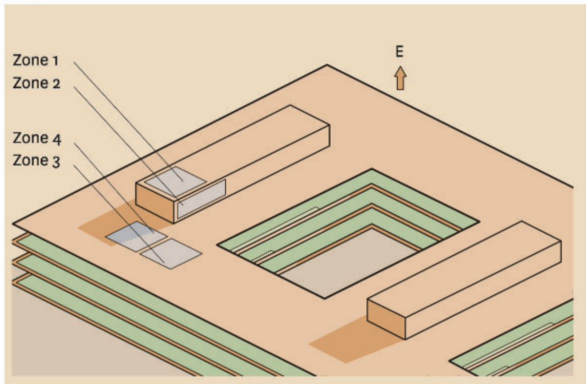
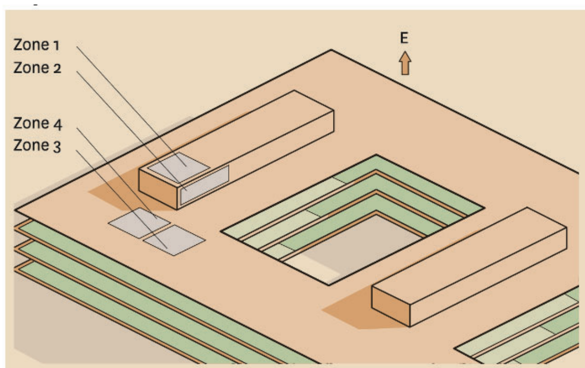
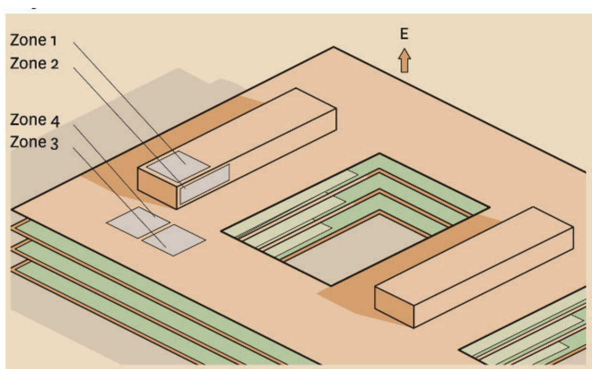
Lack of rooftop space to mount and install the PV system







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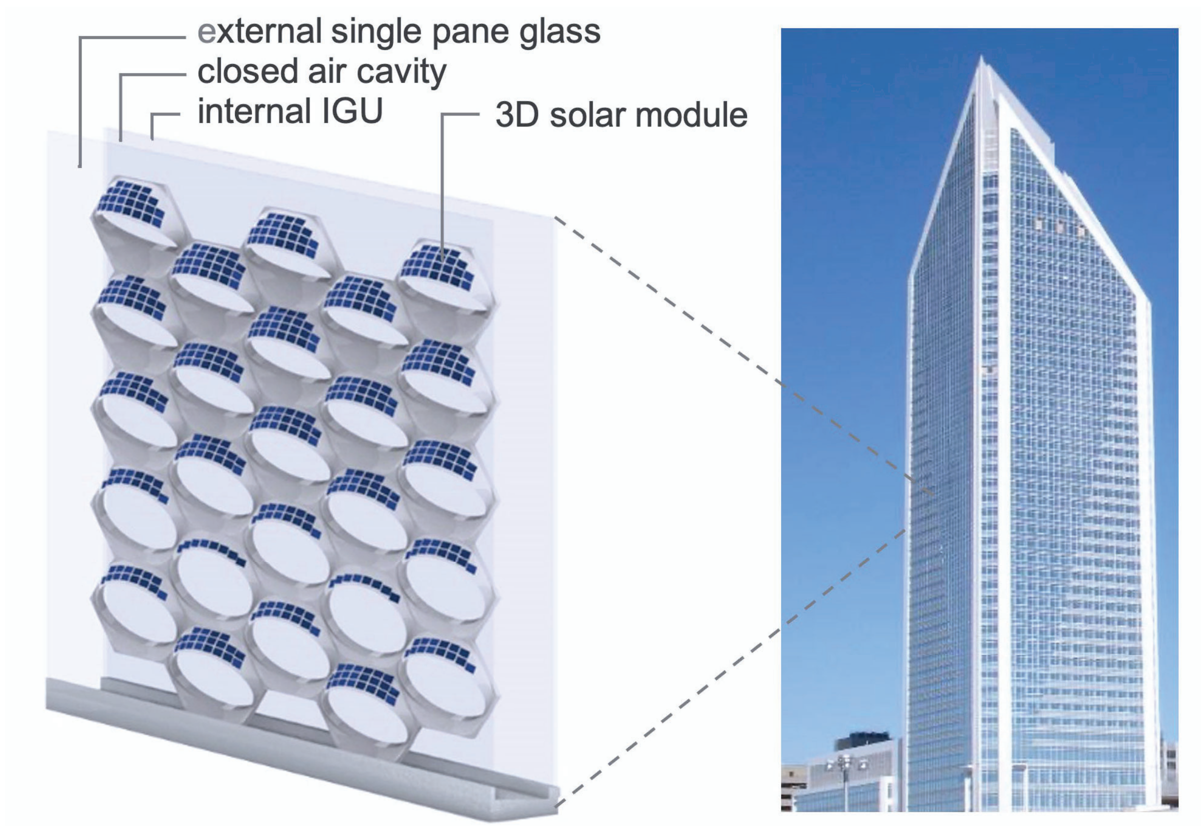
Lack of rooftop space to install PVs

The façade of the building is the best place to harness solar energy



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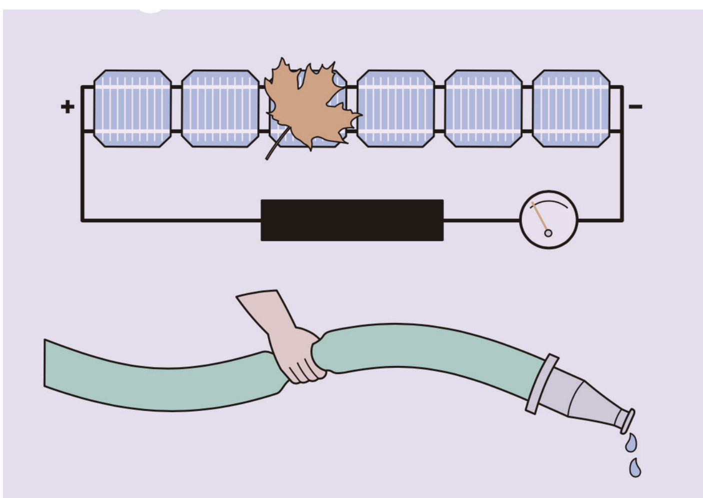
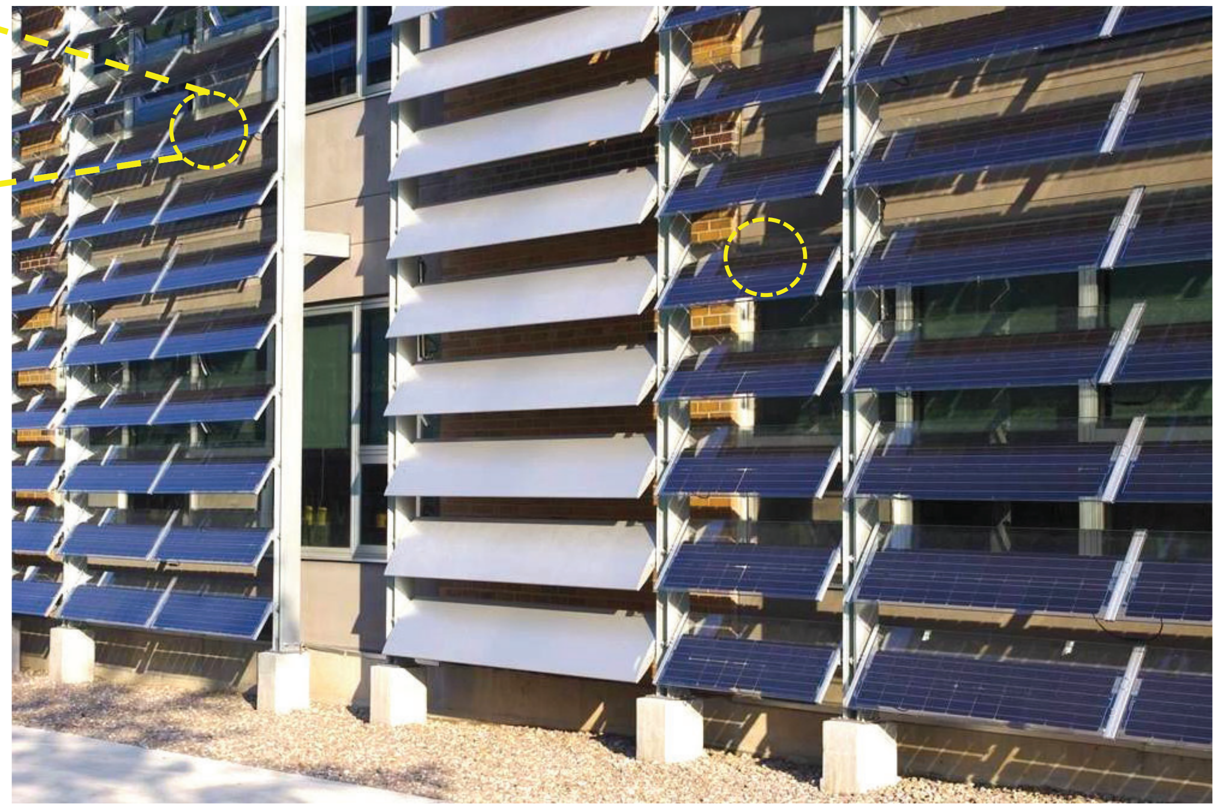
Challenges: Partial shadows





