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# KATHRYN HINKELMAN

July 2023

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## Contact Information

Department of Architectural Engineering  
Sustainable Buildings and Societies Laboratory  
Pennsylvania State University  
University Park, PA 16802

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[khinkelman.github.io](https://github.com/khinkelman)  
[Google Scholar Profile](#)  
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Former Surname: Van Lieshout

## Education

**Pennsylvania State University** Jun 2023

Ph.D. in Architectural Engineering

Concentration in Mechanical | GPA: 4.0

Thesis: *Modelica modeling & ecosystem biomimicry of district energy systems*

**University of California at Berkeley** May 2015

M.S. in Mechanical Engineering

Concentration in Design | GPA: 4.0

Thesis: *Environmental impact and indoor environmental quality assessment of Pinoleville Pomo Nation demonstration home: An implementation of life cycle assessment and culturally-inspired design*

**University of Denver** Jun 2013

B.S. in Mechanical Engineering

Summa Cum Laude, Phi Beta Kappa, Departmental Distinction | GPA: 3.97

Thesis: *Intensity rankings of plyometric exercises using joint power absorption*

## Appointments

**Pennsylvania State University**

Postdoctoral Scholar, Sustainable Buildings and Societies Laboratory

IBUILD Research Fellow, U.S. Department of Energy Building Technologies

Office, Sustainable Buildings and Societies Laboratory

Advisor: Dr. Wangda Zuo

Jul 2023 – Present

Jan 2022 – Jun 2023

**University of Colorado Boulder**

IBUILD Research Fellow, U.S. Department of Energy Building Technologies

Office, Sustainable Buildings and Societies Laboratory

Research Assistant, Sustainable Buildings and Societies Laboratory

Teaching Assistant, Dept. of Civil, Environmental & Architectural Engineering

Advisor: Dr. Wangda Zuo

Aug 2021 – Dec 2021

May 2019 – Aug 2021

Aug 2018 – May 2019

**Boulder Engineering Company**

Mechanical & Electrical Engineer

Mechanical Engineer

Jul 2016 – Jul 2018

Jul 2015 – Jul 2016

**University of California at Berkeley**

Research Assistant, Berkeley Energy & Sustainable Technologies Laboratory

Teaching Assistant, Dept. of Mechanical Engineering

Advisor: Dr. Alice Agogino

Jan 2014 – May 2015

Aug 2013 – Jan 2014

## Research Interests

Sustainable energy systems (cities, districts, buildings), thermal-fluid science, model-based systems engineering, equation-based modeling (Modelica), ecosystem biomimicry, life cycle assessment, building controls, design thinking, systems thinking

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## Research Funding

### National Science Foundation (NSF), Computer and Network Systems

EAGER: Collaborative Research: Modernizing Cities via Smart Garden Alleys with Application in Makassar City, **\$175,000**, Award No. CNS-2025459, 07/20-06/22, PI Wangda Zuo

- Contributed to full proposal writing and concept development at the equivalent level of a co-PI

### U.S. Department of Energy (DOE), Advanced Manufacturing Office

Optimal Co-Design of Integrated Thermal-Electrical Networks and Control Systems for Grid-interactive Efficient District (GED) Energy Systems, **\$4,159,922**, Award No. DE-EE0009139, 06/20- 12/23, PI Wangda Zuo

- Contributed to full proposal writing and concept development at the equivalent level of a co-PI
- Coordination proposal requirements across academic (CU Boulder, RPI, UT Austin), national lab (LBNL, NREL), and industry (Amzur Technologies) team members

