

## Assignment 10 | Energy Balance

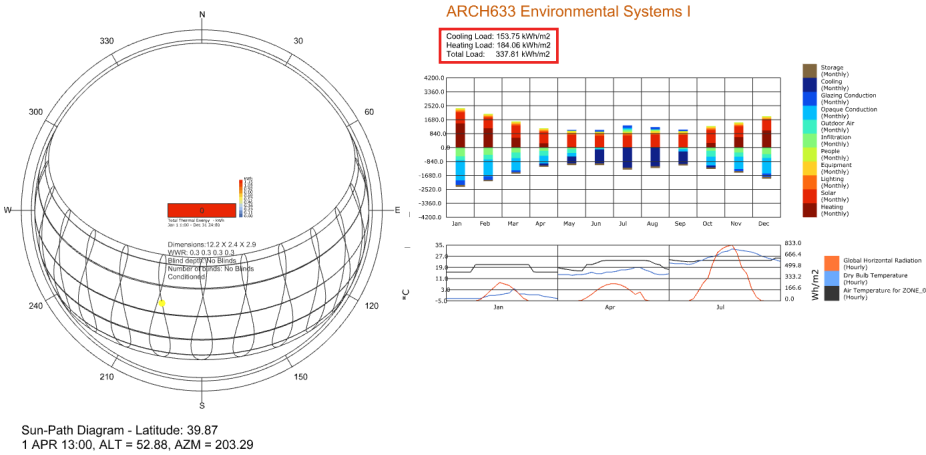
PennDesign  
Environmental Systems I  
Fall 2017  
Andrew Matia



