

CIBS

ANNUAL REPORT

2024



**CENTER FOR INTEGRATED
BUILDING SYSTEMS**

College of Engineering, Architecture and Technology





MESSAGE FROM THE DIRECTOR

Dear friends,

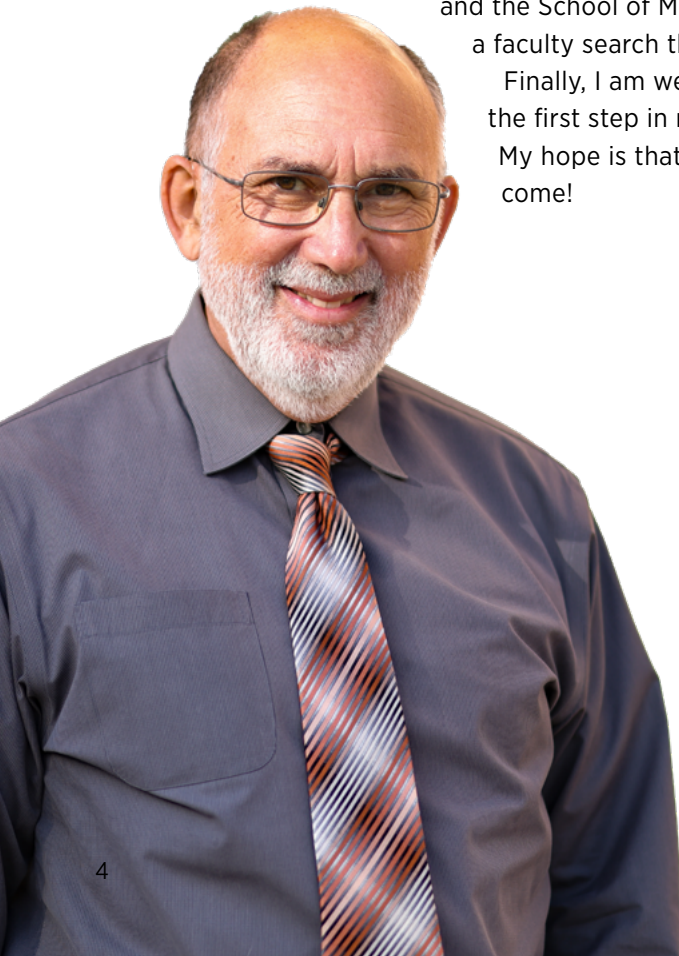
Reflection on the events and accomplishments of the last year bring two thoughts to mind. First, gratitude for your unflinching support as we transition to new leadership and new faculty for CIBS. Second, anticipation, as we bring new leaders, faculty and staff on board to chart a course for the next five years.

In the summer of 2024, CIBS founding director, Dr. Craig Bradshaw, assumed new responsibilities as Executive Director of the Air-Conditioning and Refrigeration Center (ACRC) at the University of Illinois. Since that time, I have served as Interim Director of CIBS with the immediate goal of creating a leadership succession plan for the center, hiring new faculty with industry relevant core expertise and rejuvenating and maintaining the CIBS experimental infrastructure.

I am pleased to announce that Dr. Aaron Alexander has accepted the position of Associate Director of CIBS. Aaron brings a fresh industry-centric perspective to the center. Prior to earning his Ph.D. in fluid mechanics and joining the Mechanical Engineering Technology program within the Division of Engineering Technology at Oklahoma State, Aaron served for 12 years as a noise control and fluid flow engineer—and later as a consultant—in the power generation industry. Although he is relatively new to the HVAC&R industry, his industry experience positions him for success in understanding the needs of the membership and growing the center to meet those needs.

The center will be further strengthened by the successful conclusion of the ongoing search for a new tenure track faculty member with core expertise in heat pump systems. Both the college and the School of Mechanical and Aerospace Engineering have strongly supported a faculty search that is narrowly focused on the needs of the CIBS membership.

Finally, I am well along in the process of hiring a CIBS laboratory manager as the first step in rejuvenating and maintaining the CIBS research infrastructure. My hope is that it will serve you and the HVAC&R industry for many years to come!



GO POKES!

