

Building Energy & Environments (BEE)

Dept. of Civil, Architectural & Environmental Engineering
The University of Texas at Austin



The Program

The BEE consists of faculty, staff and students who focus on a wide range of issues related to building environments. These issues include building energy usage, energy flows, and conservation methods, sources of indoor gases and particles, fate and transport of indoor pollutants, human exposure to indoor air pollution, and control of indoor pollutants. Much of the research focuses on the interactions of pollutants and indoor materials, and increasingly the nexus between building energy use and indoor environmental quality. Students of BEE choose from 11 courses involving building energy, indoor air quality, or both. Faculty and students also engage in public outreach and education.

Research Capabilities & Facilities

Research is conducted in world-class laboratories, a test house, and through field sampling campaigns. Five labs totaling 6,000 ft² are devoted to BEE research at the Center for Energy & Environmental Resources. Labs include an HVAC duct simulator, and seventeen stainless-steel environmental chambers with a spectrum of sizes (3 L to 70 m³) for conducting research ranging from volatile organic compound (VOC) and semi-VOC, e.g., phthalate, emissions from indoor sources, indoor homogeneous and heterogeneous chemistry, sorptive interactions between pollutants and indoor materials, and air and energy flow in rooms. Large chambers are retrofitted with a “family” of thermal manikins for studying the effects of humans on indoor air flow patterns and energy distribution, as well as human exposure to indoor pollutants.

BEE laboratories also contain a wide range of instruments for analysis of gaseous and particulate pollutants. Instrumentation includes gas chromatographs equipped with MS, ECD, and FID detectors and thermal desorption auto-samplers for analysis of volatile organic compounds (VOCs) and semi-VOCs, supporting sampling equipment, a range of selective gas analyzers, scanning mobility particle sizer and electrostatic classifier (0.01- 1 μm), aerodynamic particle sizer (0.5- 20 μm), laser-optical particle sizer (0.1 – 1 μm), KCl large particle generator (0.1 – 10 μm, polydisperse), vibrating orifice aerosol generator (0.1 – 50 μm), nephelometers and condensation nuclei counters, digital optical microscope, and a fluorometer for particle deposition and surface studies.

A test house facility (UTest House) located at the J.J. Pickle Research Campus is extensively used for scale-up experiments and analysis of energy usage and indoor air quality in an integrated residential setting. The 1,300 ft² UTest House includes a control room, a wide range of internal and envelope sensors for measuring pressure distributions, remote data acquisition capabilities, and more.

Significant equipment is devoted to building characterization, including two blower doors and two HVAC duct pressurizers.

Core Faculty and Staff



Ying Xu, Ph.D., Assistant Professor. Emissions of semi-volatile organic compounds from indoor materials, fate, transport and human exposures associated with the releases of emerging indoor contaminants, green materials and sustainable/healthy buildings.
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Atila Novoselac, Ph.D., Assistant Professor. Development of models for building thermal and airflow analyses, building energy analyses, simulation and measurements of airflow, pollutant distribution, and human exposure in buildings. atila@mail.utexas.edu



Jeffrey A. Siegel, Ph.D., Associate Professor. Filtration and air cleaning, indoor particle transport and deposition, secondary impacts of indoor air control strategies, HVAC systems and energy efficiency, healthy and efficient residential buildings.
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Richard L. Corsi, Ph.D., P.E., ECH Bantel Professor for Professional Practice. Sources of indoor air pollution, indoor air chemistry, interactions between pollutants and indoor surfaces, human exposure to indoor pollutants, control of indoor gases.
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Neil Crain, Ph.D., Research Engineer. Fate and transport of VOCs in paint and architectural coatings, effects of environmental conditions on emissions from building materials, building material emissions testing, indoor air sampling, soil vapor intrusion field studies.
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Affiliated Faculty



Kerry Kinney, Ph.D., Professor. Microbial growth on indoor materials, digital imaging of mold growth, HVAC filters as integrated microbial samplers, spatial associations between microbes in dust samples.
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Courses

The faculty of BEE teaches 11 courses that address various aspects of building energy use and indoor air quality. This provides students with a unique opportunity to receive both the depth and breadth of knowledge necessary to design and maintain truly sustainable buildings. Course titles include:

- Design of Energy Efficient and Healthy Buildings
- Energy Simulation in Building Design
- Renewable Energy and Environmental Sustainability
- Building Environmental Systems
- HVAC Design
- Modeling of Air and Pollutant Flows in Buildings
- Source of Indoor Air Pollution
- IAQ: Transport and Control
- IAQ: Physics and Chemistry
- Human Exposure to Indoor Air Pollution
- Energy and IAQ: Field Measurements

Students

Students are the lifeblood of BEE success. At any given time, BEE faculty members advise 20-30 M.S. and Ph.D. students conducting research on indoor environmental quality and building energy topics. BEE faculty also serves on Ph.D. committees for students in other departments who are part of the IGERT program, described below.

Our students have received numerous prestigious external scholarships and awards including ASHRAE graduate student grant-in-aids, A&WMA graduate fellowships, Harrington Dissertation Fellowships, ISIAQ paper and performance awards, and Greenguard scholarships. Recent graduates work in a variety of roles including faculty positions, postdoctoral fellowships at national laboratories, scientists at government agencies, and international consulting firms. Examples of recent employers include Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Drexel University, National Institute of Standards and Technology, and the US EPA's National Exposure Research Lab and Indoor Environment Management Branch.



NSF IGERT Program

Faculty and students of BEE benefit greatly from a National Science Foundation IGERT (Integrative Graduate Education Research Traineeship) in Indoor Environmental Science and Engineering. This interdisciplinary Ph.D. program has to date funded 20 Ph.D. students in architectural, environmental, materials, and mechanical engineering, communication science, community and regional planning, economics, and molecular biology. Students engage in research related to indoor

environmental quality, take courses from the largest related curriculum in the world, complete internships at government research labs, mentor undergraduate students, engage in public outreach activities, present their research findings at national and international conferences, and more. For more information see: www.ce.utexas.edu/IGERT/

Indoor Air 2011

Indoor Air is the preeminent international meeting on indoor air quality. It is expected that this triennial meeting (last held in Beijing in 2005 and Copenhagen in 2008) will bring 1,500 of the world's top researchers and experts from over 50 countries to Austin from June 5th-10th, 2011. BEE faculty member Richard Corsi has been named conference president. Faculty members Jeffrey Siegel, Atila Novoselac, Ying Xu, and Kerry Kinney all play key roles on the conference organizing committee. Students of BEE are also developing a robust student program, including student-driven workshops on indoor air quality in developing countries and more. For more information, see the Indoor Air 2011 website at www.indoorair2011.org.

Outreach & Public Education

Central to BEE activities are students and faculty engaging together in outreach to the public on indoor environment and energy issues. For example, these activities include interactive educational websites on topics ranging from building mass and energy balances (www.ce.utexas.edu/bmeb/), indoor air quality: (www.indoorquality.org/), and energy conservation myths (www.utwired.engr.utexas.edu/conservationMyths/), , as well as public service announcements and videos (www.indoorquality.org/PSAs/), work with local school teachers to develop energy and indoor air quality into science curricula, and numerous public demonstrations and outreach events throughout Texas.



Need more information?

Contact individual BEE participants at email addresses listed above or Doris Eubank at dori@mail.utexas.edu or 512-471-4903.