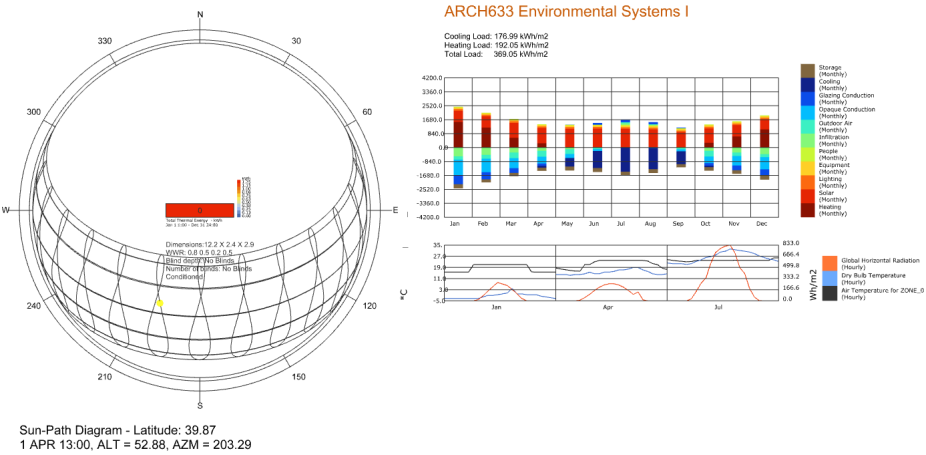
39.87° N | 75.23° W

Window To Wall Ratio

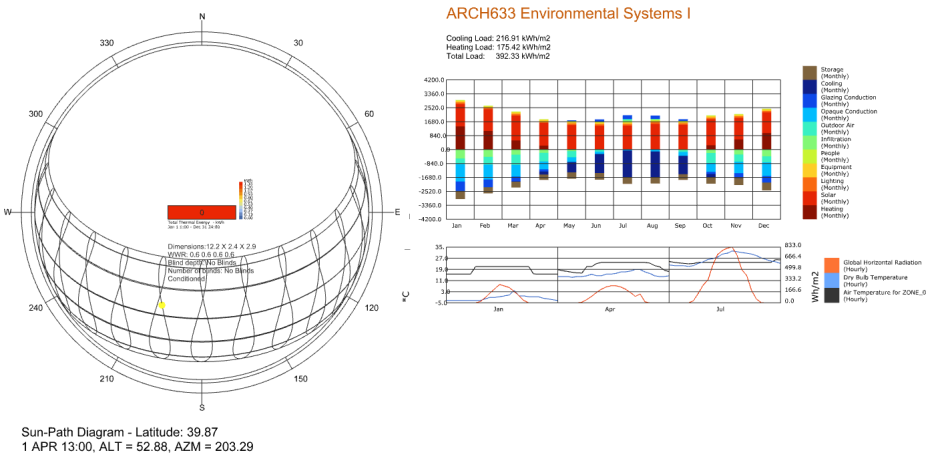
Configuration 1



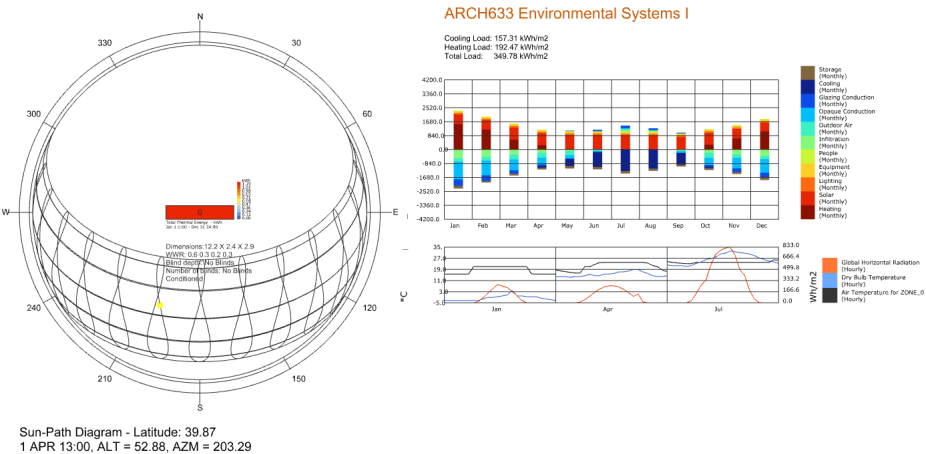
Configuration 3



Configuration 2



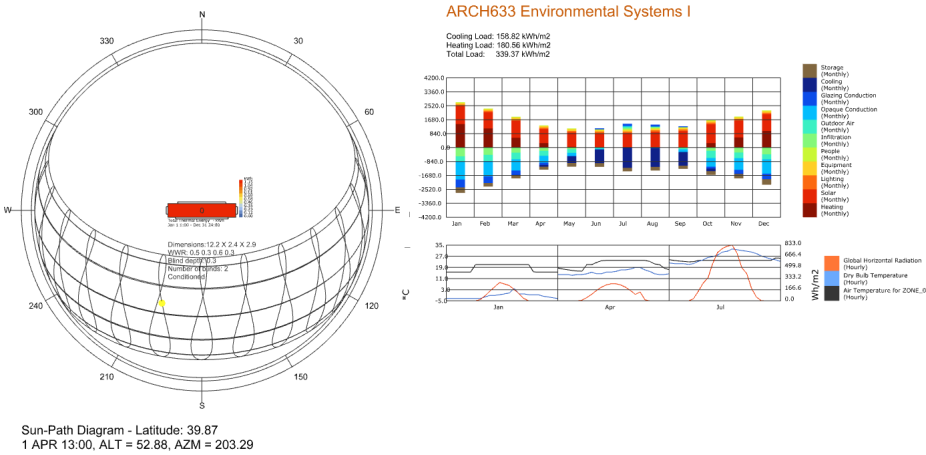