DANIEL FISHER

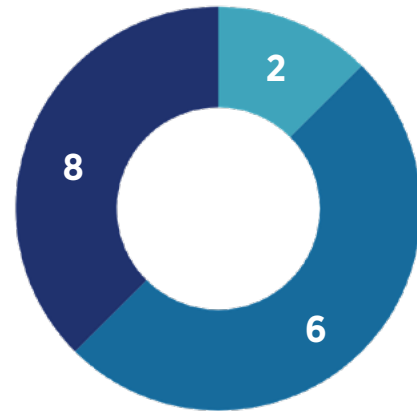
Interim Director, Center for Integrated Building Systems
Professor, Van Weathers Chair & Director of Zink Center

A handwritten signature in black ink that reads "D. E. Fisher".

CIBS PRODUCTIVITY – 2024



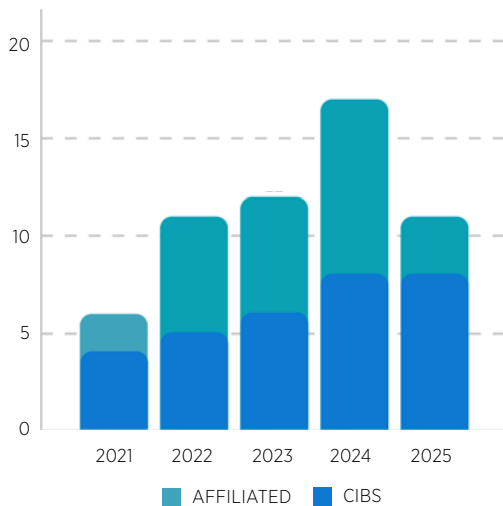
RESEARCH OUTCOMES



■ MODELS ■ DATABASE ■ CODEBASES

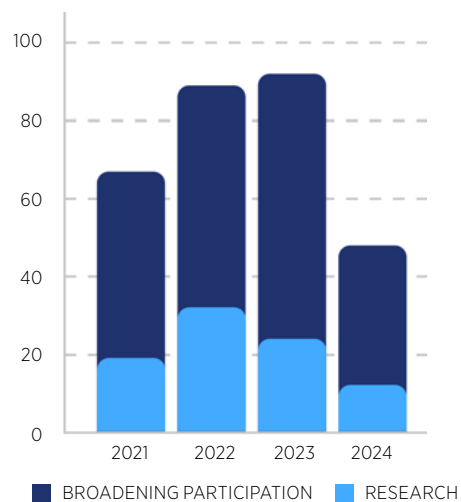
The productivity of CIBS faculty and students has resulted in outcomes and value for the membership including datasets, models and code bases.

CIBS PROJECTS IN PORTFOLIO



The center started its fourth year with **8 CIBS projects and 6 affiliated projects**. The research portfolio for 2025 maintains the number of CIBS projects while reducing the number of affiliated projects.