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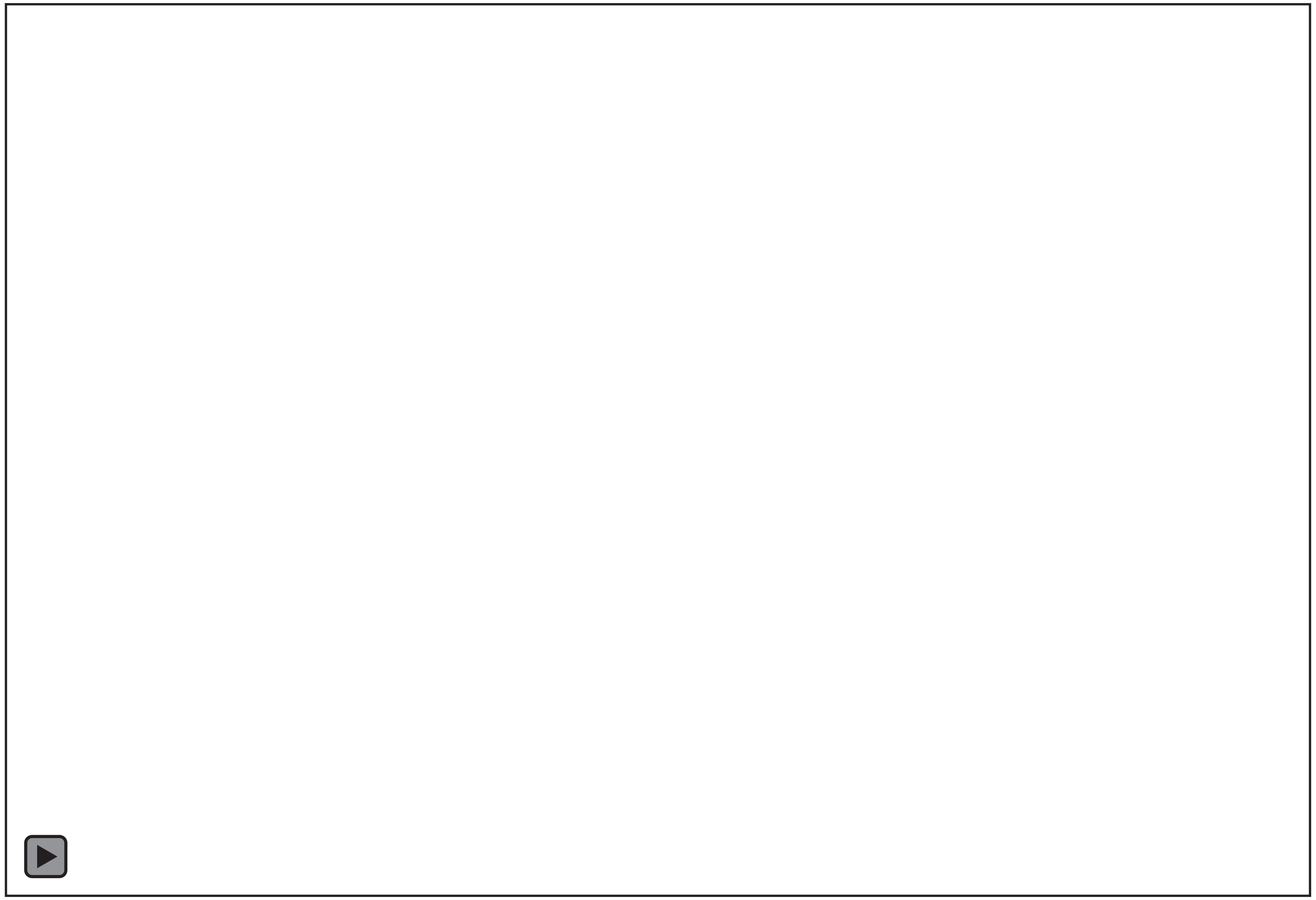
Challenges: Partial shadows



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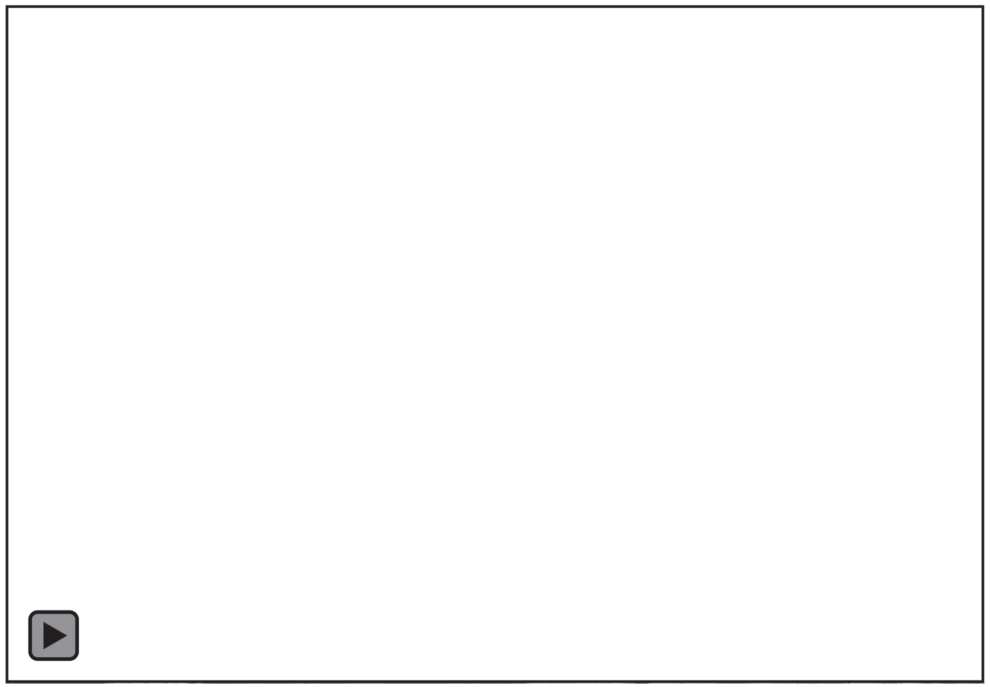
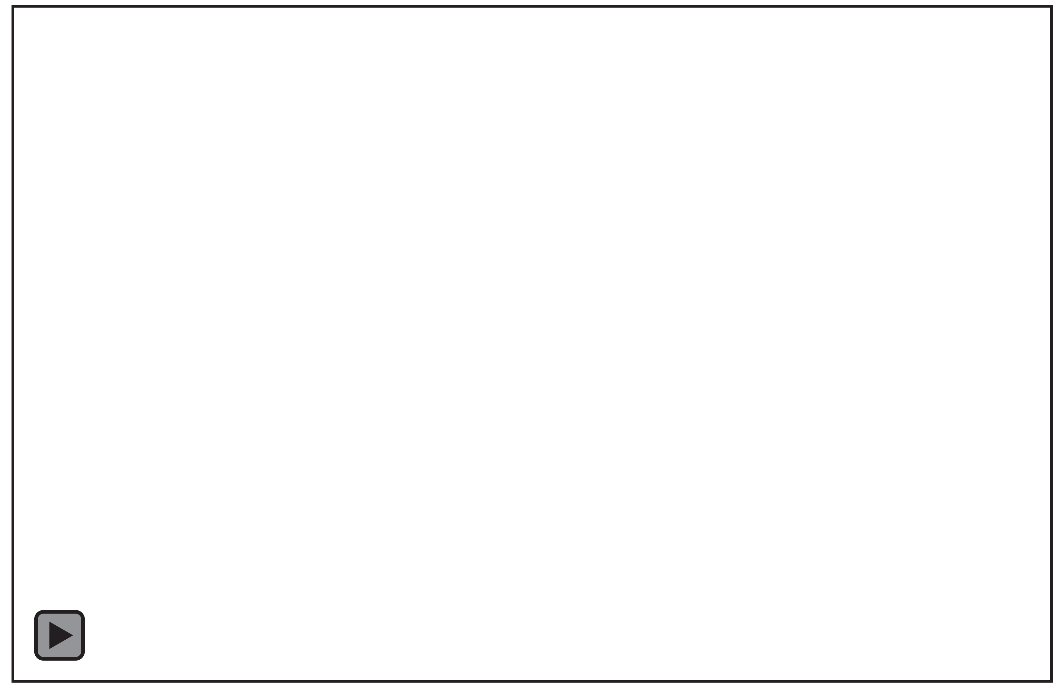
Challenges: Partial shadows

