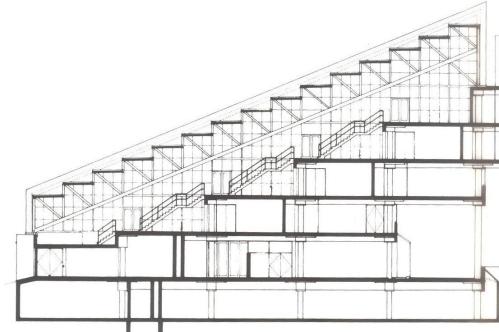




This project challenges static facade and uncontrolled building systems. A dynamic façade system could be a potential solution to the rising demand of both occupancy comfort and energy reduction in the built environment.

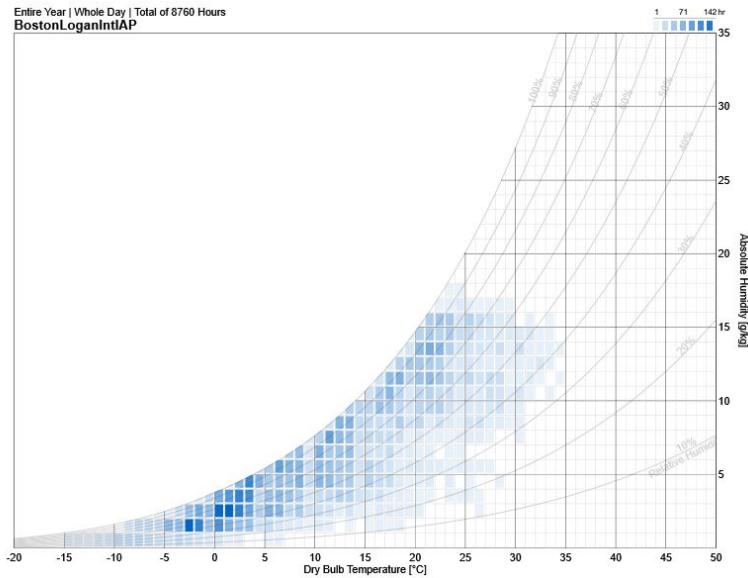
Gund Hall is selected as for its accessibility. We aim to create a transformable system associated with the roof windows to address the existing discomforts in the tray area. Common complaints include large temperature difference between the ground floor and top floor, and glare.



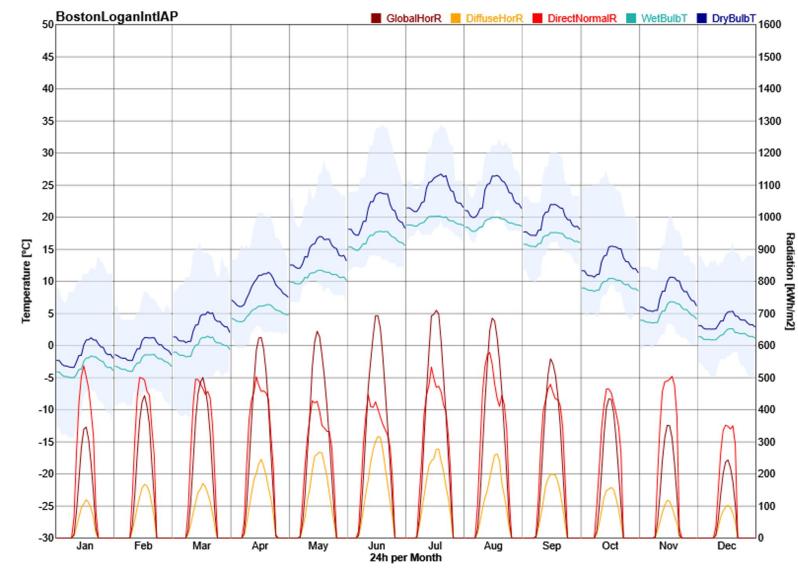
## Project Statement

## **Climate Analysis**

Entire Year | Whole Day | Total of 8760 Hours  
BostonLoganIntlAP

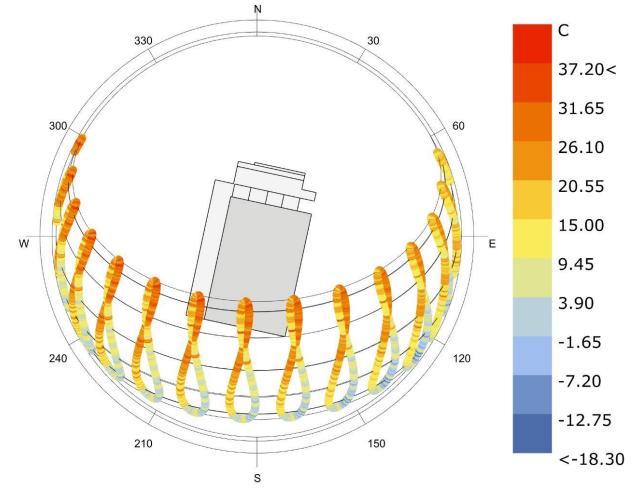
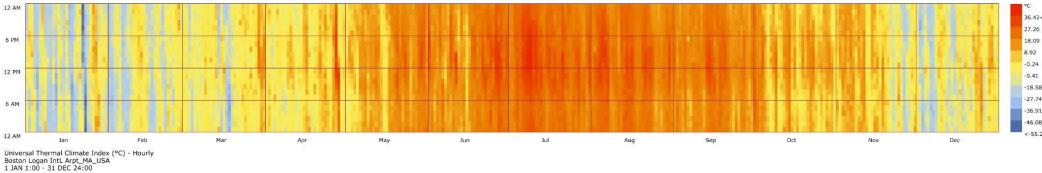
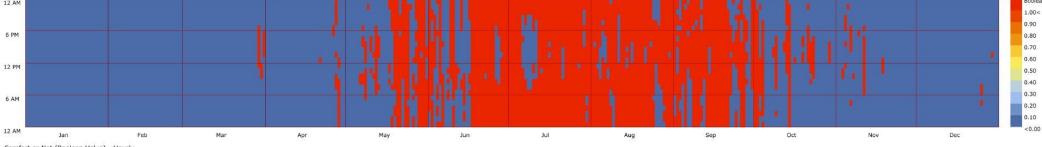