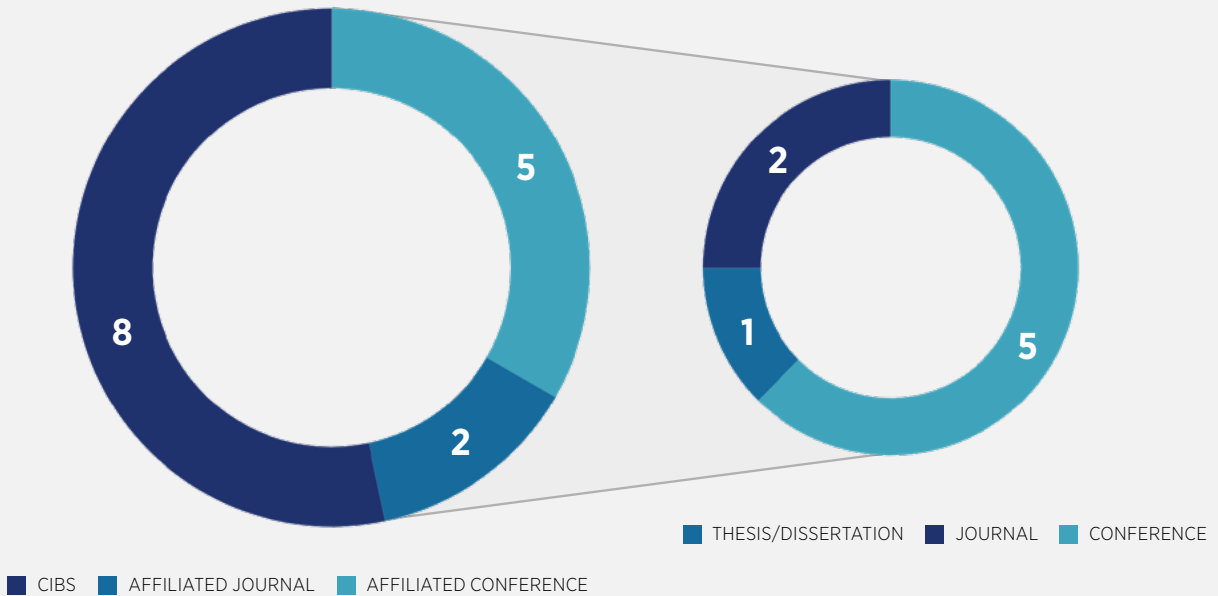
STUDENT ENGAGEMENT AND EXPOSURE



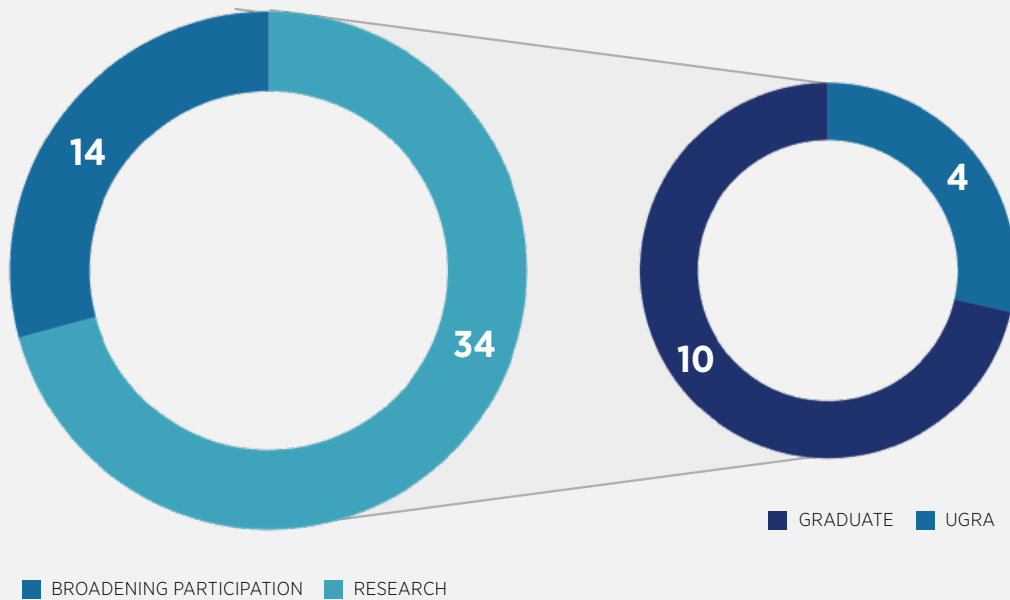
The center impacted **48 students in 2024**. The sharp decline in student participation is primarily due to the sunset of the CIBS OCAST intern program and the transfer of Dr. Bradshaw's students to UIUC.

CIBS PRODUCTIVITY – 2024

CIBS SCHOLARSHIPS, 2024



CIBS STUDENTS, 2024



CIBS projects resulted in a number of journal and conference papers in addition to dissertations- all of which reflect general knowledge generation. The center celebrated **1 Ph.D. and 2 M.S. student graduations** this year. You may access the scholarly work of CIBS faculty and students on our website: <https://ceat.okstate.edu/mae/research/cibs/>

STUDENT SUCCESS & OTHER ACTIVITIES

CIBS AT THE 2024 ASHRAE CONFERENCES



(Ala Alkhatib, Kousha Kirjavadi, Kyle Shepard, Samee Ullah, and Graham Tyra)

ASHRAE 2024 Fall Conference in Indianapolis



ASHRAE 2024 Winter Conference in Chicago

2024 CIBS STUDENT GRADUATIONS



Khaled Alghmadi, Ph.D.
Assistant Professor at Taif University



Kyle Shepard, M.S.
pursuing a Ph.D. at Purdue University



Graham Tyra, M.S.



Tauseef Ismail, M.S.
posthumous

STUDENT SUCCESS & OTHER ACTIVITIES



SEMINARS HOSTED BY CIBS FACULTY

Dr. Sarah Brown, research engineer on the Housing and Building Team at Natural Resources Canada (NRCan), and Ph.D. in mechanical engineering from Carleton University in Ottawa- gave two seminars. “Predictive Control of Hydronic Floor Conditioning, in a Highly Glazed Building- Friend or Foe?” and “Heating your Home with Passive Solar Energy and Thermal Energy Storage.” She is pictured giving her talk to Ph.D. students of CIBS and CEAT and visiting with students in the CIBS research labs.