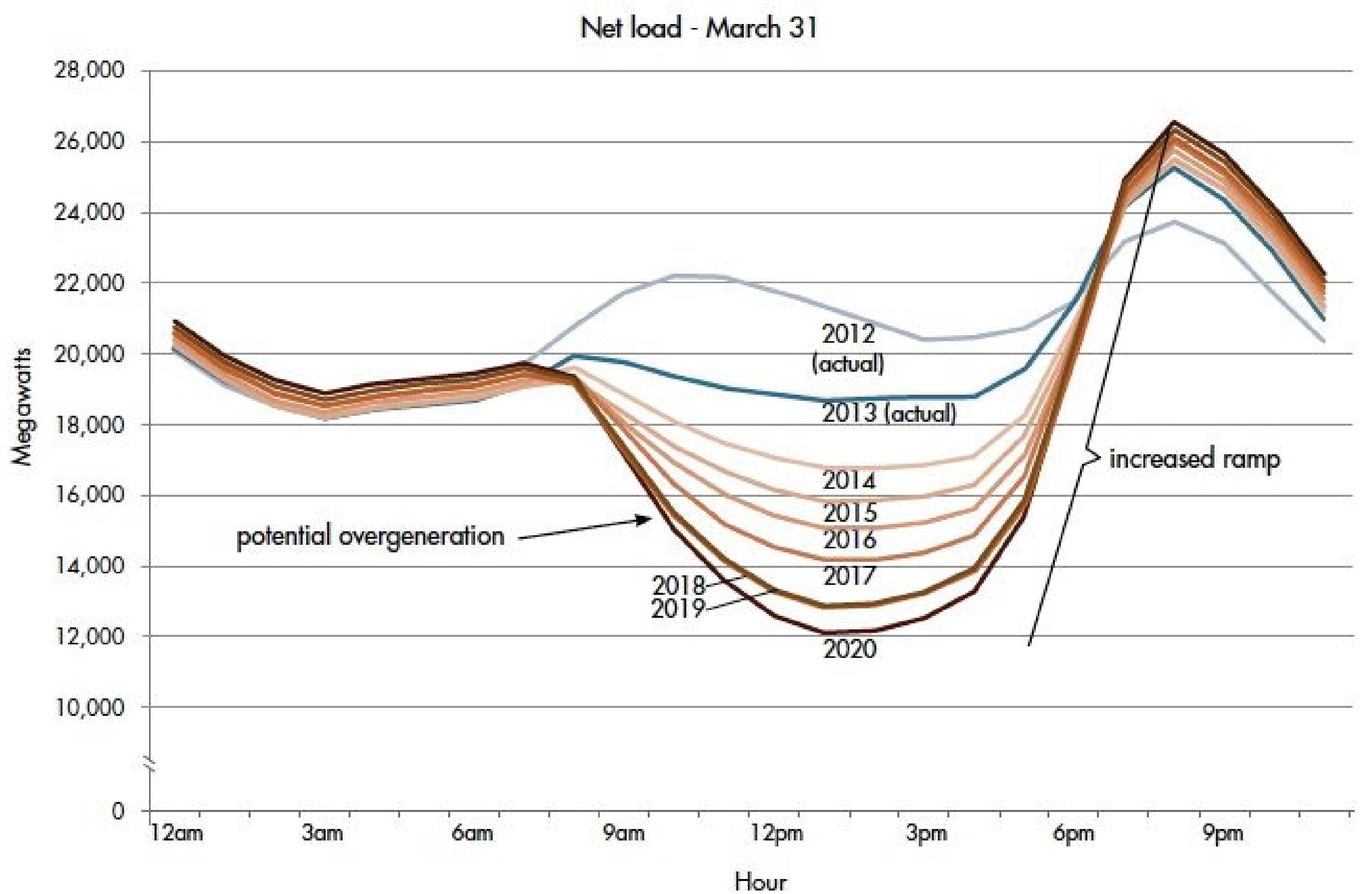


No Shadows



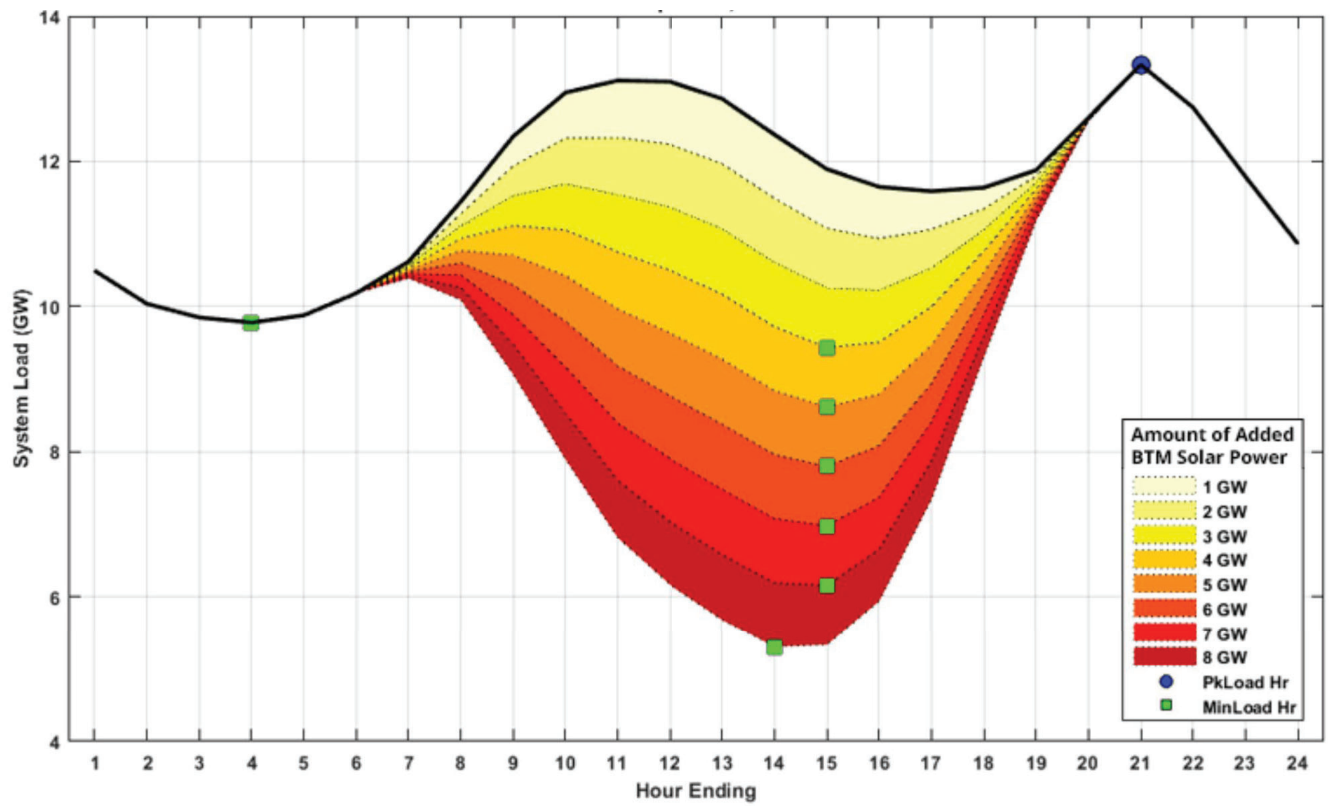
With Shadows

Challenges: Duck Curve



California Independent System Operator

Challenges: Duck Curve

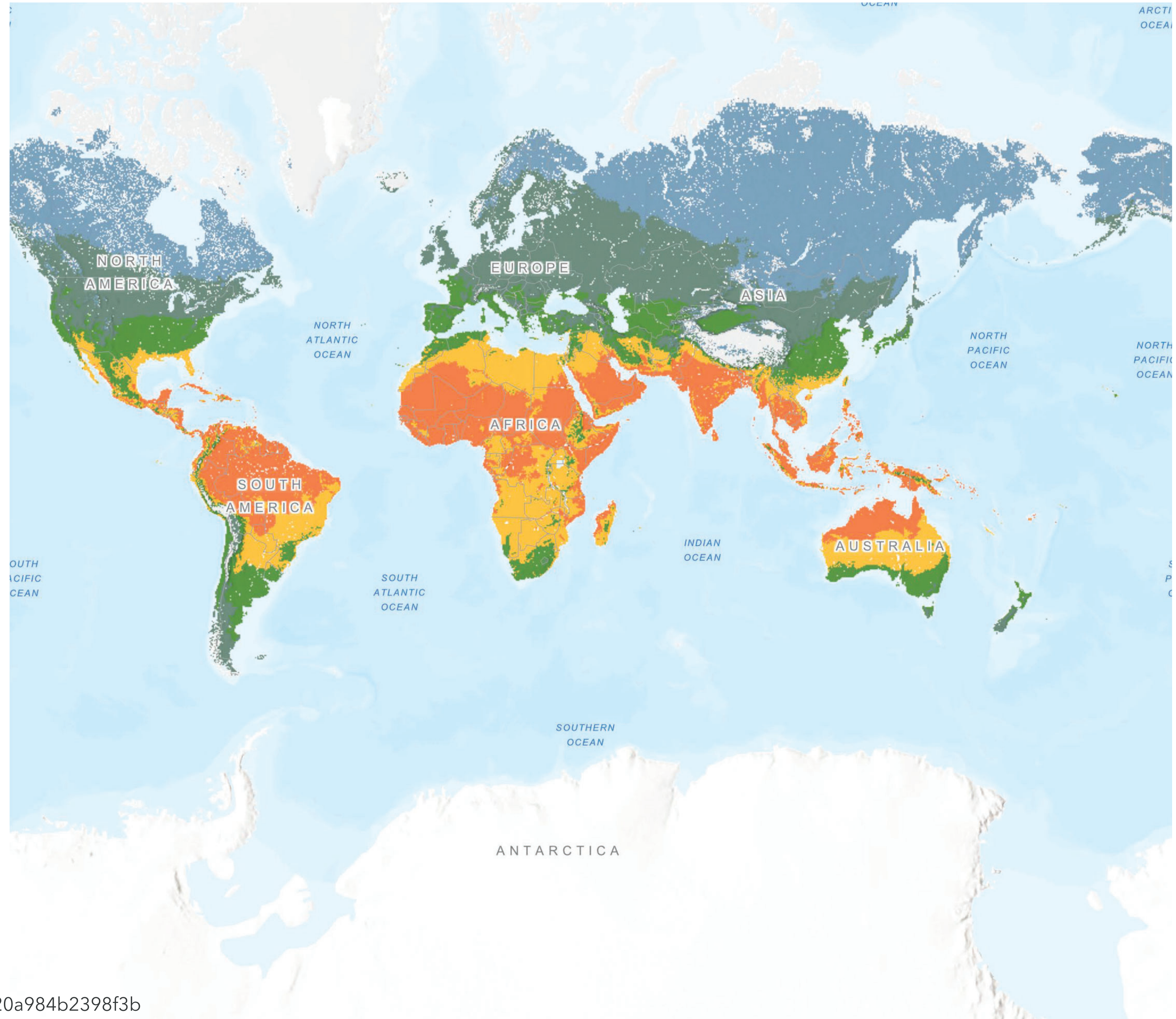


ISO-NE

Building Energy Simulation Challenges

- **Accuracy**: "garbage in, garbage out" is very true for energy modeling. It is not about "perfect" information input. It requires "right" information input.
- **Time-consuming**: A representation or design model cannot be used for energy modeling. Building geometry, system specifications, etc. should be streamlined to save simulation time.
- **Coordination**: between the design model and energy model. Architecture design models have to be capable of adopting the energy model design.
- **tradeoff**: between different performance metrics and how they will affect the overall energy performance.
- **Minimizing discrepancies**: simulation results have to be very close to the real-world application performance.

