

CURRICULUM VITAE

Stephen Bourne, Ph.D.

Postdoctoral Fellow, Center for Energy and Environmental Resources
Department of Civil, Architectural and Environmental Engineering
University of Texas at Austin
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EDUCATION

Ph.D. Civil Engineering **2010 - 2016**

University of Texas, Austin, TX

Program: Building Energy and Environments

*Dissertation: High Density Thermal Energy Stores Utilizing Phase
Change Materials for Shifting of Peak Cooling Loads*

M.S. Civil and Environmental Engineering **2008 - 2009**

University of California, Berkeley, CA

Program: Engineering and Project Management

Engineering and Business for Sustainability

B.S. Civil and Environmental Engineering **2005 - 2007**

University of California, Berkeley, CA

ACADEMIC POSITIONS

Postdoctoral Fellow **2016 -**

Department of Civil, Environmental and Architectural Engineering
University of Texas, Austin TX

Graduate Research Assistant **2011 - 2016**

Department of Civil, Environmental and Architectural Engineering,
and the School of Architecture
University of Texas, Austin TX

Graduate Teaching Assistant **2015**

Department of Civil, Environmental and Architectural Engineering
University of Texas, Austin TX

AWARDS

THRUST 2000 Fellowship **2010 - 2013**

4-year merit-based fellowship for University of Texas engineering graduate students

American Society of Heating, Refrigeration and Air Conditioning Engineers **2011 - 2012**

Merit-based Grant-in-Aid award to support ASHRAE-related research

University of Texas Graduate School Recruitment Fellowship in Engineering **2010 - 2011**

Merit-based recruitment award for qualified graduate school applicants

HILP Scholarship, University of California, Berkeley **2008**

Merit-based award for graduate students in Engineering and Project Management

PROPOSAL DEVELOPMENT/RESEARCH EXPERIENCE

Baseline Indoor Air Quality Field Study in Occupied New Homes

2017

Funding Agency: DOE

Prepare proposal (PI: Dr. Richard Corsi) to develop baseline indoor air quality (IAQ) data and related metadata for new (post-2012) occupied homes built to current energy codes. The study will be completed in a hot and humid climate, a category that includes parts of 10 U.S. states plus Puerto Rico. The results of this study will assist future technology and standards development to insure that the IAQ in homes in the fastest growing region of the U.S. is maintained or even improved as more stringent residential energy efficiency standards are developed. This multi-year proposal is valued at \$860K. (Under review)

Multi-Pollutant Model Predictive Ventilation Control

2017

Funding Agency: DOE

Prepare proposal (PI: Dr. Atila Novoselac) to develop and implement a novel approach for the control of residential ventilation systems using Model Predictive Control (MPC) methods. Proactive monitoring of indoor and outdoor environments using the latest low-cost sensor technologies are to be combined with predictive modeling and multi-variable constrained optimization methods running on local, low-cost computing hardware such that ventilation-related energy consumption is minimized while simultaneously reducing occupants' exposure to contaminants below acceptable levels. The objective is to seek the optimum between building energy efficiency and indoor air quality. This multi-year proposal is valued at \$760K. (Under review)

The Impact of Hidden Spaces on the Microbiome of Portable Classrooms

2016 – 2017

Funding Agency: Sloan Foundation

Prepare proposal (PI: Dr. Kerry Kinney) to the Sloan Foundation for the investigation of the impact that hidden spaces – attics, wall cavities, and crawl spaces – can have on the indoor environment of portable classrooms. A portable classroom is fully characterized with respect to HVAC system operation and building envelope performance. A single tracer gas test method is developed that combines regression with field measurements to characterize the communication between the occupied and hidden spaces, which is then validated against the microbiome-based experimental data. Experiments are performed using biogenic markers of the existing microbiome as well as artificially DNA-encoded particles to determine communication effects between the occupied and hidden spaces. This 1.5 year research proposal is valued at over \$250K. (Awarded 10/2016)

Extend Load Calculation Methods for Radiant Cooling Model

2016 – 2017

Funding Agency: American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE)

