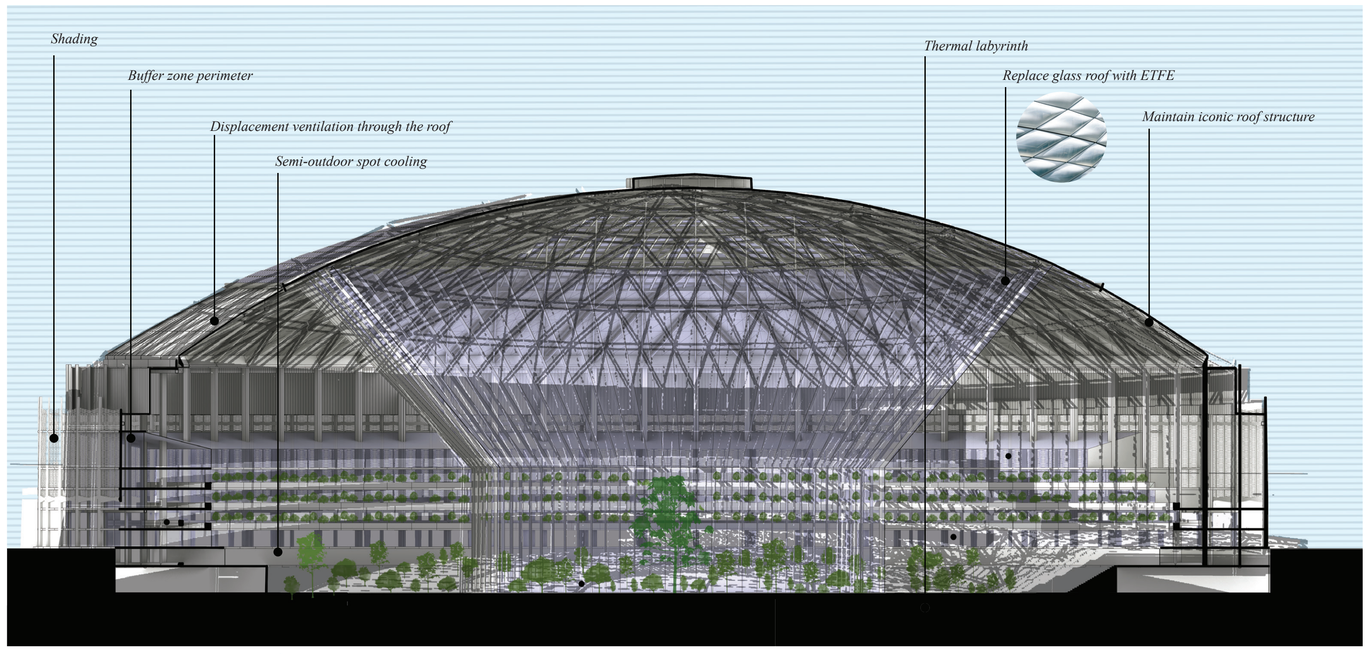
CARBON LIGHTERS

ASHRAE LowDown Showdown

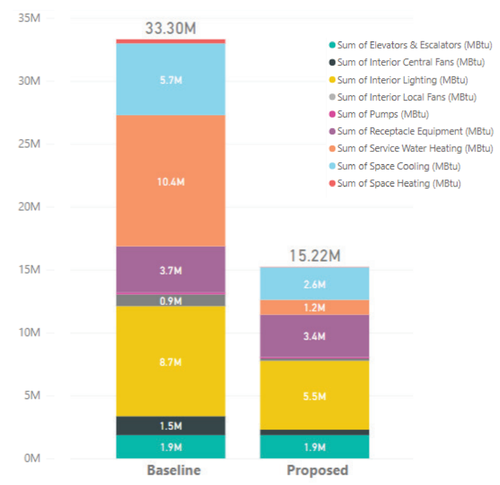
2023 Building Performance Analysis Conference

