CHAPTER/REGIONAL TECHNOLOGY AWARD - SHORT FORM

1. Category - Check one and indicate New, Existing, or Existing Building Commissioning (EBCx)

- ☐ Commercial Buildings — ☐ New ☐ Existing or ☐ EBCx
- Institutional Buildings:
  - ☒ Educational Facilities — ☒ New ☐ Existing or ☐ EBCx
  - ☐ Other Institutional — ☐ New ☐ Existing or ☐ EBCx
- ☐ Health Care Facilities — ☐ New ☐ Existing or ☐ EBCx
- ☐ Industrial Facilities or Processes — ☐ New ☐ Existing or ☐ EBCx
- ☐ Public Assembly — ☐ New ☐ Existing or ☐ EBCx
- ☐ Residential (Single and Multi-Family)

2. Name of building or project: University of Illinois Campus Instructional Facility

City/State: Urbana, IL

3. Project Description: 4 Story Classroom and Lecture Hall

Project Study/Design Period: 02/2018 (Begin date (mm/yyyy)) to 08/2021 (End date (mm/yyyy))

Percent Occupancy at time of submission: 100%

4. Entrant (ASHRAE member with significant role in project):

a. Name: Guerrero, Marcos (Last / First / Middle)

Membership Number: 8357974

Chapter: Illinois

Region: VI

b. Address (including country): 303 W Erie Street

City	State	Zip	Country
Chicago	IL	60654	USA

c. Telephone: (O) 312-847-1043 d. Email: mguerrero@dbhms.com

e. Member's Role in Project: Mechanical Engineer

f. Member's Signature: Marcos Guerrero

Digitally signed by Marcos Guerrero
DN: C=US, E=mguerrrero@dbhms.com, O=dbHMS, CN=Marcos Guerrero
Date: 2021.09.17 06:51:58-05'00'

5. Engineer of Record: Sachin Anand

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the owner and have received permission from the owner to submit this project to the ASHRAE Technology Awards Competition.

UNIVERSITY OF ILLINOIS
CAMPUS INSTRUCTIONAL FACILITY

The College of Engineering at the University of Illinois Urbana-Champaign (opened August 2021) envi-sions a campus that promotes collaboration and innovation between engineering disciplines. The de-sign of the Campus Instructional Facility creates an environment where interdisciplinary ideas can de-velop between distinct engineering majors. The facility includes large and open flexible collaboration spaces that include gathering spaces, classrooms, and lecture halls.

dbHMS developed a design that maximizes the flexibility of the building and provides efficient heating and cooling strategies. The facility includes hydronic radiant panels that are coupled with a dedicated outside air system (DOAS). These serve as the primary means of heating, cooling, and ventilating the facility.

The facility promotes integrated and sustainable design features including exposed steel radiant pan-els, an open ceiling concept, and exposed structural steel. Radiant tubing is integrated with the com-posite metal deck at the first floor providing additional heating where there is a higher window to wall ratio.

The Campus Instructional Facility includes a 135 ton geothermal well field specifically sized to balance the year round heating and cooling loads. This provides stability to the well field preventing it from be-coming heating or cooling dominated over the life of the system. Additionally, the well field includes a 450-ft deep fiber optic temperature sensor that monitors the field in real-time. This will be used to op-timize the operation of the well field showing the campus' dedication to optimization and sustainability. The remaining load of the facility is addressed by district connections to campus chilled water and steam.

The hydronic systems include two (2) separates loops primarily serving dehumidification/pre-heat loads and radiant loads in the facility, for both hot water and chilled water. These loops are cascaded in design allowing the AHU coil return water to serve as the supply water to the radiant loads in the facili-ty. The cascaded design provides a larger dT (20˚F cooling/54 ˚F heating) and improves the overall district dT.