Dr. Ahmed Elatar, R&D associate staff at Oak Ridge National Laboratory (ORNL), gave a seminar titled “Challenges and Opportunities of Heat Pump Water Heating Technology for Building Decarbonization.” Dr. Elatar’s education includes a Ph.D. in mechanical engineering from The University of Western Ontario, London, ON, Canada, a M.S. in mechanical engineering, and a B.S. in mechanical engineering from Alexandria University, Alexandria, Egypt.



STUDENT SUCCESS & OTHER ACTIVITIES

CIBS LABORATORY TOURS FOR SPECIAL GUESTS



CIBS hosted ASHRAE President Ginger Scoggins, PE, CEM, CxA, LEED-AP, FASHRAE. Ms. Scoggins spoke to nearly 100 engineering students at Oklahoma State University and had a chance to visit the CIBS laboratories.



The OSU Board of Regents visited the CIBS Labs on their 2024 tour of university research infrastructure.

STUDENT SUCCESS & OTHER ACTIVITIES



Drs. Moftakhari, Bach, Alghamdi, Spittler, Alexander, and Fisher

2024 CIBS STUDENTS DEFEND THESIS

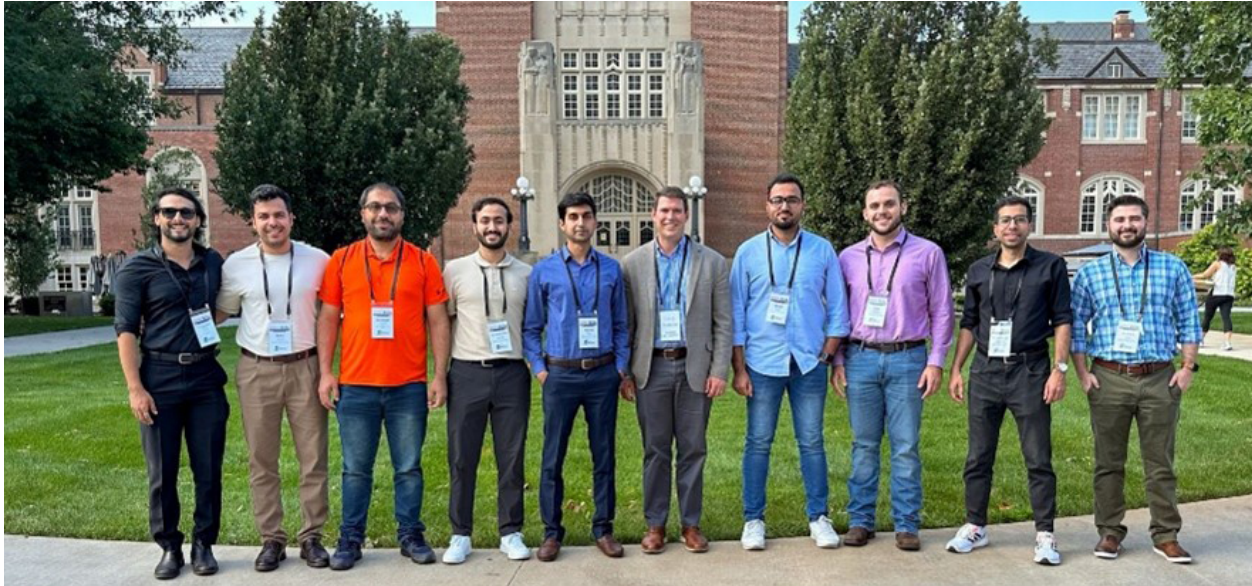
Congratulations, Dr. Khaled Alghamdi! Khaled Alghamdi successfully defended his Ph.D. thesis, titled: “Development of Component and System Models for a Novel Residential Vapor-Compression System Integrating Water-Based Thermal Energy Storage and Incorporating Both Rule-Based and Model-Predictive Control Options.” He gave an excellent presentation to a packed room of colleagues, mentors, and friends. Dr. Alghamdi is now an assistant professor at Taif University.



Kyle Shepard successfully defended his M.S. thesis titled, “The Foamability Properties of Low GWP Refrigerant and Oil Mixtures”. Committee Members: Drs. Craig Bradshaw, Ardeshir Moftakhari, and Daniel Fisher.