Prepare proposal (PI: Dr. Atila Novoselac) in response to ASHRAE 1729-TRP for the purpose of updating the Heat Balance Method (HBM) and the Radiant Time Series Method (RTSM) to include the capability to properly calculate cooling loads for systems incorporating radiant cooling elements. Radiant cooling elements are to be combined with forced air cooling or a dedicated outdoor air system to determine the radiant cooling parameters necessary to maintain the desired indoor operative temperature range. The research makes extensive use of the Thermal Façade Labs at the University of Texas at Austin School of Architecture. This two-year proposal combines numeric modeling with experimental verification, and is valued at over \$180K. (Awarded 7/2016)

Dust Fouling of Horizontal and Rafter-Installed Radiant Barriers

Funding Agency: American Society of Heating, Refrigeration and Air Conditioning Engineers

This study investigated the effects of dust fouling on radiant barriers used in residential attics. The study was performed using a numerical analysis that gauged the impact of radiant barrier emissivity changes on overall attic temperatures, which alters the net energy exchange through the floor of the attic into the occupied space. The results showed that even small changes in emissivity resulted in large reductions in radiant barrier effectiveness. Results presented at the COBEE conference in Denver, CO in 2012. Proposal valued at \$10K. (Awarded 2011).

RESEARCH EXPERIENCE

Improving Indoor Air Quality in Portable Classrooms

2015 - 2016

Funding Agency: Sloan Foundation

(PI: Dr. Kerry Kinney) This research focuses on the use of portable classrooms in schools. These structures are based on standard building units designed for uses that may not anticipate the number of occupants found in classroom-specific applications. An investigation is conducted with respect to the performance of the building envelope and HVAC system in portable classrooms, and how they can be easily altered to improve indoor air quality. This 1 year research proposal is valued at ~ \$200K. (Awarded 2015)

PCM-based, High-Density Thermal Stores for Retrofit Applications

2012 - 2016

Funding Agency: University of Texas

This research investigates the development of a simple, high-density thermal storage system suitable for residential or small commercial retrofit applications utilizing tube-encapsulation paraffin-based PCM (phase change material). A scale experimental model is designed and tested, and a finite volume numerical model is developed for design and real-time control applications. Design guidelines are established to optimize encapsulation tube parameters for specific applications, with parametric modeling used to optimize other design parameters. This design is the subject of UT patent application number PCT/US17/35681. (Ph.D. dissertation)

UT Thermal Façade Lab Construction and Development

2013 - 2015

Funding Agency: NSF (facility developed as a part of IGERT Smart Grid Demonstration Project)

Provide engineering and design support for the construction of the Thermal Façade Labs, a research lab developed as a collaborative effort between the Cockrell School of Engineering and the School of Architecture. Design and install a hydronic-based HVAC system, including facilities to support both air and radiant cooling systems as well as PCM-based (phase change material) thermal storage systems. Design, program, and deploy specialized control systems for these systems to support engineering research at the Thermal Façade Lab. Provide ongoing engineering support for the use and advancement of the labs. This multi-year project is valued at \$200K. (Completed)

Domestic Hot Water

2011 - 2012

Funding Agency: Pecan Street Inc.

The goal of this research is to investigate the primary energy use of different options for domestic hot water systems. The systems include conventional gas fired, condensing gas-fired, tankless gas fired, resistive electric, and electric condenser (heat pump) systems. Performance is weighed relative to primary energy use to allow for a fair comparison between gas fired and electric options. Local solar electric generation capabilities are also considered when evaluating electric powered options. (Research consulting)

PUBLICATIONS, PROCEEDINGS & PRESENTATIONS

Publications:

Bourne, Stephen, and Atila Novoselac. 2016. "Improved Performance in Tube-Encapsulated Phase Change Thermal Energy Stores for HVAC Applications." *Building and Environment* 98 (March): 133–44. doi:10.1016/j.buildenv.2015.12.023.

Bourne, S., Novoselac, A. 2015. "Compact PCM-Based Thermal Stores for Shifting Peak Cooling Loads." *Building Simulation*, July. doi:10.1007/s12273-015-0243-6.