Geographical location and climate regions



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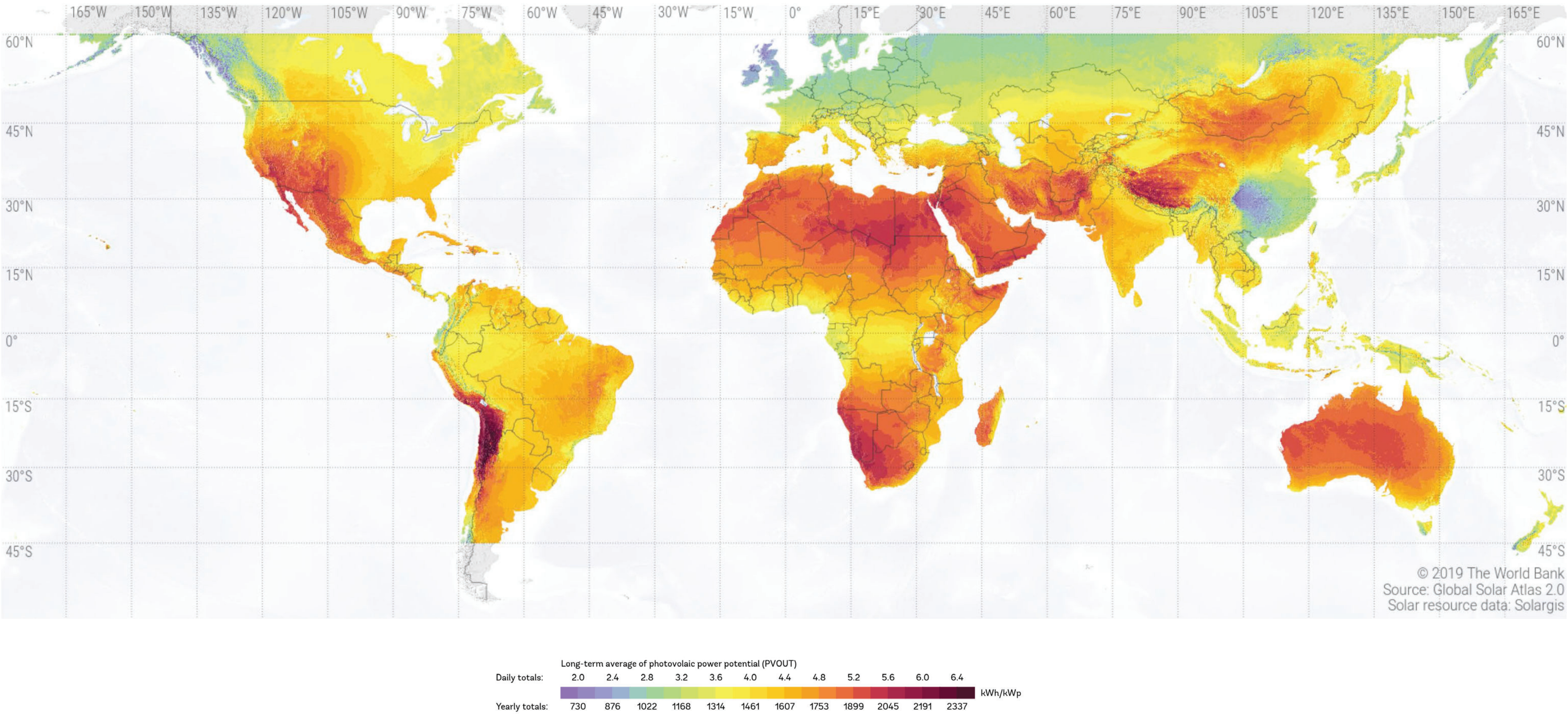
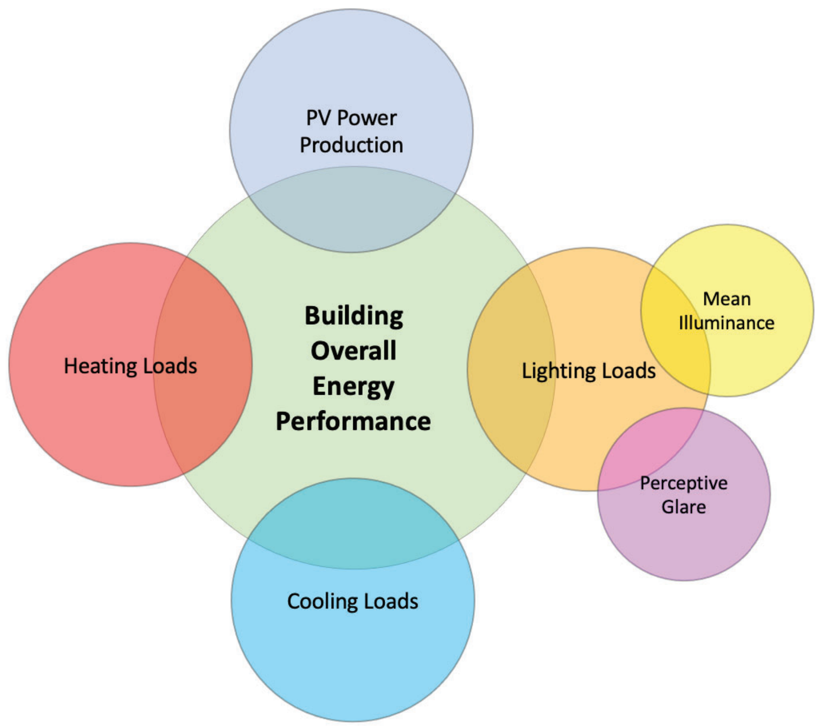
Irradiance levels in different regions