Configuration 4



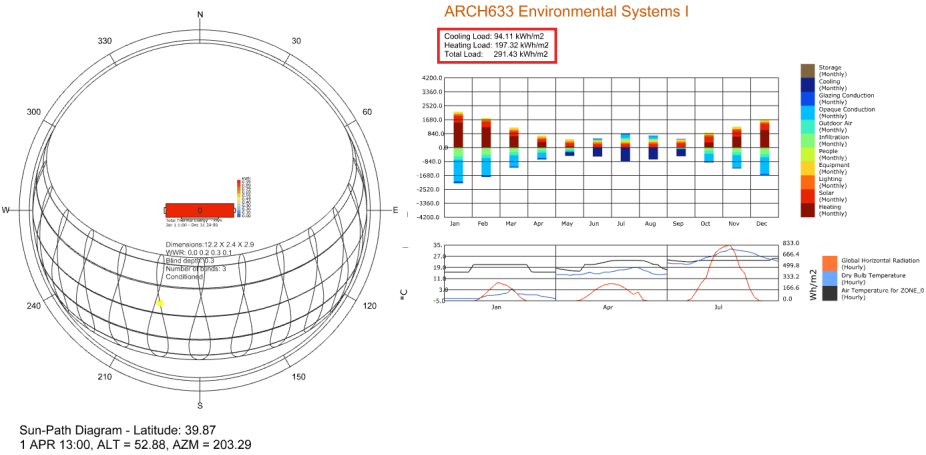
\*Best In Category Configuration

Blinds

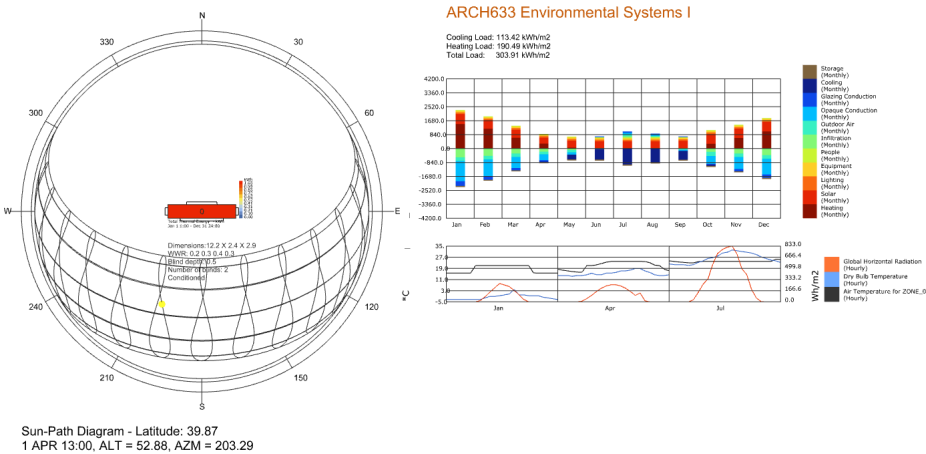
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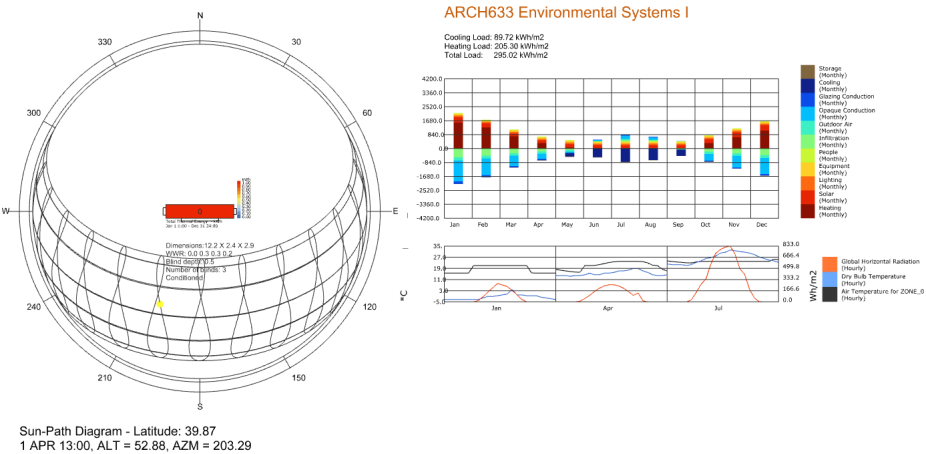
Configuration 3