BostonLoganIntlAP



## Boston Climate Analysis

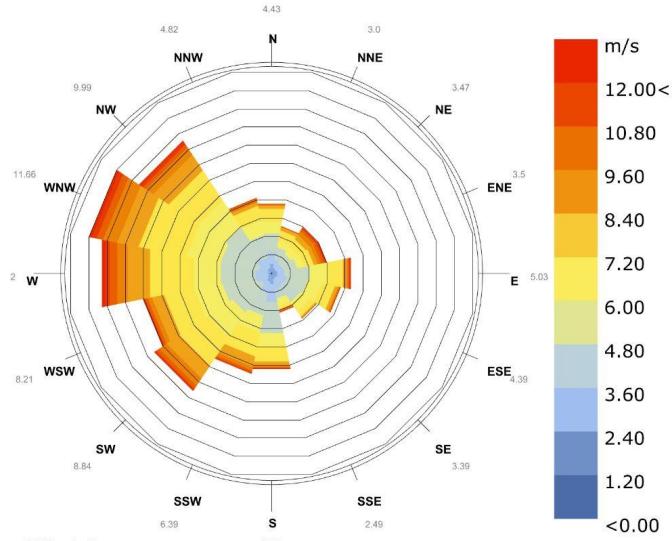
(Temperature, Humidity, Comfort, NV)



**Thermal climate analysis** (Percent of time comfort : 32.26%)

**Sun path**

**Boston Climate Analysis**  
(Temperature, Humidity, Comfort, NV)

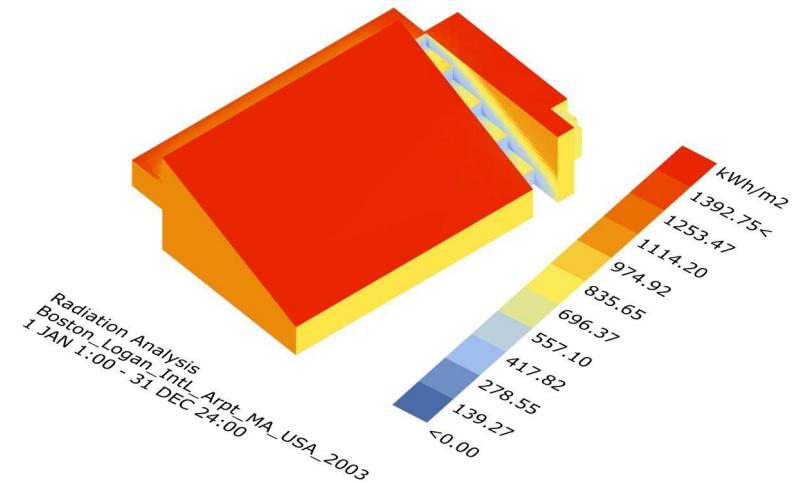


Wind-Rose  
Boston Logan IntL Arpt\_MA\_USA  
1 JAN 1:00 - 31 DEC 24:00

Hourly Data: Wind Speed (m/s)

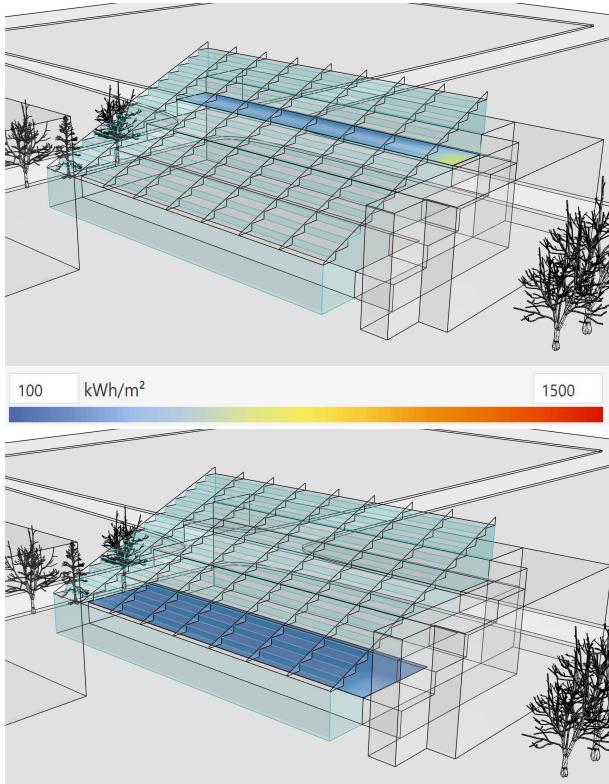
Calm for 0.40% of the time = 35 hours.

Each closed polyline shows frequency of 1.2%. = 102 hours.