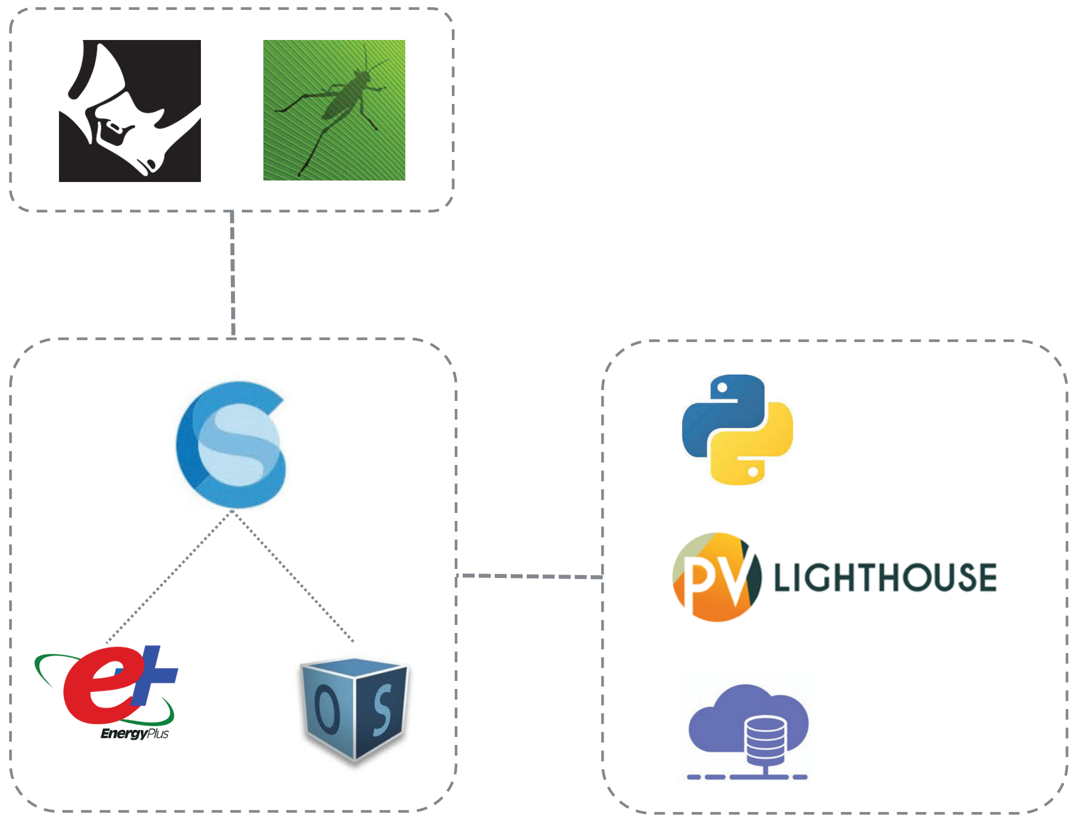
The trade-off of performance metrics



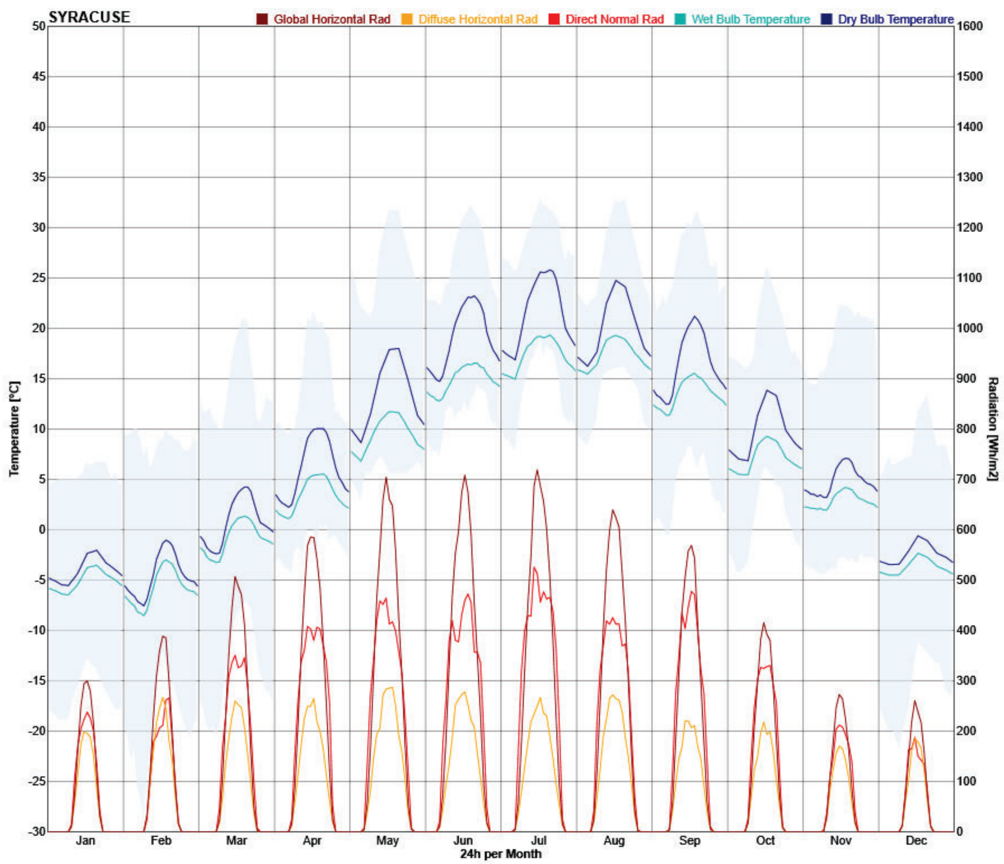
ClimateStudio

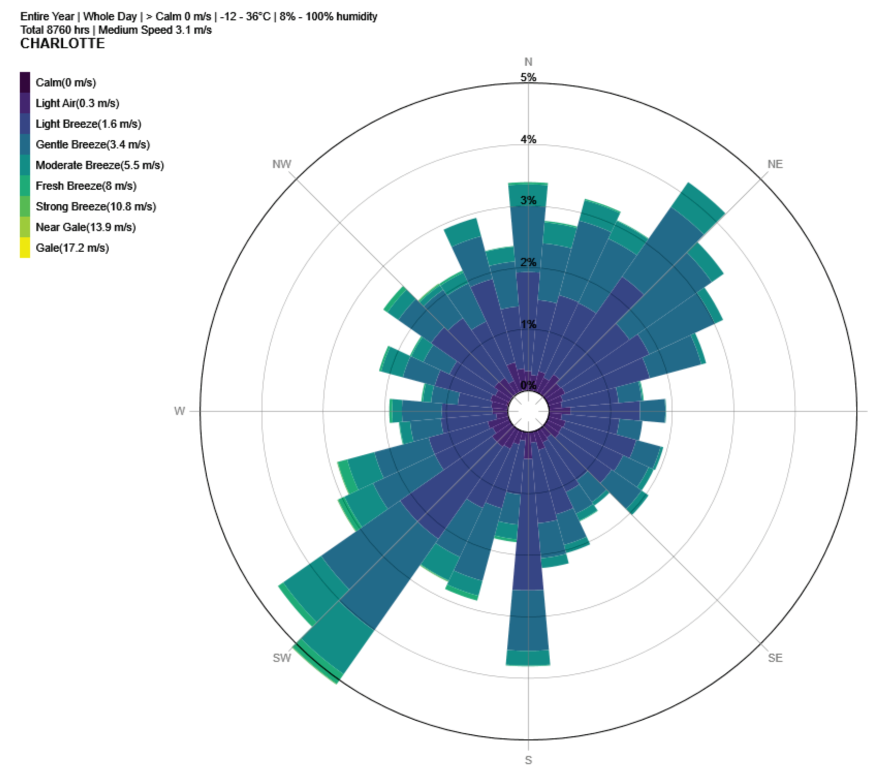
https://climatestudiodocs.com/index.html

