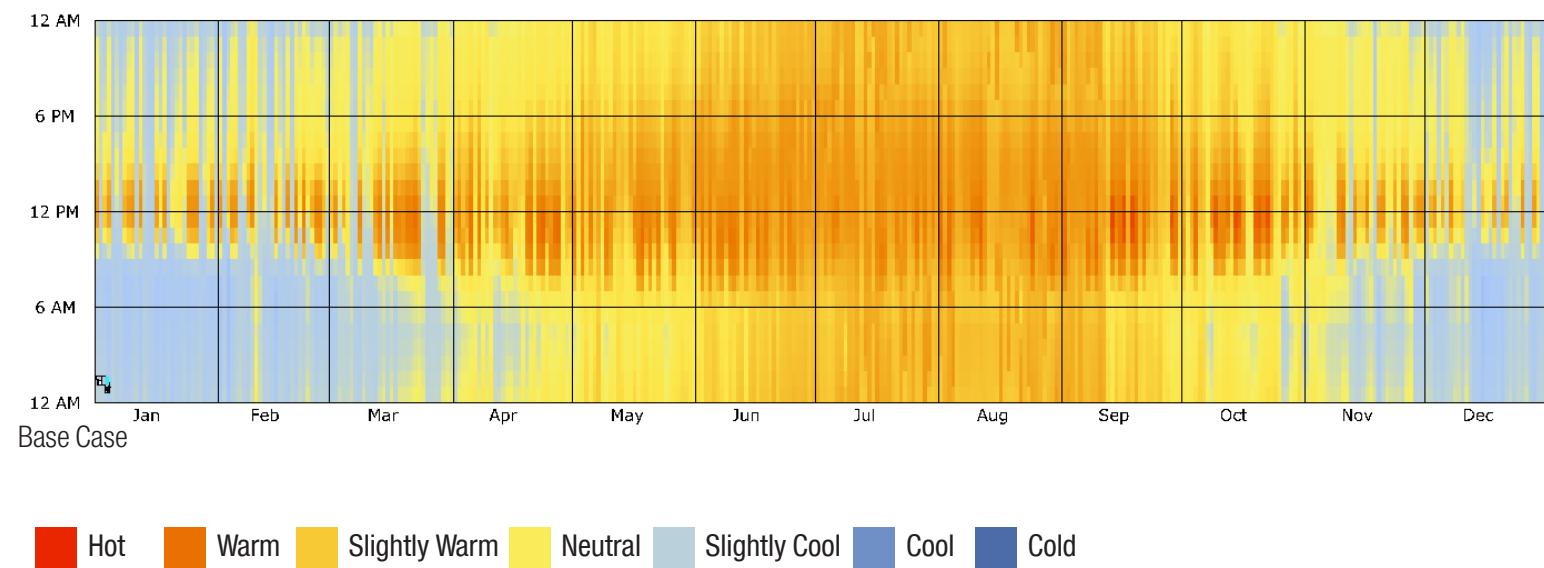
July 21st @ 9am



Mar 21st @ 9am

- Looking solely on the two problem cases from the base case design of July 21st and 9am and March 21st and 9am.
- Both cases show drastic glare reduction with the new balcony sun room attachment

Indoor Thermal Comfort



Final Assessment & Conclusion

Seoul, South Korea features a climate that is pleasant in the spring and fall months but extremely humid and hot in the summer and windy and chilly in the winter months. Keeping that in mind, the proposed building faces south to allow sun to penetrate the room in the winter. Creating this 1m sun room in front of the window would also create extra insulation in the winter from the harsh wind and provide an extra barrier from the sun and its glare in the summer. Because the air/wind is either really humid or really cold, natural ventilation is not an option.

This design proved to be effective in reducing energy use in the hot summers, creating favorable indoor thermal comfort and daylighting conditions. I was not expecting the heating loads to rise as the space would provide insulation to the studio apartment in the winter. I assume this could be solved if the sun room was modeled more as a room, rather than a shading device.

The current model essentially neutralizes the indoor comfort a bit by reducing the extreme conditions. Additional comfort could be gained by occupants through the use of radiant floors or simply by adding or removing clothes. July has the most uncomfortable hours in the winter still because this is the peak summer in Seoul. Dec-Feb has some streaks of cold hours for similar reasons.