Publications under review:

Bourne, Stephen and Atila Novoselac. "Design guidelines for high-density thermal storage systems utilizing hexagonal packed tube encapsulated PCM." (*Submitted to Energy and Buildings 4/2017*).

Conference Proceedings:

Bourne, S., Novoselac, A. Improving ventilation in portable classrooms: simple, low cost solutions. *Indoor Air 2016: The 14th international conference of Indoor Air Quality and Climate*. July 3-8, 2016. Ghent, Belgium.

Bourne, S., Novoselac, A. PCM-based High-Density Thermal Storage Systems for Residential and Small Commercial Retrofit Applications. *The Third International Conference on Building Energy and Environment (COBEE 2015)*. July 12-15, 2015, Tianjin, China.

Bourne, S., Novoselac, A. Compact Phase Change Based Thermal Stores: Experimental Apparatus, Methodology, and Results. *ASHRAE Winter Conference New York*, ASHRAE Papers CD: 2014 ASHRAE Winter Conference, New York, NY

Bourne, S., Novoselac, A. The Effects of Emissivity and Insulation Levels on Radiant Barrier Performance. *The Second International Conference on Building Energy and Environment (COBEE 2012)*. August 1-4, 2012, Boulder, CO.

Invited Presentations:

Kerry Kinney, and Stephen Bourne. 2016. "Ventilation in Portable Classrooms: Impacts on Indoor Air Quality and Microbiome." presented at the 5th Annual MoBE Conference, Boulder, CO, June 3.

Bourne, S. Panelist, AIA Austin – Building Enclosure Council (BEC), "Phase Change Materials (PCM) for High Performance Enclosures". AIA Austin Center for Architecture. Dec 3, 2014. Austin, TX.

Bourne, S., Thermal Storage and the Building Side of Smart Grid. *University of Texas at Austin Energy Symposium*, Sept. 6, 2012. Austin, TX.

Bourne, S., Novoselac, A. Radiant Barriers in Residential Applications. *University of Texas at Austin Energy Forum*, Feb 4, 2011, Austin, TX.

TEACHING EXPERIENCE

University of Texas at Austin, Austin TX

Energy Simulation in Building Design (Teaching Assistant)

2015

Building Energy Systems (Lecturer)

2014

Lucent Technologies, Alameda CA

Senior courseware developer and Technical Trainer

1998 – 2002

MENTORSHIP EXPERIENCES

University of Texas at Austin, Austin TX

Senior Design Project, Department of Mechanical Engineering (ME 266K)

2016

***Project Description:** Performance testing of a sun shading elements and their impact on thermal and lighting loads.*

***Students:** Kaitlin Handel, Lindsey Lewallen, Lou Sunderman, Madeline Roemer*

TEACHING AREAS – COURSES PREPARED TO TEACH

Applied Thermodynamics
Fundamentals of Fluid Mechanics
Computer Methods
Building Environmental Systems
HVAC Design
Energy and Indoor Air Quality/Field Measurements

PROFESSIONAL EXPERIENCE

Lucent Technologies, Alameda CA

1998 - 2002

Senior Courseware Developer and Technical Trainer

PROFESSIONAL SERVICE AND SELECTED OTHER ACTIVITIES

DeafTEC Summer STEM Camp panelist, Texas School for the Deaf	2016
Development of K-12 modules on energy-related topics	2014 - 2015
Science Fair judge – Texas School for the Deaf	2013 - 2016
Science Club – Texas School for the Deaf	2013 - 2016
Science Sundays/NanoDays – Austin Children’s Museum	2012 - 2013

COMPUTER SKILLS

Software Packages: eQuest, WUFI, RISA 2D, Energy Plus

Programming: MATLAB

Networking: Extensive knowledge of networking and network protocols

Computers: Experience with both PC (Windows) and Mac operating systems

PATENTS

Novoselac, Atila, and Stephen Bourne. Pending. HIGH-DENSITY LATENT HEAT STORAGE DEVICE. Application number PCT/US17/35681. Filed June 2, 2017.

CERTIFICATIONS

Engineer-in-Training, certificate #EIT 132187