ClimateStudio



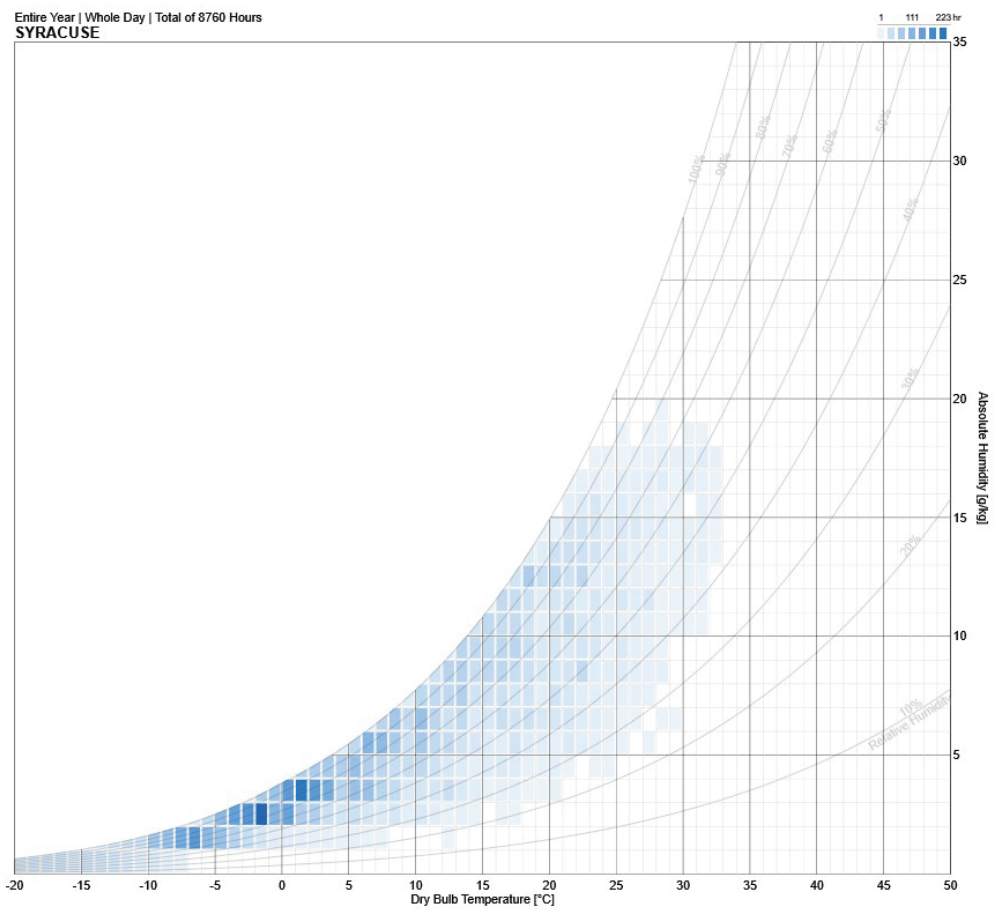
Site analysis

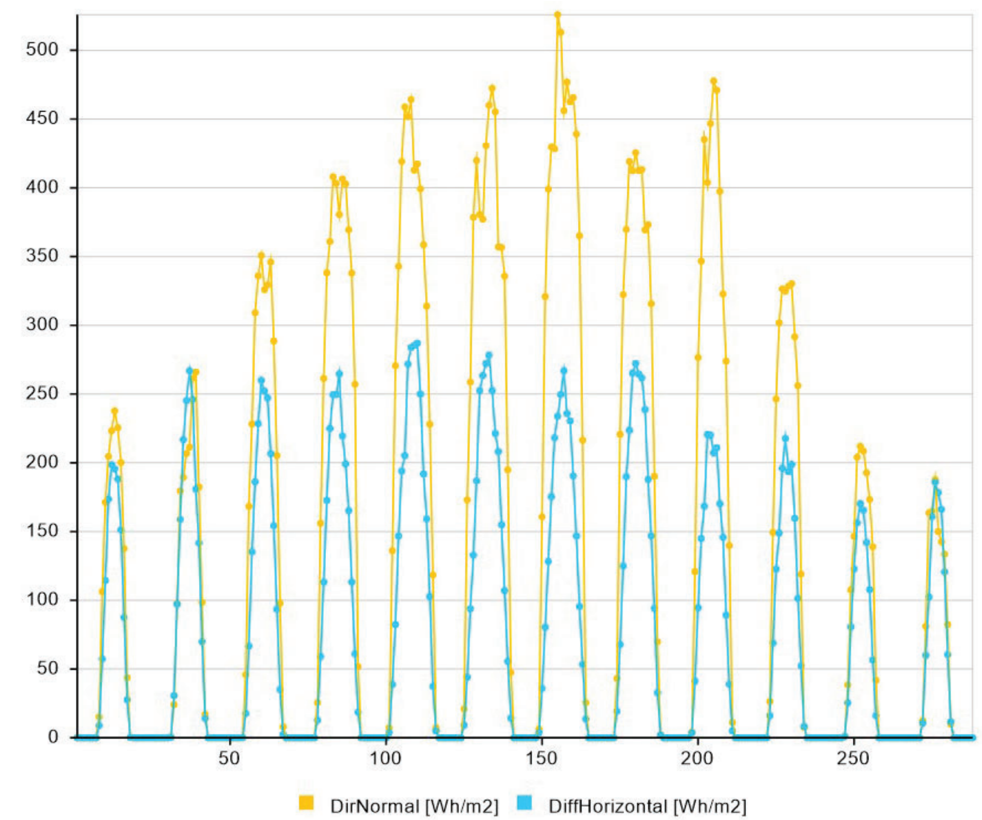


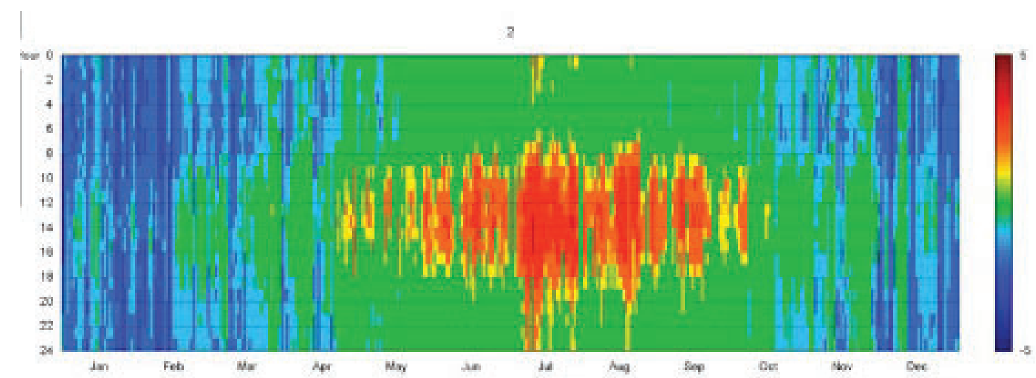


CS

Site analysis