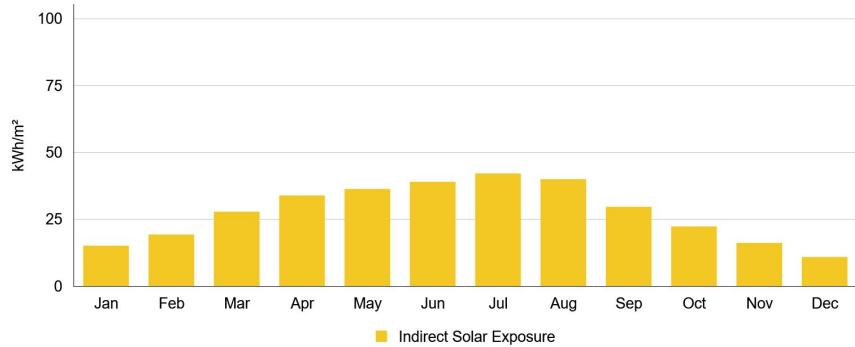


## Boston Climate Analysis (Site - Wind/Radiation)

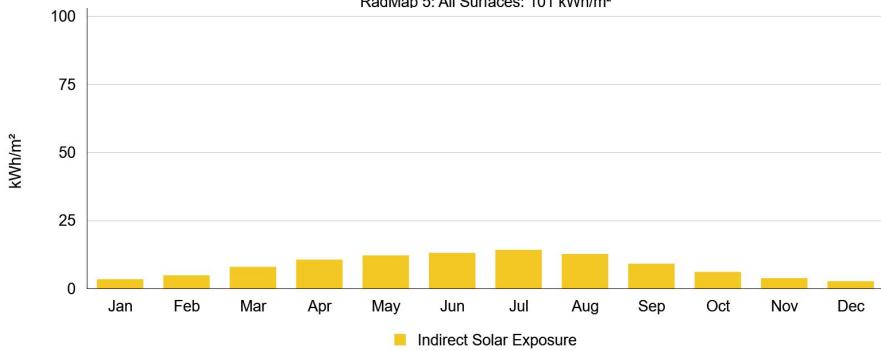
## **Problem Identification**



RadMap 4: All Surfaces: 332 kWh/m<sup>2</sup>

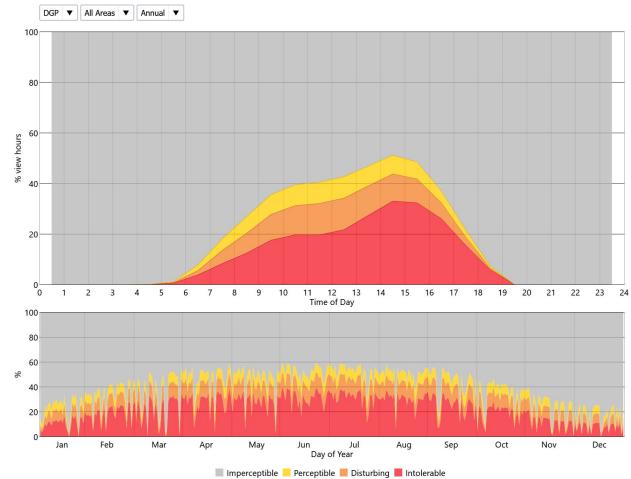
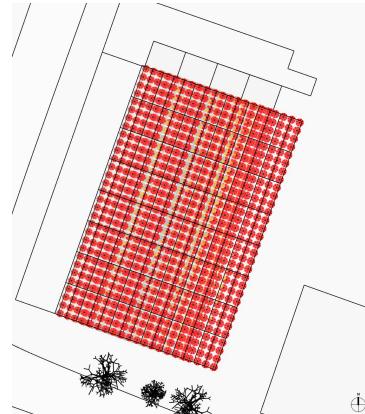
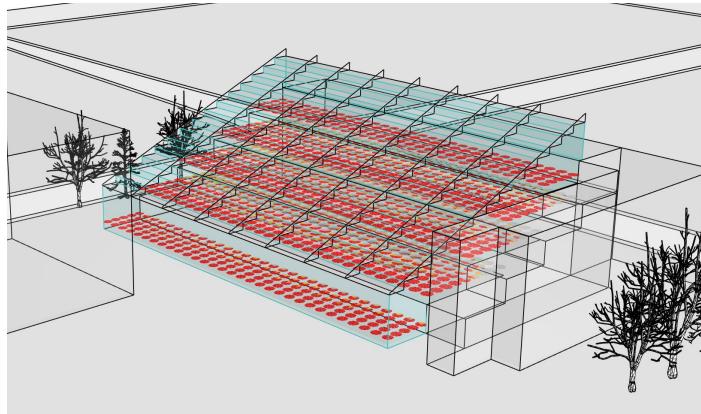


RadMap 5: All Surfaces: 101 kWh/m<sup>2</sup>

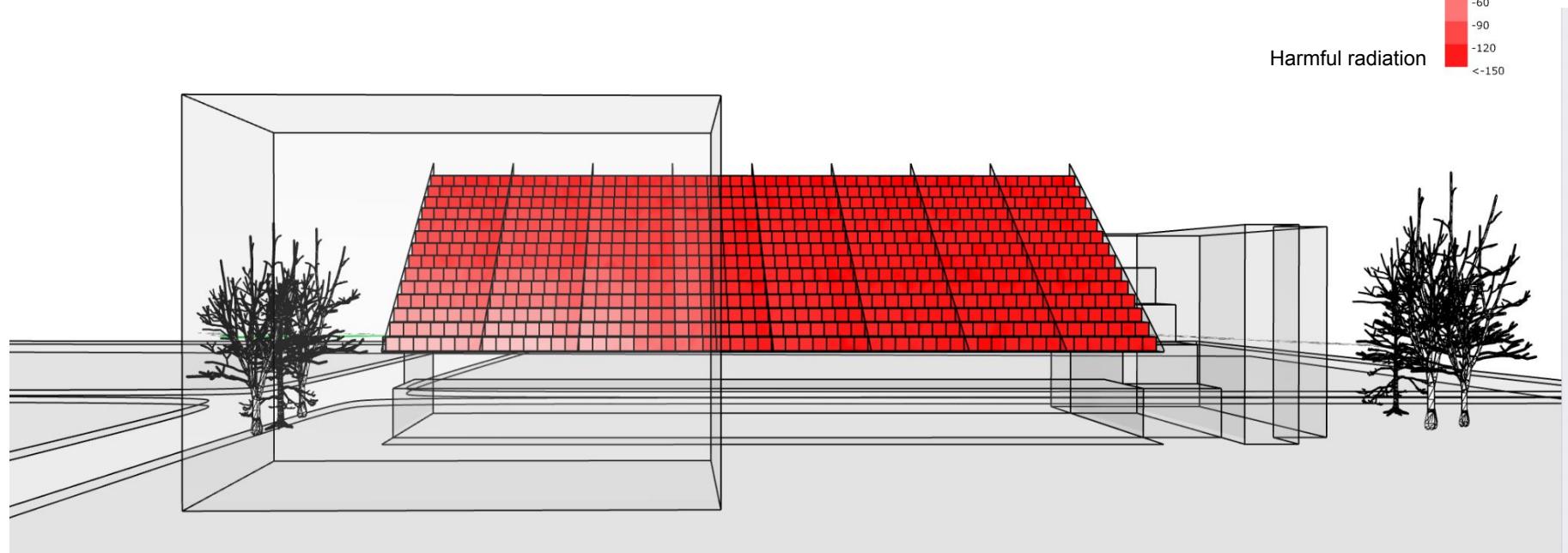
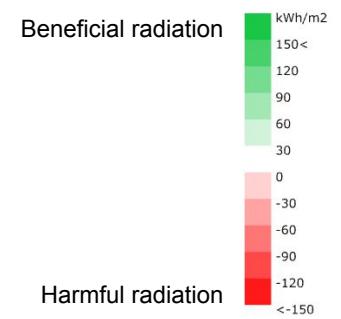