The DOAS includes both energy recovery and desiccant dehumidification wheels that provide dry air to the facility (47˚ DP). This allows the DOAS to tackle both the ventilation and dehumidification require-ments for the facility. Further, the dry conditions of the facility allow it to operate at a low space dew-point (55˚F) and allows the radiant chilled water to operate at a lower supply water temperature (56˚F); improving its capacity and efficiency.

ENERGY EFFICIENCY

The building systems have been optimized to reduce the energy consumption of the facility. The systems provide a 50.1% reduction over ASHRAE 90.1-2010 and an energy cost savings of 38.3%.

The design of the facility provides an EUI of 49 kbtu/sf/yr.

Table 1: Predicted Energy Performance Relative to ASHRAE 90.1-2010 Baseline

	Baseline	Proposed
Electricity Consumption (kWh)	1,402,810.1	1,564,026.1
Purchased Chilled Water (therm)	50,441.5	666.7
Purchased Steam (therm)	19,309.8	3,867.0
Total Consumption (Btu x 10^6)	**11,761.5**	**5,789.8**

Table 2: Predicted Energy Cost Relative to ASHRAE 90.1-2010 Baseline		
	Baseline	Proposed
Electricity	$120,511	$134,360
Purchased Chilled Water	$78,084	$1,032
Purchased Steam	$31,261	$6,260
Total Consumption (Btu x 10^6)	**$229,856**	**$141,653**

INDOOR AIR QUALITY

The facility includes a dedicated outside air system (DOAS) with demand control ventilation in each space to maintain a high quality environment for indoor air quality.

INNOVATION

The facility includes the use of geothermal well fields, radiant heating and cooling panels, and a cascaded piping design all with the goal of maximizing the use of heating and cooling energy. Additionally, the well field includes a fiber optic temperature sensor for further optimization of the well field over the life of the building.

OPERATION & MAINTENANCE

All major mechanical equipment is located to two (2) mechanical rooms in the building where they are easily accessible.

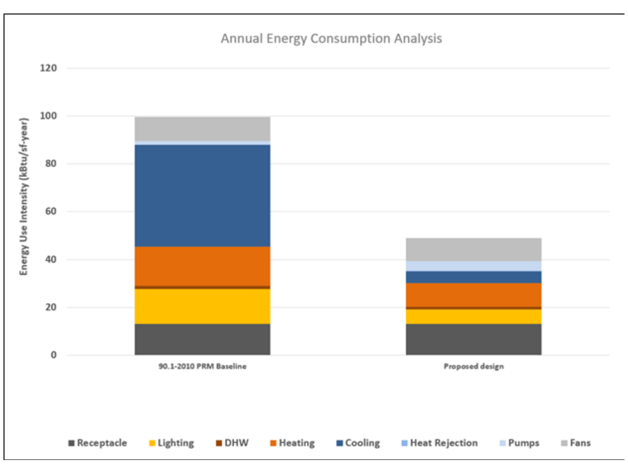
COST EFFECTIVENESS

A detailed cost analysis was conducted by the Construction Manager during pre-construction to properly assign cost to the proposed design. This includes analysis in comparison with a traditional VAV system that included comparisons in air handler sizes/quantities, duct distribution, plant side sizing, floor to floor heights, and structural costs. The cost of the radiant design was optimized by improving the overall dT of the system and the geothermal well field was funded by Institute for Sustainability and Energy at the University of Illinois.