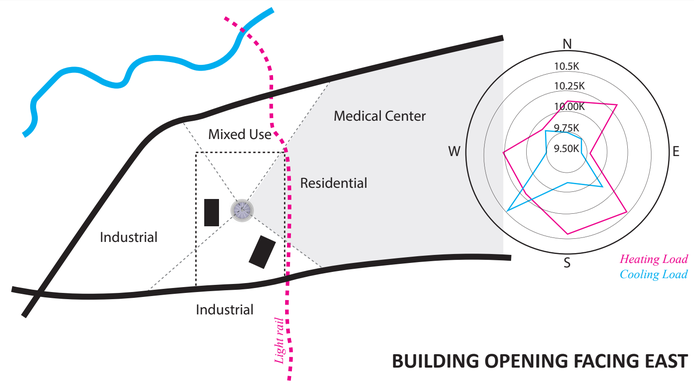
Building: Houston Astrodome

Location: Houston, TX

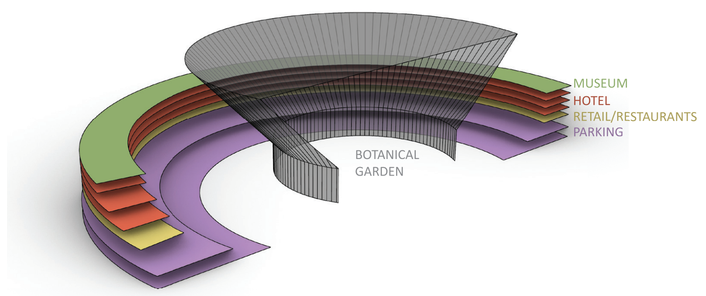


ENERGY SAVINGS

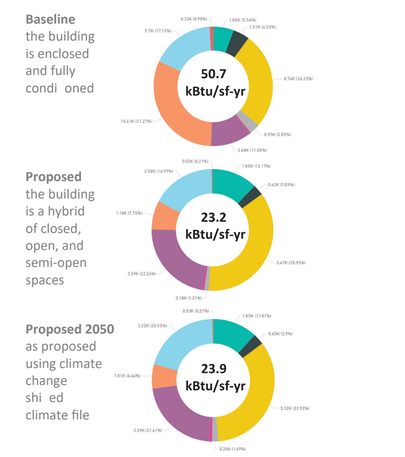




BUILDING OPENING FACING EAST



PROGRAM



Total Site Energy Usage

15,449,144 kBtu

Site EUI

23.5 kBtu/ft² yr

Source EUI

74.1 kBtu/ft² yr

Annual Operational Carbon

1.99 kgCO2e/ft² yr

Total Embodied CO2e

94,253,677.69 kg CO2e

Annual Water Usage

299,767 Gallons

Annual Energy Costs

0.60 $/ft²

Annual Water Costs

0.005 $/ft²

Total Annual Costs

0.605 $/ft²

Total Energy Generation

125,593,517 kBtu

**All SF uses the conditioned floor area of 657,111 SF (does not include parking garage area)*

Design Description

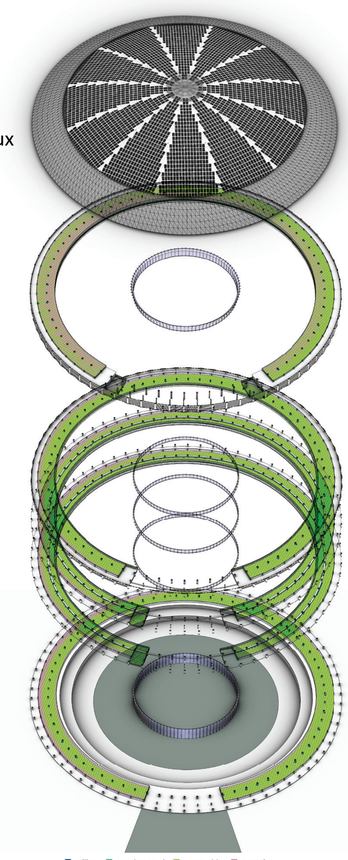
The main uses of the new design are retail and restaurants, a 500-room hotel, a botanical garden, and an Astrodome museum. The concourse areas are maintained as existing, but occupied partially to reduce operational energy. The outer most layer of the building is converted to sizable 20' deep semi-outdoor spaces that act a thermal buffer and at the same time augment the flexibility of the space and its connection to the outdoors. All areas' parking needs are served by an underground parking area that uses the existing below-grade structure.

Energy Savings Strategies

The skylights are replaced with ETFE with a fritted translucent layer with a SGHC of 25 and a VLT of 62%. The LPD was reduced between 30% to 40% as compared to the current building energy code and all spaces have photosensors and occupancy/vacancy sensors. The Hotel public areas, Museum, and Retail are mixed-mode with dedicated outside air systems with enthalpy wheel for humidity control. The Hotel rooms are VRFs operated by the guests. The Botanical Garden is only treated for humidity and uses displacement ventilation. Under the Botanical Garden there is a thermal labyrinth which will precool the incoming air. The remaining semi-outdoor space between the botanical garden and the concourse areas has spot cooling and displacement ventilation. Water from condensate is collected, treated and used for irrigation. An extensive array of photovoltaics is designed in the surface parking lot areas, providing sufficient electricity to have the building be netzero energy.