## Gund - Interior Analysis

### Solar Radiation



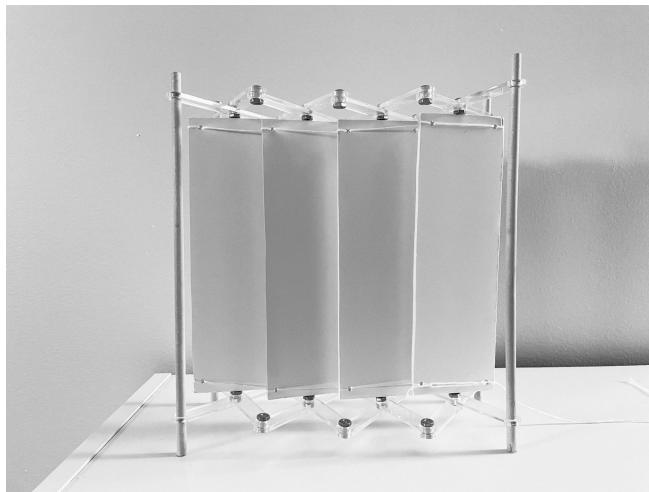
**Gund - Interior Analysis**  
Glare 8am-6pm

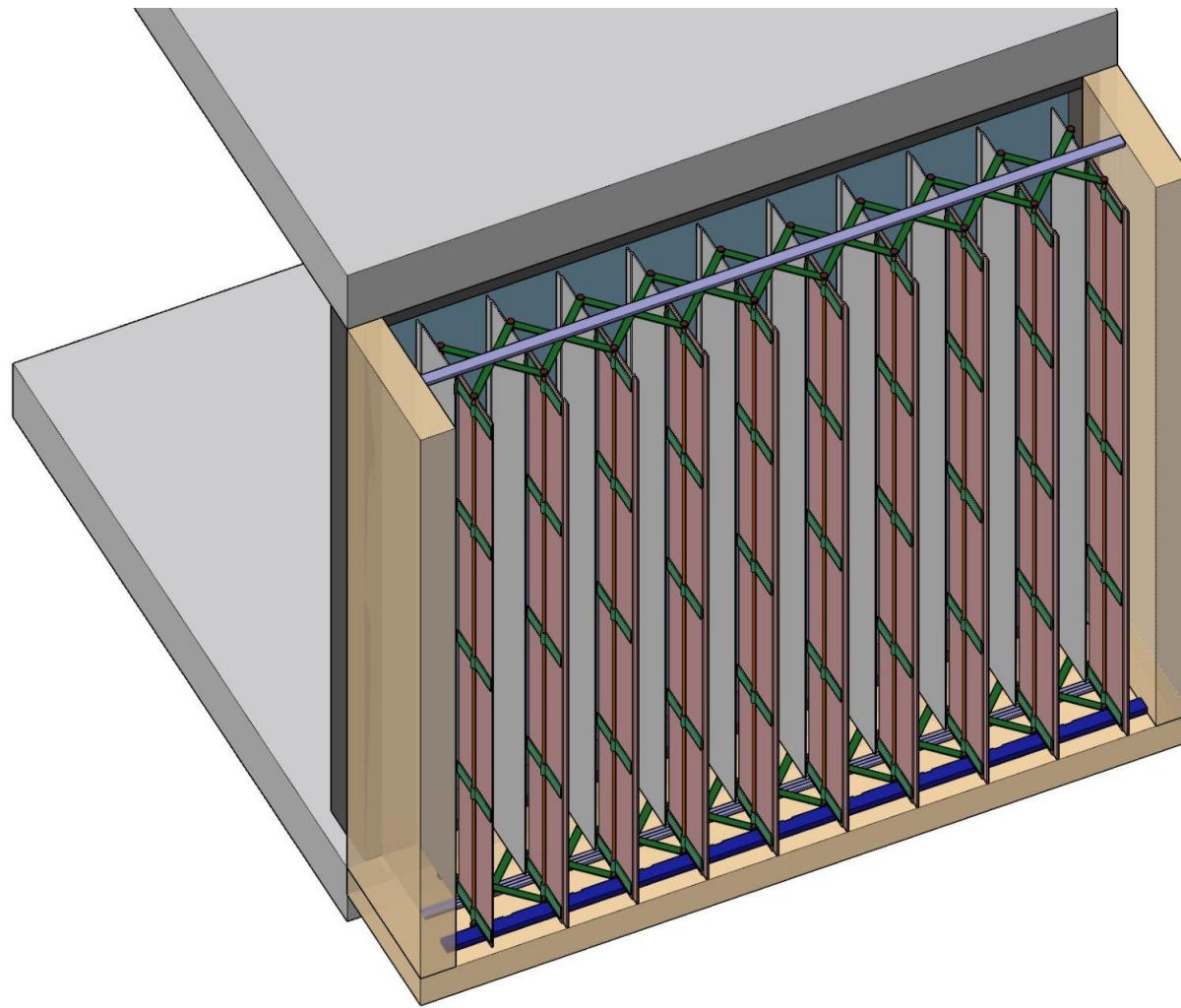


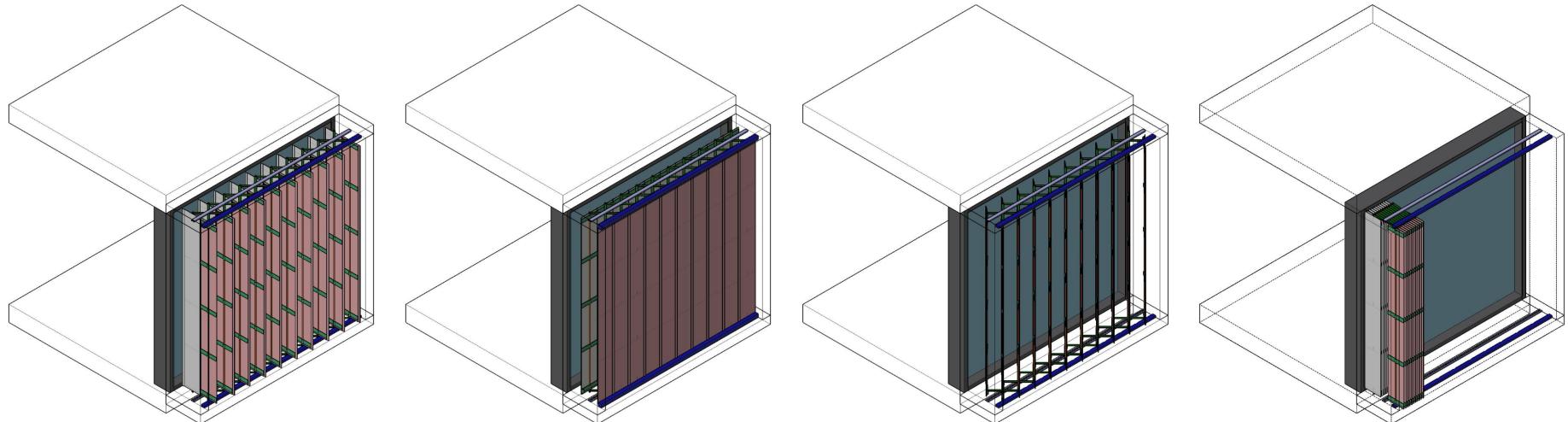
1. Reduce the range of solar radiation received on each floor
2. Control glare
3. Add additional insulation to reduced energy usage