Configuration 2



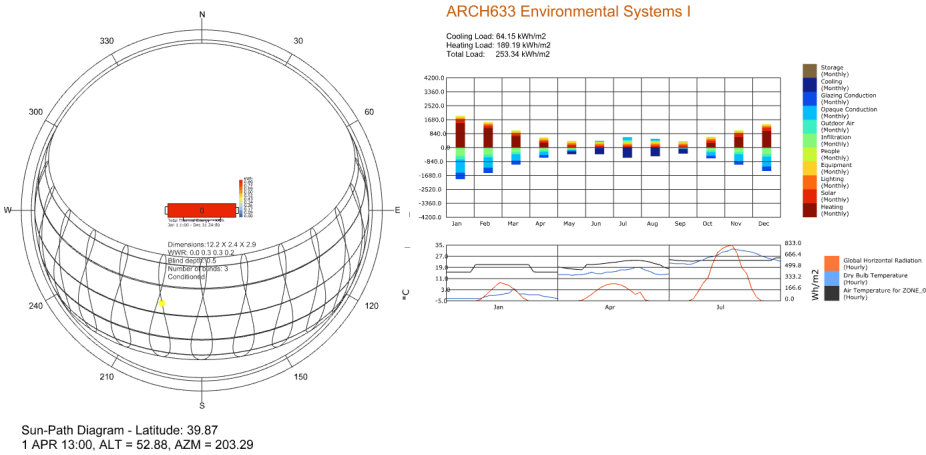
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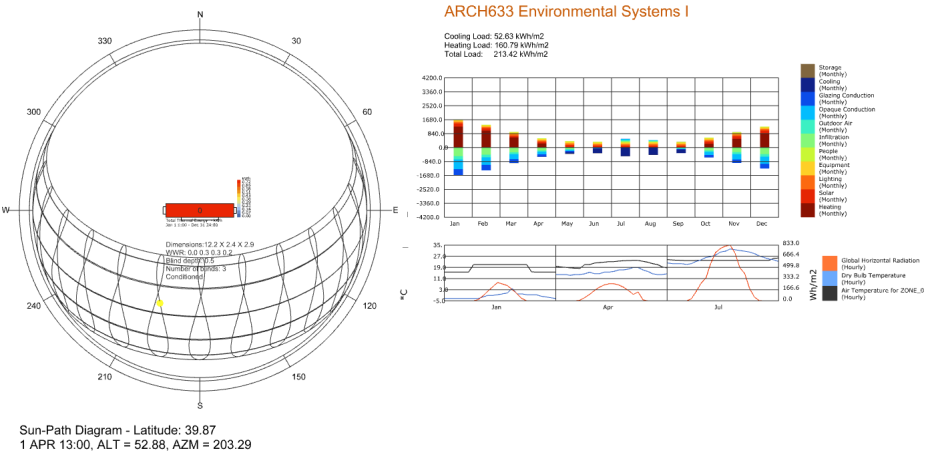
\*Best In Category Configuration