DAYLIGHT

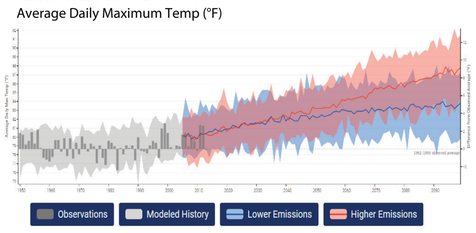
sDA: 97.8%
ASE: 0%
UDI: 78.7%
avrg lux: 1,192lux



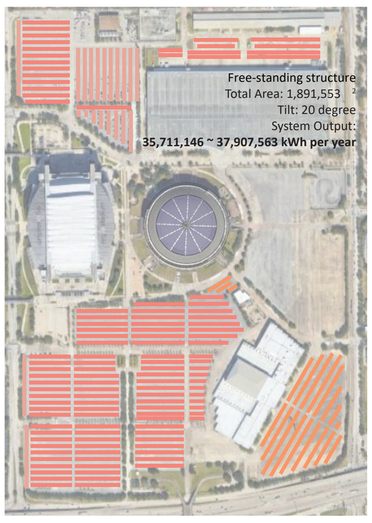
UDI

CLIMATE PROJECTIONS

Average Daily Maximum Temp (°F)

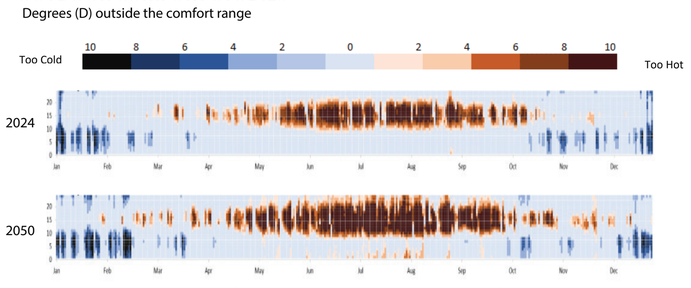


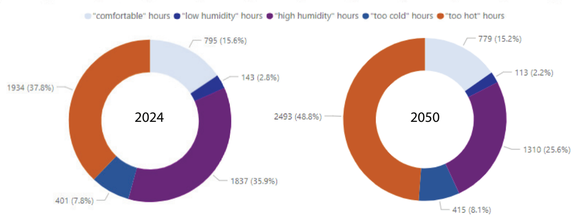
PHOTOVOLTAIC PANELS



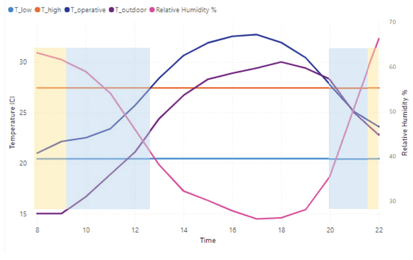
OUTDOOR COMFORT STUDIES

Degrees (D) outside the comfort range

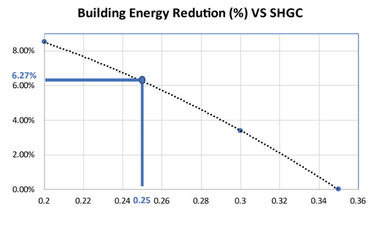




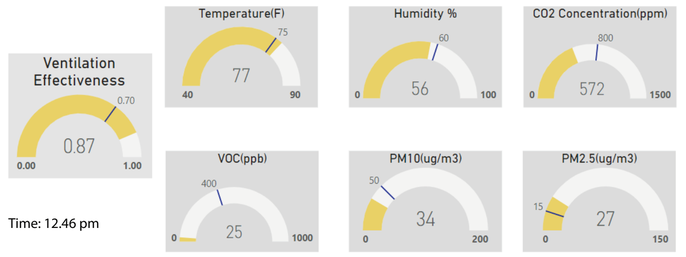
ACCEPTABLE OPERATIVE TEMP



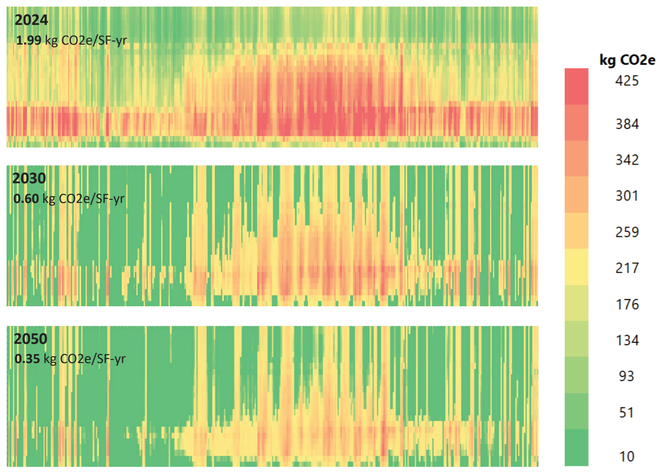
ENVELOPE OPTIMIZATION



INDOOR AIR QUALITY



OPERATIONAL CARBON



Team

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