## **Key Performance Challenges**

## **Facade Louver Design**







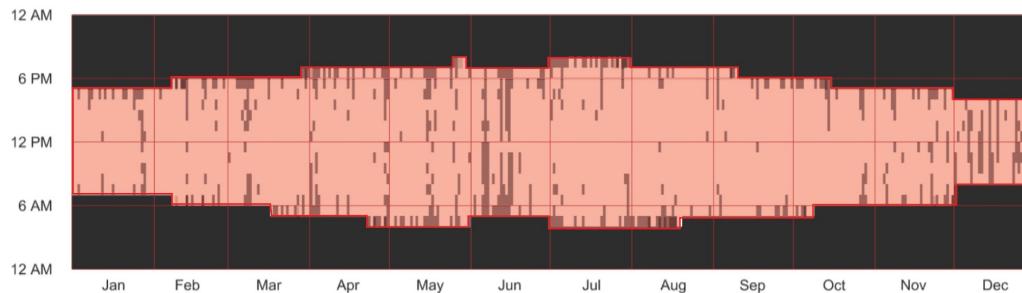
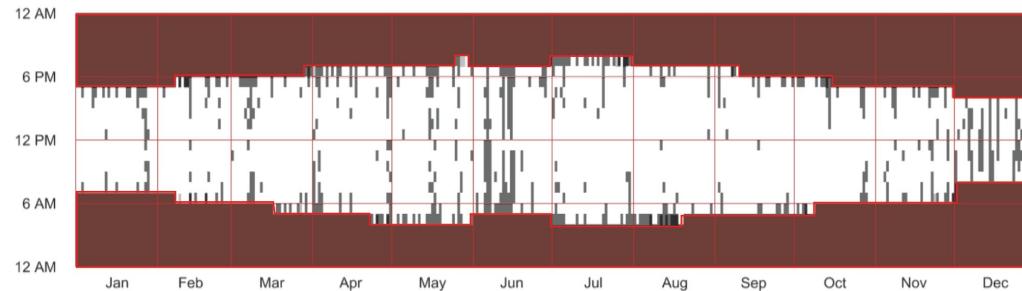
Open

Close

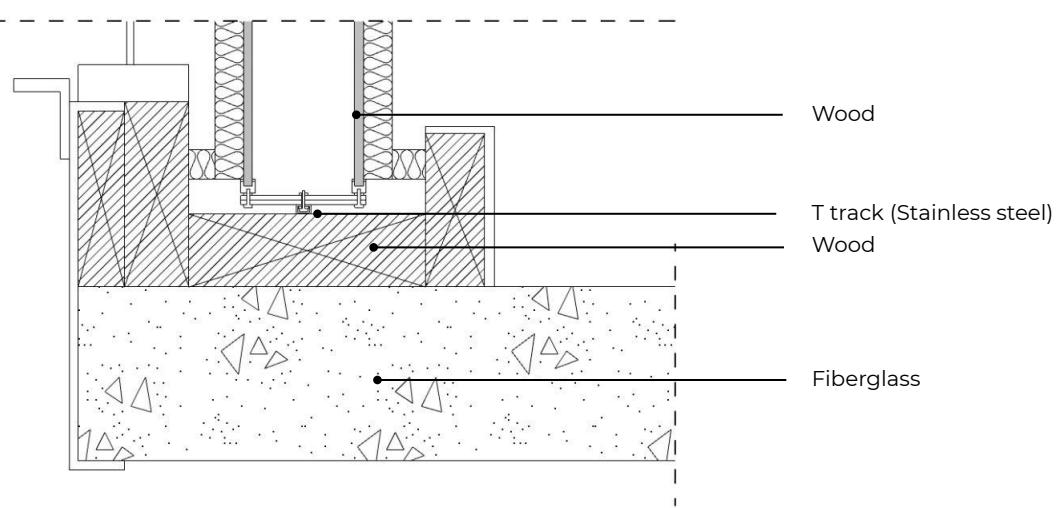
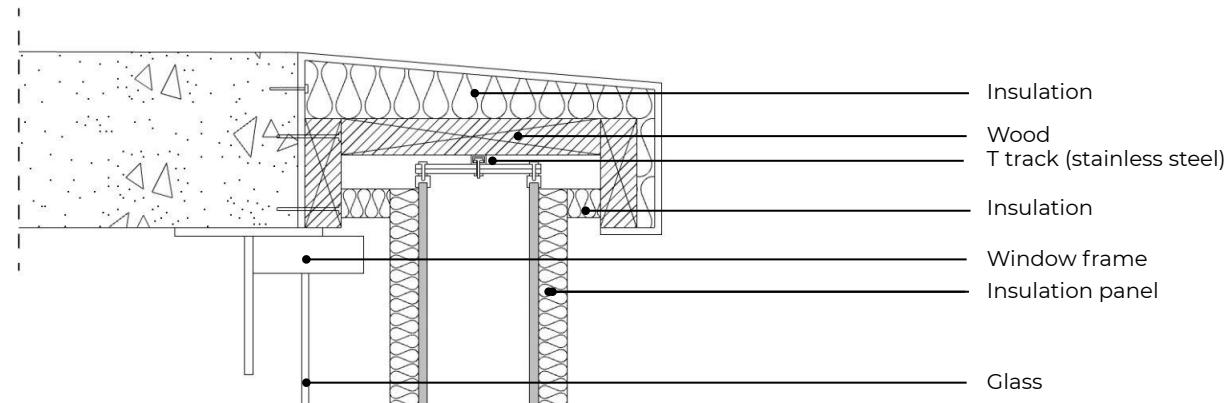
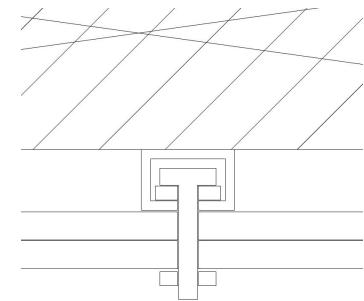
Half - Additional  
Shading