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## Journal Publications

- J-1. (Under Review) **Hinkelman, Kathryn**, Saranya Anbarasu, Wangda Zuo. "Exergy-Based Ecological Network Analysis for Integrated Building Energy Systems." *Building Simulation*.
- J-2. **Hinkelman, Kathryn**, Yizhi Yang, Wangda Zuo. "Engineering Applications and Design Methodologies for Ecosystem Biomimicry: An Interdisciplinary Review Spanning Cyber, Physical, and Cyber-Physical Systems." *Bioinspiration & Biomimetics*, 18:2 021001. [10.1088/1748-3190/acb520](https://doi.org/10.1088/1748-3190/acb520).
- J-3. Ildiri, Nasim, Heather Bazille, Yingli Lou, **Kathryn Hinkelman**, Whitney Gray, Wangda Zuo. 2022. "Impact of WELL Certification on Occupant Satisfaction and Perceived Health, Well-being, and Productivity: A Multi-Office Pre- Versus Post-Occupancy Evaluation." *Building and Environment*, 224: 109539. [10.1016/j.buildenv.2022.109539](https://doi.org/10.1016/j.buildenv.2022.109539).
- J-4. **Hinkelman, Kathryn**, Saranya Anbarasu, Michael Wetter, Antoine Gautier, Wangda Zuo. 2022. "A Fast and Accurate Modeling Approach for Water and Steam Thermodynamics with Practical Applications in District Heating System Simulation." *Energy*, 254:A 124227. [10.1016/j.energy.2022.124227](https://doi.org/10.1016/j.energy.2022.124227).
- J-5. **Hinkelman, Kathryn**, Jing Wang, Wangda Zuo, Antoine Gautier, Michael Wetter, Chengliang Fan, Nicholas Long. 2022. "Modelica-Based Modeling and Simulation of District Cooling Systems: A Case Study." *Applied Energy*, 311: 118654. [10.1016/j.apenergy.2022.118654](https://doi.org/10.1016/j.apenergy.2022.118654).
- J-6. Huang, Sen, Jing Wang, Yangyang Fu, Wangda Zuo, **Kathryn Hinkelman**, Raymond M. Kaiser, Dong He, Draguna Vrabie. 2021. "An open-source virtual testbed for a real Net-Zero Energy Community." *Sustainable Buildings and Society*, 75: 103255. [10.1016/j.scs.2021.103255](https://doi.org/10.1016/j.scs.2021.103255).
- J-7. Fan, Chengliang, **Kathryn Hinkelman**, Yangyang Fu, Wangda Zuo, Sen Huang, Chengnan Shi, Cary Faulkner, Xiaoqing Zhou. 2021. "Open-Source Modelica Models for the Control Performance Simulation of Chiller Plants with Water-side Economizer." *Applied Energy*, 299: 117337. [10.1016/j.apenergy.2021.117337](https://doi.org/10.1016/j.apenergy.2021.117337).
- J-8. Ye, Yunyang, **Kathryn Hinkelman**, Yingli Lou, Wangda Zuo, Gang Wang, Jian Zhang. 2021. "Evaluating the Energy Impact Potential of Energy Efficiency Measures for Retrofit Applications: A Case Study with U.S. Medium Office Buildings." *Building Simulation*, 14: 1377-1393. [10.1007/s12273-021-0765-z](https://doi.org/10.1007/s12273-021-0765-z).
- J-9. Ye, Yunyang, **Kathryn Hinkelman**, Jian Zhang, Wangda Zuo, and Gang Wang. 2019. "A Methodology to Create Prototypical Building Energy Models for Existing Buildings: A Case Study on U.S. Religious Worship Buildings." *Energy and Buildings*, 194: 351–365. [10.1016/j.enbuild.2019.04.037](https://doi.org/10.1016/j.enbuild.2019.04.037).
- J-10. Lu, Xing, **Kathryn Hinkelman**, Yangyang Fu, Jing Wang, Wangda Zuo, Qianqian Zhang, and Walid Saad. 2019. "An Open Source Modeling Framework for Interdependent Energy-Transportation-Communication Infrastructure in Smart and Connected Communities." *IEEE Access*, 7: 55458–76. [10.1109/ACCESS.2019.2913630](https://doi.org/10.1109/ACCESS.2019.2913630).
- J-11. **Van Lieshout, Kathryn G**, Joy G Anderson, Kevin B Shelburne, and Bradley S Davidson. 2014.

