## 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, Architectural and Environmental Engineering
University of Texas, Austin TX

**Graduate Research Assistant** **2011 - 2016**
Department of Civil, Architectural and Environmental Engineering/SOA
University of Texas, Austin TX

**Graduate Teaching Assistant** **2015**
Department of Civil, Architectural and Environmental 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)

**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** **2011 – 2012**
***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

**Impact of Hidden Spaces on the Microbiome in Portable Classrooms** **2016 - 2018**

***Funding Agency:*** *Sloan Foundation*

(PI: Dr. Kerry Kinney) The goal of this study is to systematically assess the transport of particles and microorganisms from hidden, unmaintained spaces such as ceiling plenums and crawl spaces into the occupied space of buildings. To this end, we are applying a newly developed method to track the movement of particles from hidden spaces in buildings (and from outside buildings) into the interior space. This novel approach utilizes unique, DNA-labeled particles that allow us to readily seed one space in a building and then trace where the particles move as a function of ventilation conditions and other factors (resuspension by occupants, vibrations due to doors opening, shutdown and restart conditions, etc.). This 1.5 year research proposal is valued at ~ $250K. (Awarded 2016)

**Effect of Ventilation on the Microbiome & Air Quality Inside Portable Classrooms** **2014 - 2017**

***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 3 year research proposal is valued at ~ $200K. (Awarded 2014)

**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.

**Bourne, Stephen** and Atila Novoselac**.** "Design guidelines for high-density thermal storage systems utilizing hexagonal packed tube encapsulated PCM." (*Submitted to Science and Technology for the Built Environment 6/2018).*

**Bourne, Stephen** and K. Kinney, A. Novoselac, J.P. Maestro**.** "Ventilation and indoor air quality within a within a sample of portable and conventional classrooms in Texas." (*In preparation for submission to Indoor Air, 7/2018).*

**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**

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|---|---|
| ***Energy Simulation in Building Design*** *(Teaching Assistant)* | **2015, 2016** |
| ***Building Energy Systems*** *(Guest Lecturer)* | **2014** |

**Lucent Technologies, Alameda CA**

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| *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*

***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

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|---|---|
| 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
**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 (California) & 61639 (Texas)

## REFERENCES

**Atila Novoselac, Ph.D.**
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