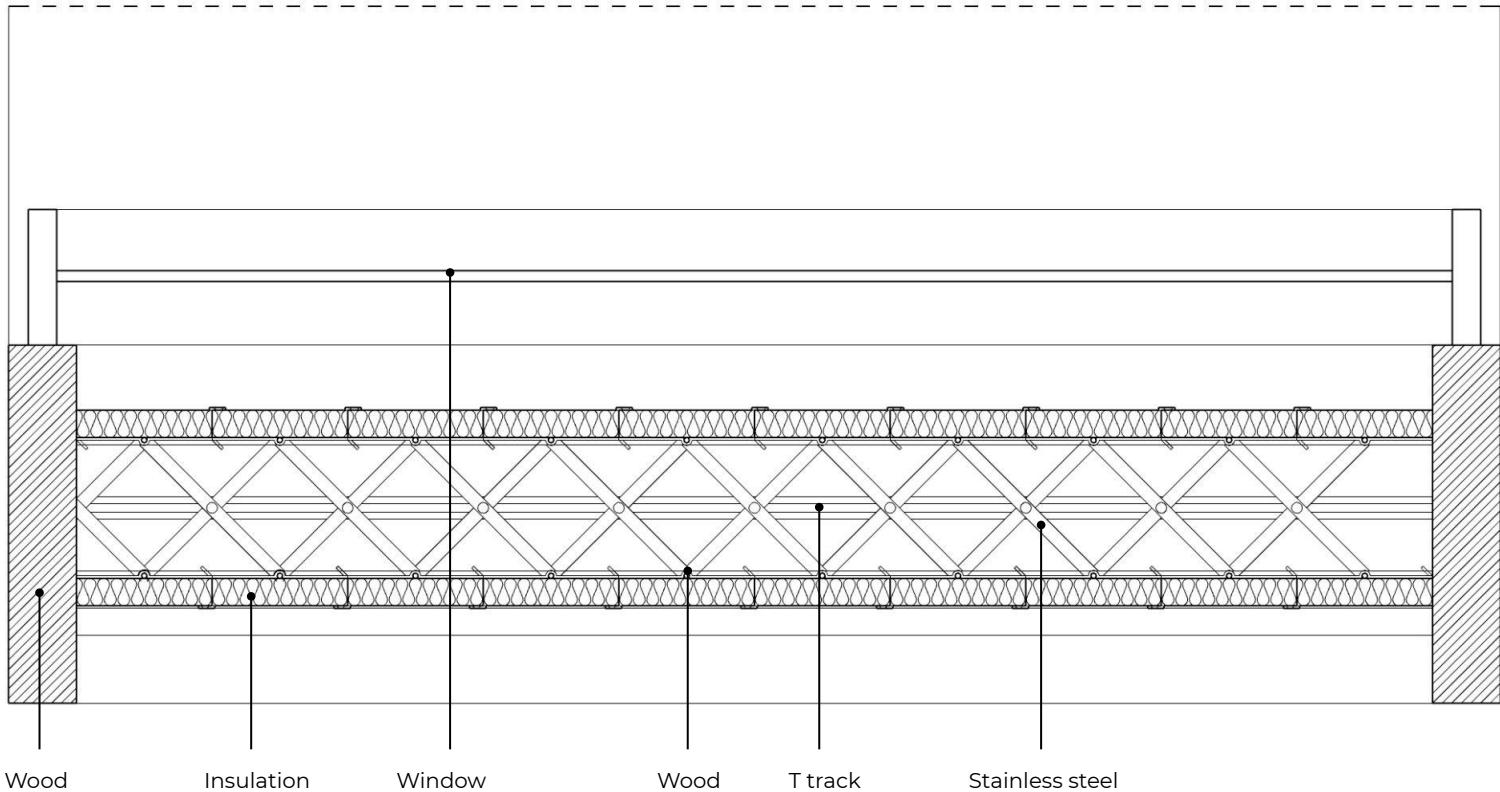
Contract

## Solar Radiation - Boston



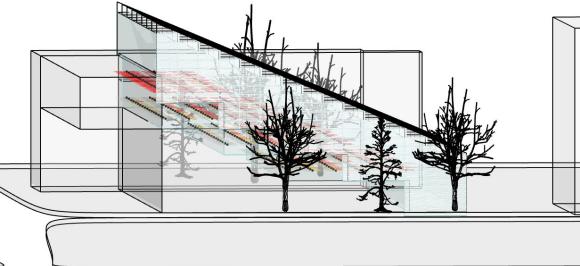
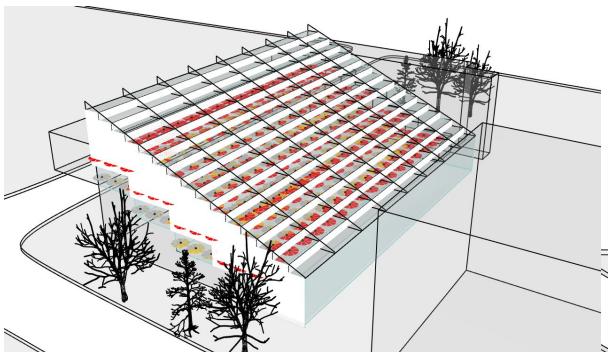
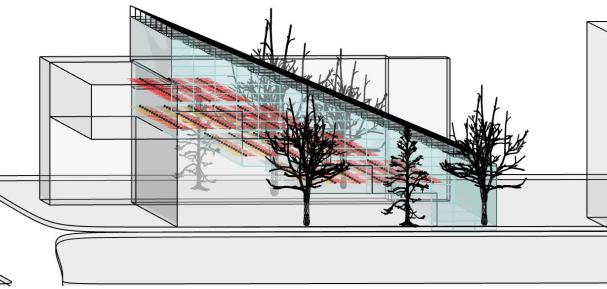
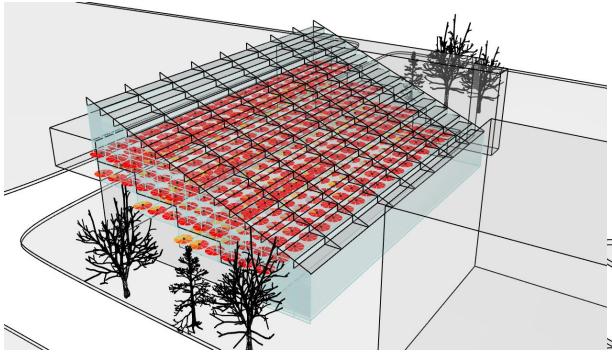
	num_fins	glare_value	illuminance_value	spatial_daylight	annual_sunlight
9	26	0.338025	690.151225	0.105625	0.105625
10	28	0.339300	688.821675	0.106150	0.106150
8	24	0.340375	692.373275	0.105375	0.105375
11	30	0.341175	686.233475	0.104875	0.104875