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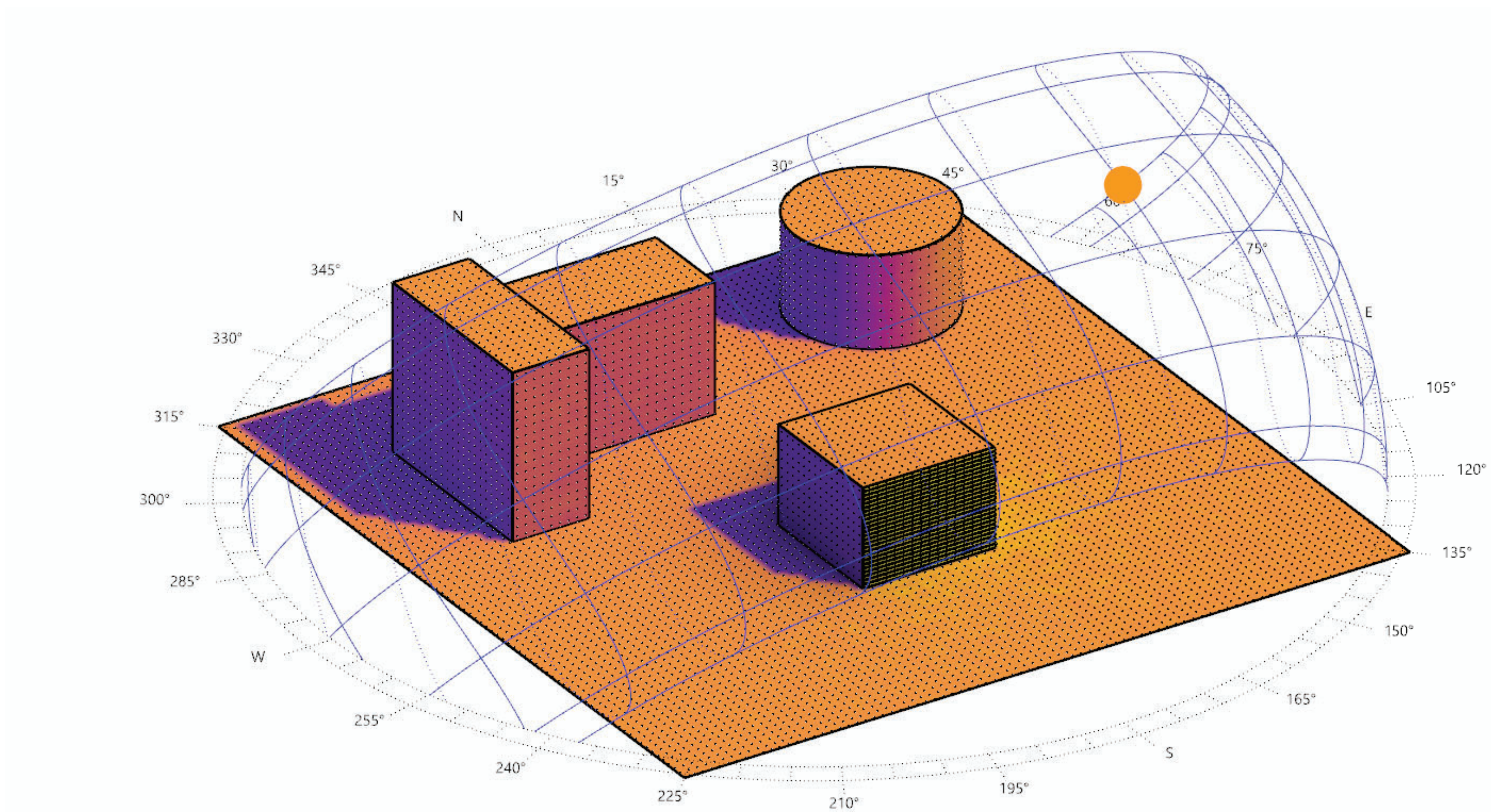
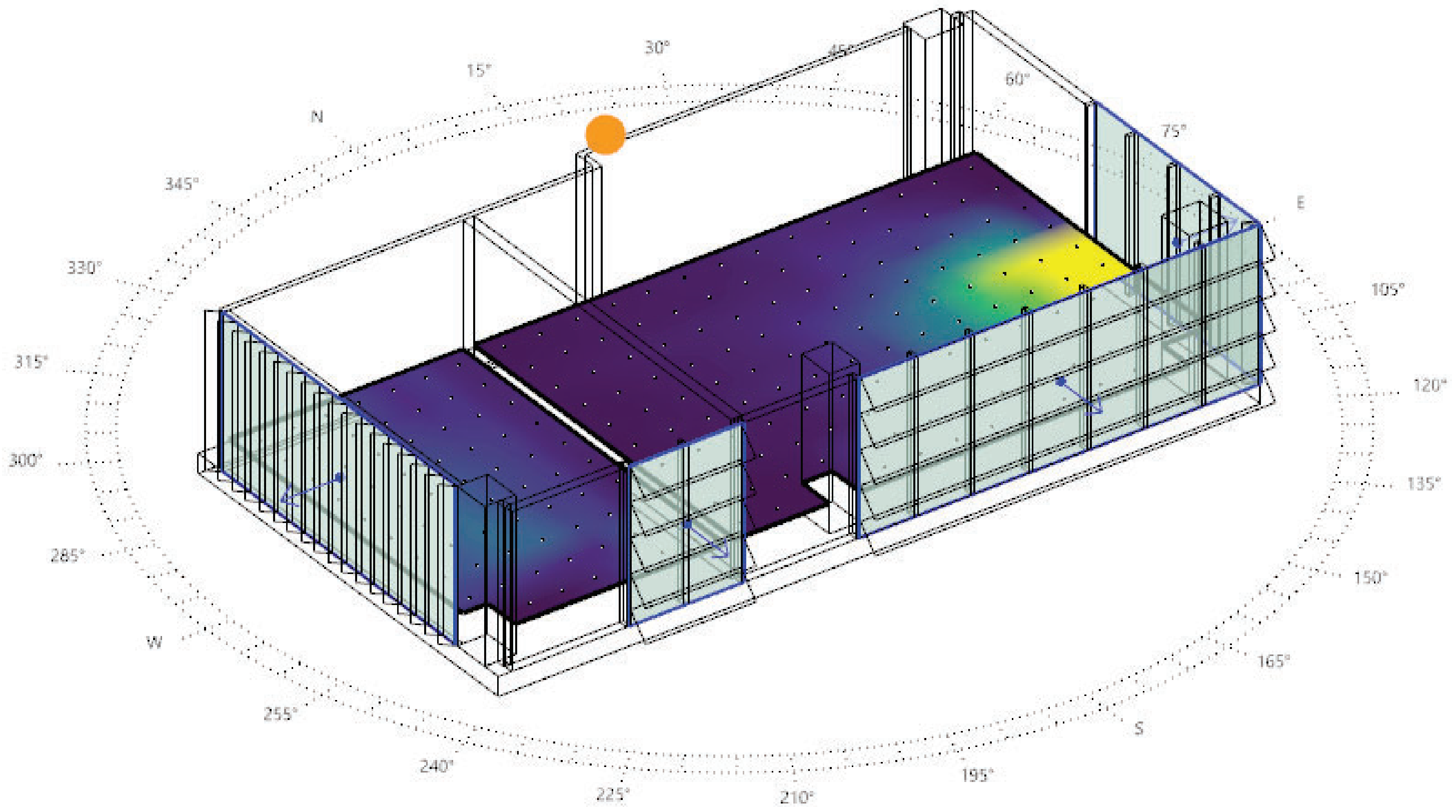
Annual radiation map analysis for urban massing