STUDENT SUCCESS & OTHER ACTIVITIES

CIBS STUDENTS ABROAD



Members of CIBS at the 2024 Herrick Conferences at Purdue University. The students and faculty on the CIBS team were well represented with 13 papers presented from CIBS. Pictured (left to right): Syed Mohammad Meesam Raza, Matin Ghadiri Yazdi, Shahzad Yousaf, Ata Al-Khatib, Samee Ullah, Dr. Craig Bradshaw, Amjid Khan, Kyle Shepard, Seyed Kousha Mirjavadi, and Graham Tyra.



IRCC – Part 1 in Germany! TU Dresden hosted students and professors from Karlsruhe University of Applied Sciences, OSU and Purdue.

STUDENT SUCCESS & OTHER ACTIVITIES

Spring and Fall Senior Design Expo



Hot Gas Bypass Chiller



Thermal Pod



Off-Grid Heating and Cooling system for a tiny house 2024 Spring & Fall



CIBS students and faculty collaborated with the ASHRAE Student Branch at Oklahoma State University to organize a visit to Greenheck, one of CIBS' newest members.



Shawn Hern and Michael Wilson from Climate Control Group teamed up to give a guest lecture to the Thermal Fluids Design class at Oklahoma State University.

2025 PROJECT SELECTION & PLANNING

The CIBS 3-year plan, 2023-2025 includes three major research thrust areas: 1) Decarbonization & integration, 2) Refrigerant diversity and future and 3) Other energy topics. The first research thrust resulted in two major areas of research for 2025, a) heat pumps/components and b) thermal energy storage. The second research thrust touches nearly every project at some level. Other energy topics were not addressed in the projects selected for 2025.



CENTER FOR INTEGRATED BUILDING SYSTEMS
College of Engineering, Architecture and Technology

- 1. DECARBONIZATION & INTEGRATION**
 - HEAT PUMP EQUIPMENT DEVELOPMENT
 - COMPRESSION
 - HEAT EXCHANGER TECHNOLOGY
 - THERMAL ENERGY STORAGE AND HYDRONICS
- 2. REFRIGERANT DIVERSITY AND FUTURE**
 - TEST DATA ON NEW REFRIGERANTS
 - LEAKAGE AND SAFETY OF FLAMMABLE REFRIGERANTS
- 3. OTHER ENERGY TOPICS**
 - INDUSTRIAL HEAT PUMPS
 - WASTE-HEAT RECOVERY W/ HVAC&R EQUIPMENT

EVENTS FOR 2025

March 26-27th, 2025

Project Update and Center Strategy Meeting | Stillwater, OK

October 8-9th, 2025








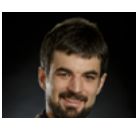
Project Update and Project Selection Meeting | Stillwater, OK

If you aren't a member, please contact contact Dan Fisher (dfisher@okstate.edu) to discuss membership so you don't miss out on our events for 2025.













2025 PROJECT SELECTION & PLANNING

The project list for 2025 includes 8 unique projects representing two of the three major research thrust areas.

2025 PROJECT TITLES AND FACULTY LEADER

Additional benefits of secondary loop systems: Thermal storage and demand response		Bach
Solar-powered ultra-low-GWP A3 heat pumps with DC compressors and TES		Spitler
Reversing valve loss and leakage models for low temperature low-GWP heat pumps		Bach
Physics-based models for performance analysis of refrigerant-to-water heat exchangers in hydronic heat pump applications		Moftakhari
Development of design algorithms for ground heat exchangers with angled boreholes		Spitler
Generating in-system test data and semi-physics tunable models for performance metrics and injection flowrate for low-GWP fluids		Bach
Compact thermal energy storage for heat pump applications		Moftakhari
Heat exchangers and for high-glide low-GWP refrigerants: Effects of refrigerant glide and refrigerant quality maldistribution		Bach

SPONSORS

DOUBLE FULL MEMBER	
 	
FULL MEMBER	
       	
INSTITUTIONAL SUPPORTERS	SMALL BUSINESS /CONTRACTOR MEMBERS
	

CONTACT US:

CIBS.OKSTATE.EDU | CIBS@OKSTATE.EDU



**CENTER FOR INTEGRATED
BUILDING SYSTEMS**

College of Engineering, Architecture and Technology