7	22	0.341575	696.239850	0.105125	0.105125
3	14	0.342700	719.955925	0.105650	0.105650
6	20	0.343375	698.787975	0.106150	0.106150
5	18	0.343925	706.509075	0.105650	0.105650
4	16	0.343975	711.392050	0.105375	0.105375
2	12	0.350050	730.921675	0.106675	0.106675
1	10	0.354825	743.693750	0.106900	0.106900
0	8	0.356625	768.255450	0.109175	0.109175



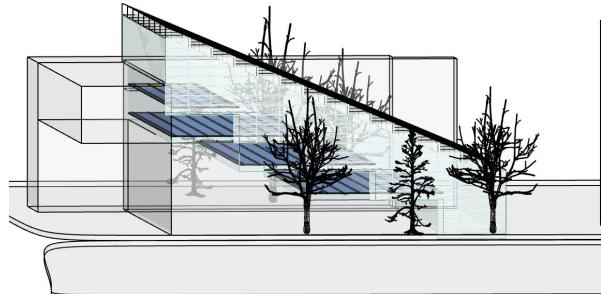
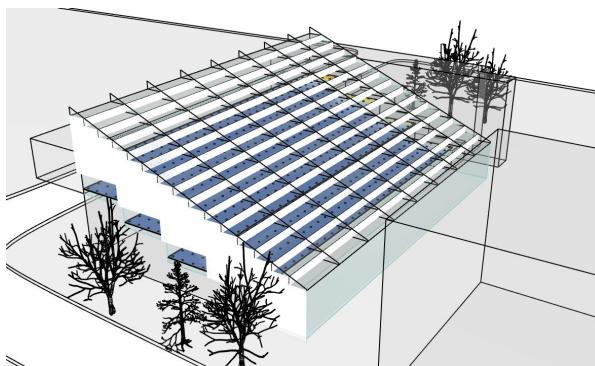
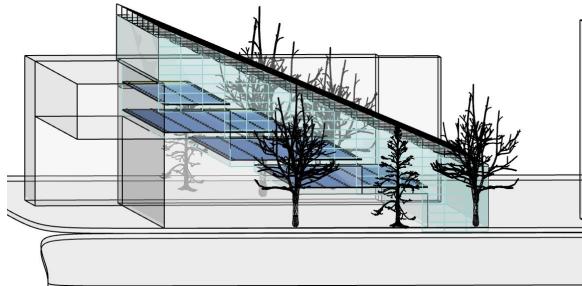
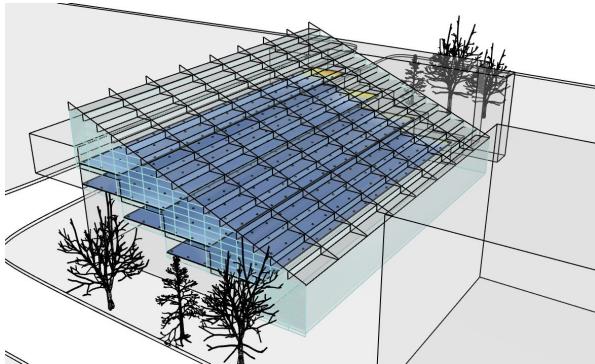