Construction Assembly

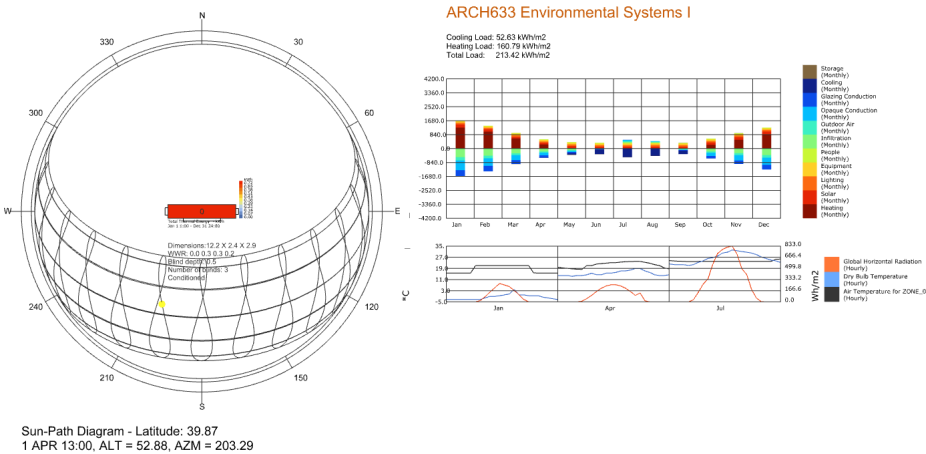
Configuration 1



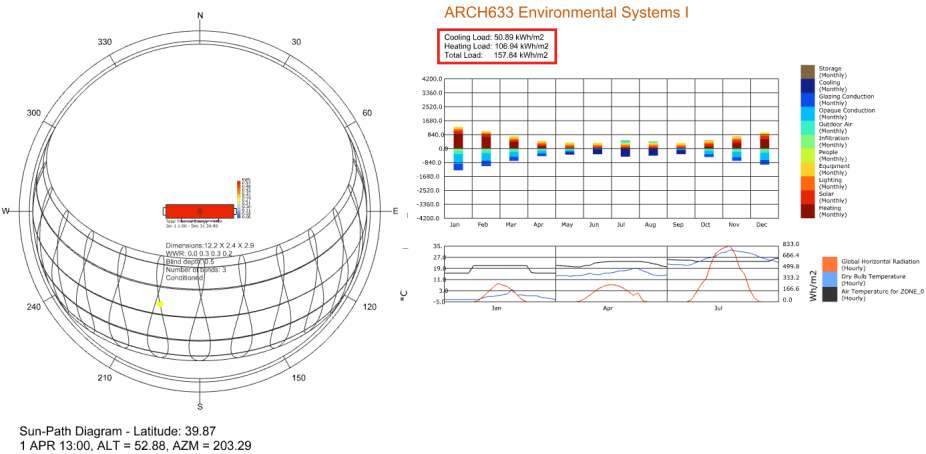
Configuration 3



Configuration 2



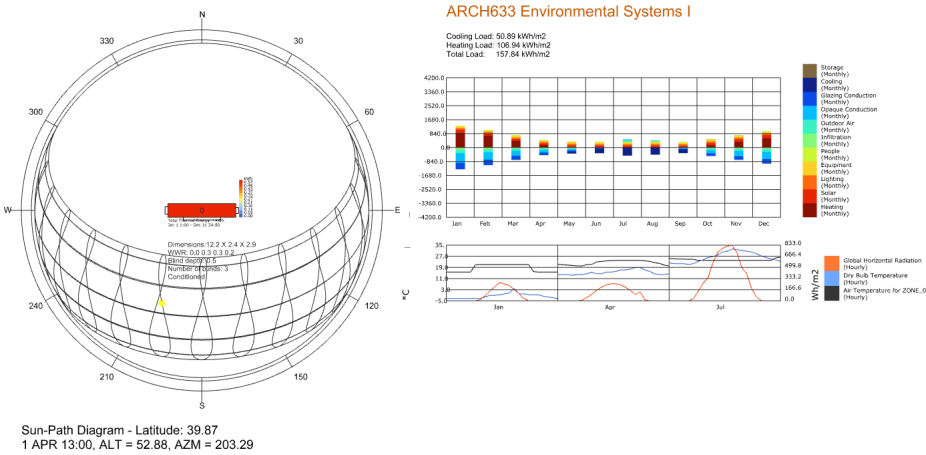
Configuration 4



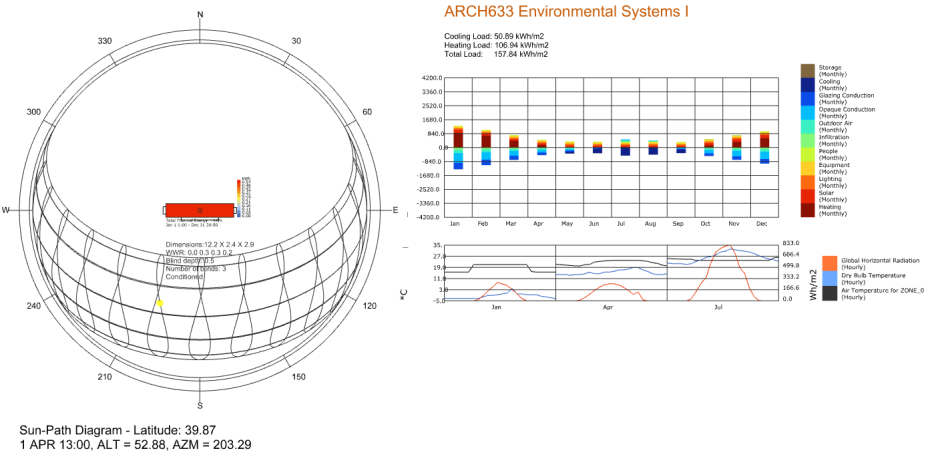
\*Best In Category Configuration

Thermal Mass

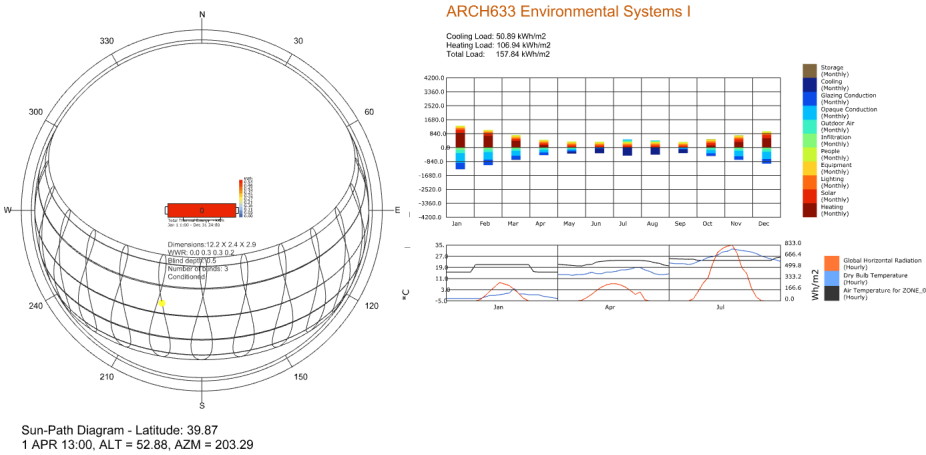
Configuration 1



Configuration 3



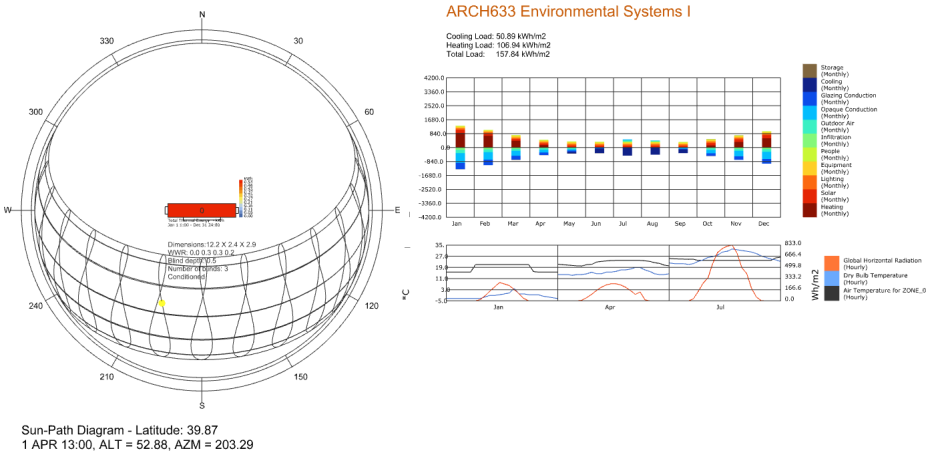
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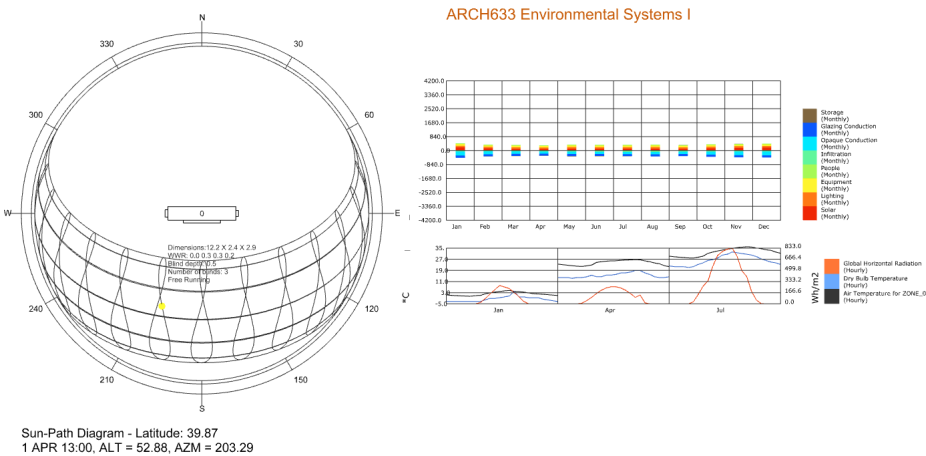
\*Best In Category Configuration

# Final Assemblage

## Conditioned System



## Non-Conditioned System



### Conditioned System Loads

#### [minimum total load]

Cooling Load: 50.89 kWh/m<sup>2</sup>

Heating Load: 106.94 kWh/m<sup>2</sup>

Total Load: 157.85 kWh/m<sup>2</sup>

#### [maximum total load]

Cooling Load: 216.91 kWh/m<sup>2</sup>

Heating Load: 175.42 kWh/m<sup>2</sup>

Total Load: 392.33 kWh/m<sup>2</sup>

After running the analysis a few dozen times, I have concluded that the greatest factors affecting the final calculation for total load of the shipping container is the window to wall ratio along with the construction assembly. I noticed minimal effect when switching between thermal mass variables and only subtle difference when configuring between the louvres; although, it is worth mentioning that it seems an appropriate balance between louvre depth and quantity is to be maintained. The preferred configuration for my analysis was 3 blinds with .5m depth. It seems that the WWR and construction assembly is of greatest importance because they deal directly with the surfaces where heat is either lost or gained through either solar radiation and/or conduction; the specific location of heat transfer. Although being able to reduce total load on the systems by more than 50% through the course of the analysis, I was a little disappointed in the fact that the temperature range inside the shipping container varied so drastically in the summer and winter months. In the winter months the temperature ranged between 2–5°C while in the summer months the temperature ranged between 28–36°C. The indoor temperature is consistently correlated to the dry bulb temperature of the specific time period and shows about a 5% increase over the dry bulb. Although it is possible to decrease total system load by quite a significant amount, it seems impossible to provide total independence from spatial conditioning through only the means of WWR, blinds, construction and thermal mass.