Annual illuminance simulations
for LEED v4 daylighting credits



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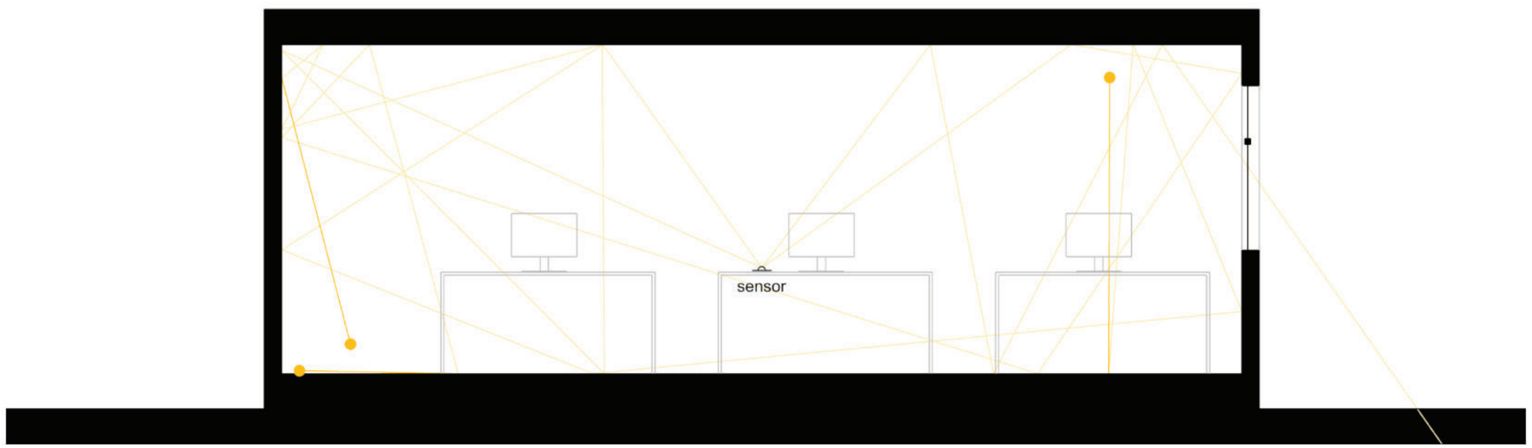

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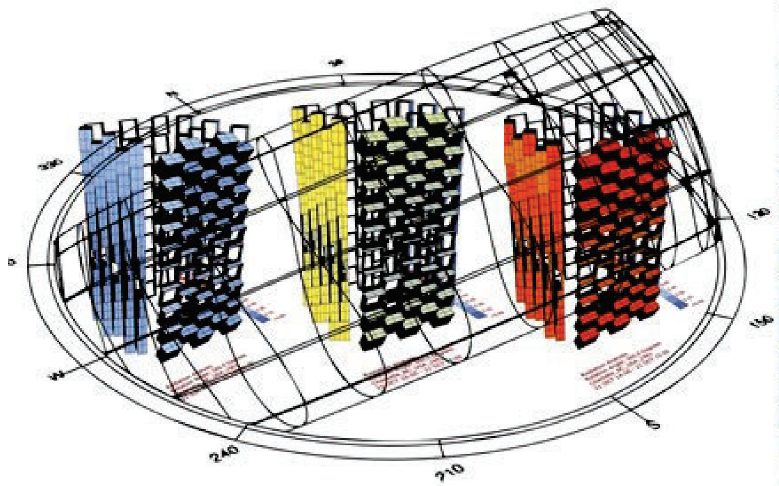

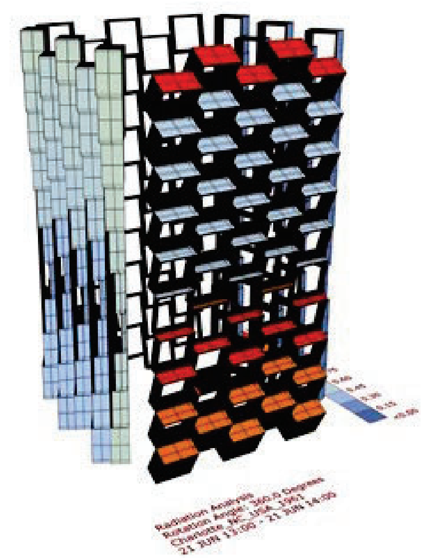

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How occupants perceive the environment

Daylight

- Visual comfort = 500 – 2000 lux
- Adequate daylight in the occupied area on the working surface
- Identify potentials for glare.

Glare

- Level of visual comfort
- Where might it happen?

Balancing out the performance metrics

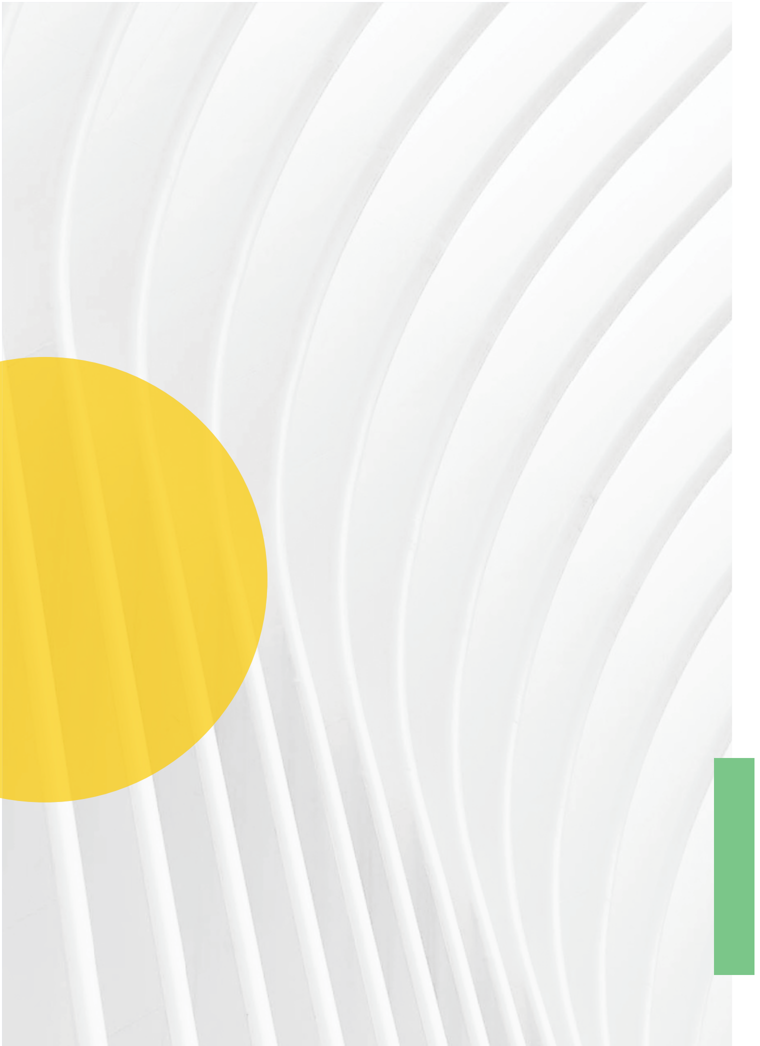
Heating and Cooling

- The BIPV systems will block the sunlight --> less SHGC
- But also, more electricity consumption to heat up the space during winter.

Conclusion

The solar industry is rapidly growing and understanding how the BIPV system works, challenges and opportunities is significantly important.

It is vital for architects and engineers to be knowledgeable about the variables impacting the system, enabling them to make informed decisions during the design stage. This ensures that BIPV systems operate as intended in real-world applications.



Thank You!

shossei5@charlotte.edu

LinkedIn

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