## **Impact of the Double Layered Louvers**

## Glare Analysis



## Solar Radiation Mapping



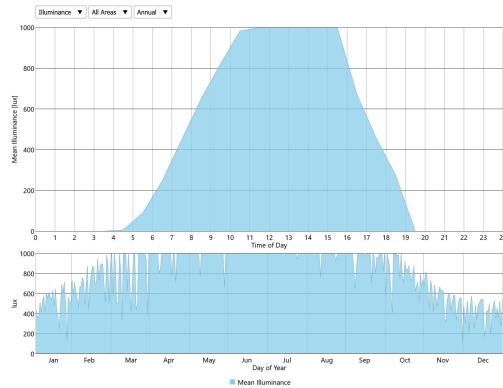
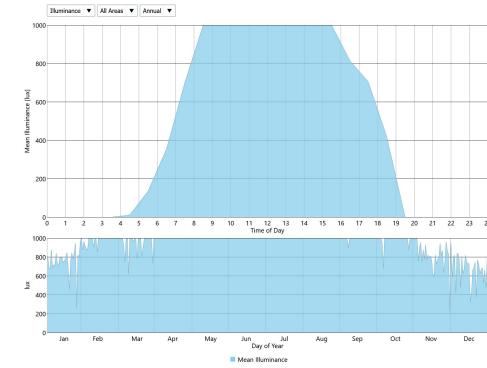
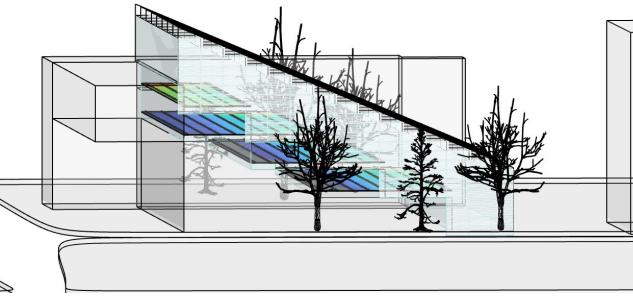
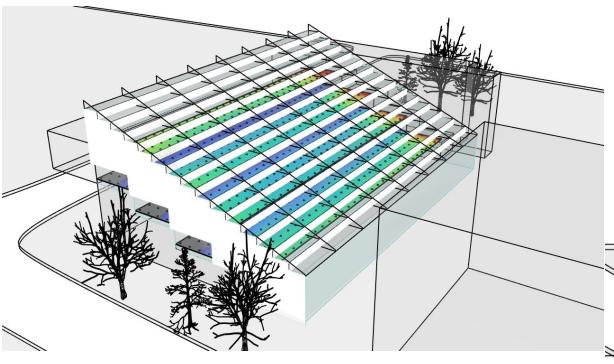
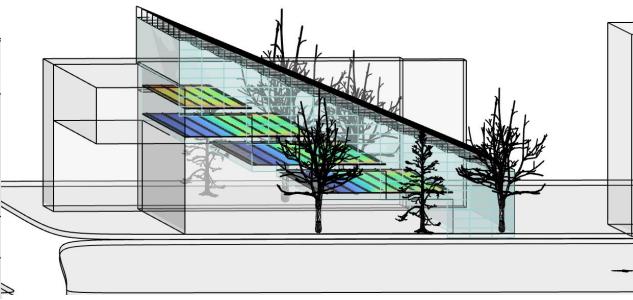
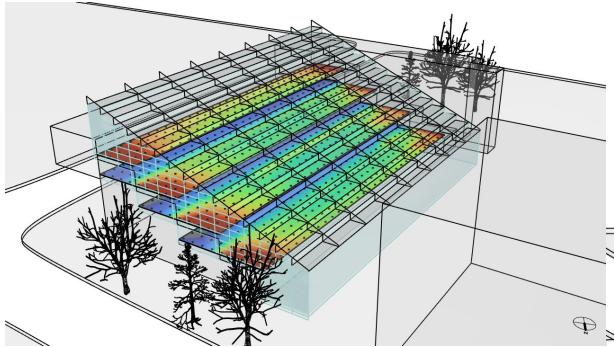
### Current

Top Tray Floor 332 kWh/m<sup>2</sup>  
Lowest Tray Floor 101 kWh/m<sup>2</sup>  
Ratio = 3.28

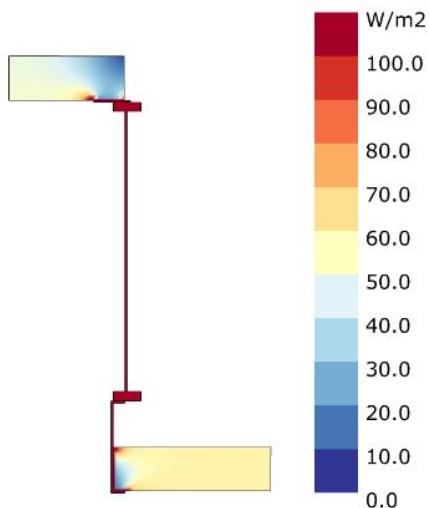
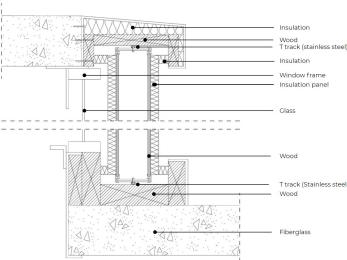
### Proposed

Top Tray Floor 203 kWh/m<sup>2</sup>  
Lowest Tray Floor 80 kWh/m<sup>2</sup>  
Ratio = 2.53

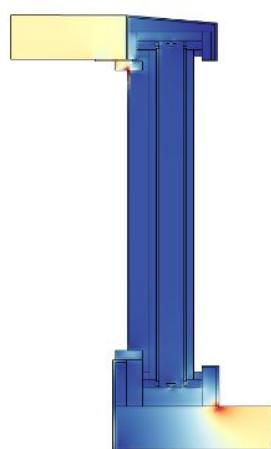
## Annual Illuminance



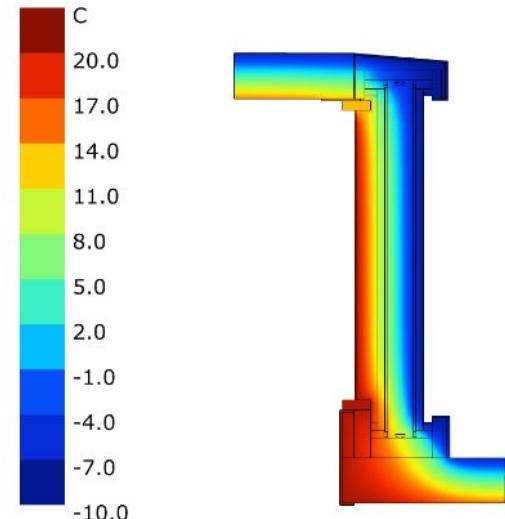
**Overall mean U-factor for Gund Hall is 2.45 W/m<sup>2</sup>K**



U-factor 3.64 W/m<sup>2</sup>K



U-factor 0.63 W/m<sup>2</sup>K



## Total GWP for a single window coverage: 17 kgCO<sub>2</sub>e