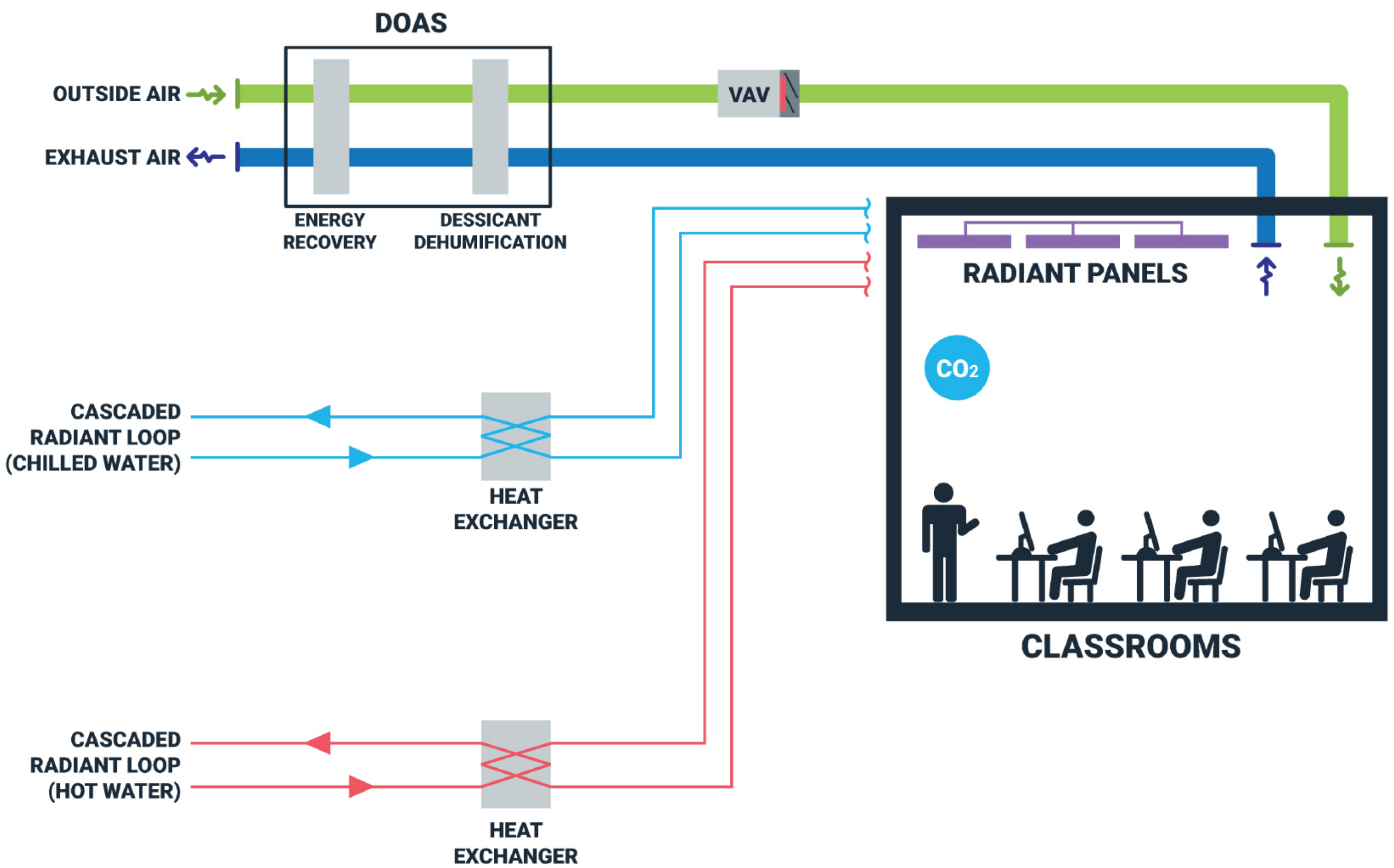
ENVIRONMENTAL IMPACT

Table 2 summarizes the predicted environmental impact of the building relative to the ASHRAE 90.1-2010 Appendix G Baseline:

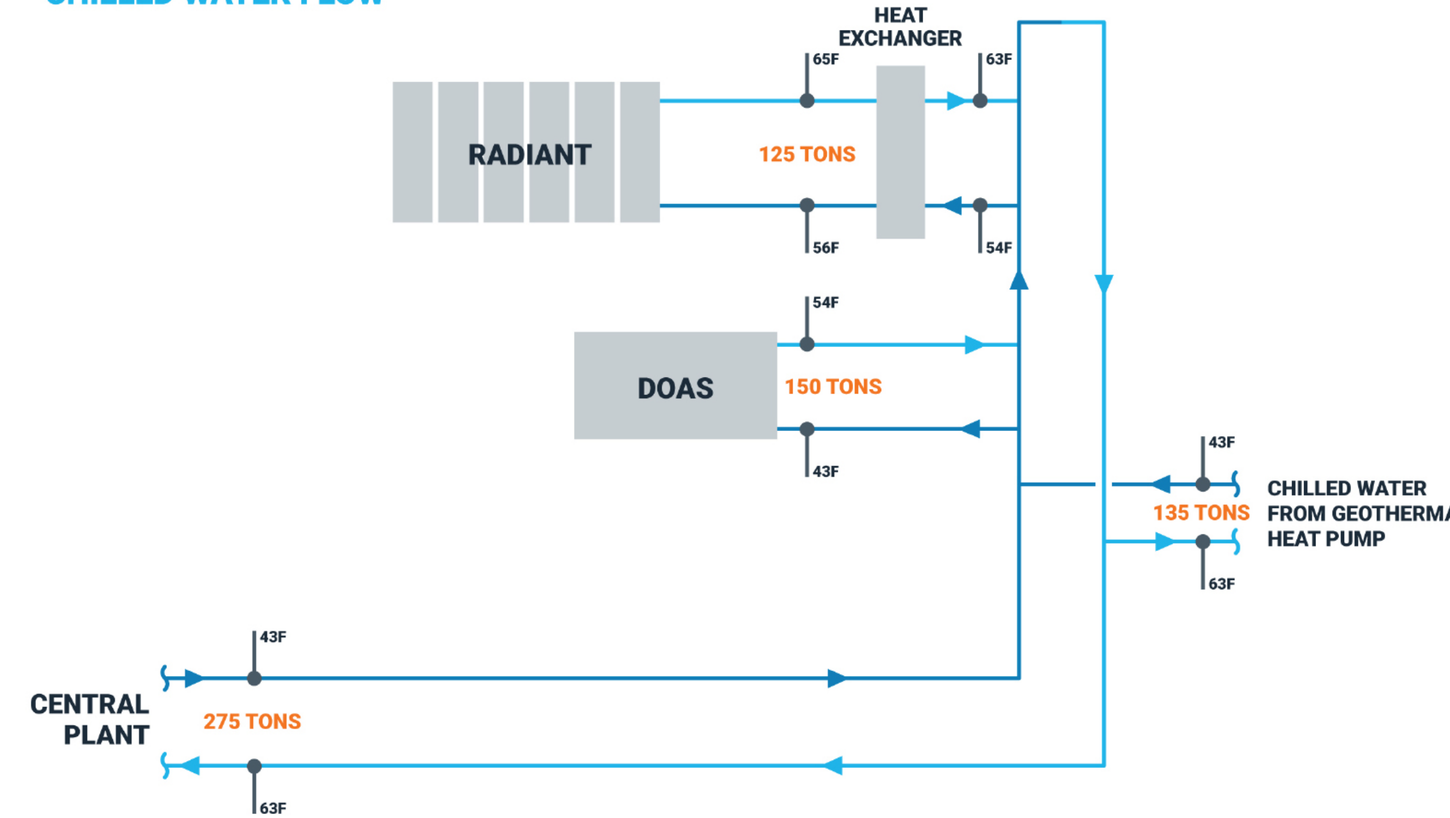
Table 3: CO2 Reduction from ASHRAE 90.1-2010 Baseline			
	Baseline	Proposed	Reduction
kg CO2 equivalent*	2,095,374	677,024	1,418,351
Estimated Building Energy Intensity (kBtu/sf)	99.5	49.0	50.5
*107.62 kg CO2e/ kWh and 66.4 kg CO2e/MBTU for Chilled Water and Steam- EnergyStar 2021			



SCHEMATIC



SCHEMATIC
CHILLED WATER FLOW



SCHEMATIC
HEATING WATER FLOW