**Full-Paper  
Peer-  
Reviewed  
Conference  
Publications**

- C-1. (Under Review) **Hinkelman, Kathryn**, David Milner, Wangda Zuo. 2023. “Open-Source Models for Sand-Based Thermal Energy Storage in Heating Applications.” *The 15th International Modelica Conference*, Aachen, Germany.
- C-2. (Accepted) Milner, David, **Kathryn Hinkelman**, Wangda Zuo, Zhiwen Ma. 2023. “Sand-based thermal storage for building heating applications: a district energy case study.” *The 7<sup>th</sup> International Conference ASTECHNOVA 2023*, Yogyakarta, Indonesia.
- C-3. **Hinkelman, Kathryn**, Saranya Anbarasu, Wangda Zuo. 2023. “Ecological Network Analysis of Integrated Energy Systems with Modelica: A Novel Biomimetic Approach for Building Design and Operation.” *Building Simulation Conference*, Shanghai, China.
- C-4. **Hinkelman, Kathryn**, Wangda Zuo, Jing Wang, Sen Huang, Michael Wetter. 2022. “Ecosystem-Level Biomimicry for the Built Environment: Adopting Systems Ecology Principles for the Control of Heterogeneous Energy Systems.” *The 5th International Conference on Building Energy and Environment*. Montreal, Canada.
- C-5. Anbarasu, Saranya, **Kathryn Hinkelman**, Wangda Zuo. 2022. “Tracing the Dependency of Water and Energy in Smart and Connected Communities through a Multi-Domain Modeling Framework.” *The 5th International Conference on Building Energy and Environment*. Montreal, Canada.
- C-6. **Hinkelman, Kathryn**, Saranya Anbarasu, Michael Wetter, Antoine Gautier, Baptiste Ravache, Wangda Zuo. 2022. “Towards Open-Source Modelica Models for Steam-Based District Heating Systems.” *The 1st International workshop on Open Source Modelling and Simulation of Energy Systems*, 1-6. Aachen, Germany. [10.1109/OSMSES54027.2022.9769121](https://doi.org/10.1109/OSMSES54027.2022.9769121).
- C-7. **Hinkelman, Kathryn**, Jing Wang, Chengliang Fan, Wangda Zuo, Antoine Gautier, Michael Wetter, Nicholas Long. 2021. “A Case Study on Condenser Water Supply Temperature Optimization with a District Cooling Plant.” *The 14<sup>th</sup> International Modelica Conference*, 587-595. Linköping, Sweden. [10.3384/ecp21181587](https://doi.org/10.3384/ecp21181587).
- C-8. **Hinkelman, Kathryn**, Sen Huang, Jing Wang, Wangda Zuo. 2019. “Enhancing the Implementation of a First-order Equivalent Thermal Parameter Model to Enable Accurate and Robust Building Thermal Response Prediction.” *Building Simulation Conference*, 1859-1865. Rome, Italy. [10.26868/25222708.2019.210582](https://doi.org/10.26868/25222708.2019.210582).
- C-9. Ye, Yunyang, **Kathryn Hinkelman**, Jian Zhang, Yulong Xie, Wangda Zuo. 2019. “A Methodology to Determine Energy Savings Impact of Building Energy Code Upgrades: A Case Study on Small Offices.” *Building Simulation Conference*, 3894-3901. Rome, Italy. [10.26868/25222708.2019.210692](https://doi.org/10.26868/25222708.2019.210692).
- C-10. **Van Lieshout, Kathryn G**, Cindy Bayley, Sarah O Akinlabi, Lisa von Rabenau, and David Dornfeld. 2015. “Leveraging Life Cycle Assessment to Evaluate Environmental Impacts of Green Cleaning Products.” In *Procedia CIRP*, 29:372–377. Sydney, Australia. [10.1016/j.procir.2015.02.063](https://doi.org/10.1016/j.procir.2015.02.063).

**Peer-  
Reviewed  
Extended  
Abstracts**

- A-1. Ye, Yunyang, **Kathryn Hinkelman**, Wangda Zuo, Gang Wang. 2019. “ASHRAE TRP-1771: Methodology to Evaluate Sensitive Levels of Inputs for U.S. Commercial Building Models.” *ASHRAE Summer Conference*, Kansas City, MO.
- A-2. **Van Lieshout, Kathryn G**, Owen RW Dennis, Joy G Anderson, Kevin B Shelburne, Bradley S Davidson. 2013. “Intensity Rankings of Plyometric Exercises using Joint Power Absorption.” *Medicine and Science in Sports and Exercise*.

## Peer-Reviewed Poster Sessions

### † BEST POSTER AWARD

- P-1. **Hinkelman, Kathryn.** “BICEPS – Biomimetic Integrated Community Energy and Power Systems.” *U.S. Department of Energy Building Technologies Office (BTO) Peer Review*, Arlington, VA, April 24-28, 2023.
- † P-2. **Hinkelman, Kathryn,** Wangda Zuo. “Ecological Network Analysis for Architectural Engineering: How might building energy systems learn from nature?” *AEI Conference*, Denver, CO, April 12-14, 2023.
- P-3. **Hinkelman, Kathryn,** Xing Lu, Wangda Zuo, Yangyang Fu, Jing Wang, Yingchen Zhang. “Multi-domain Modeling Framework for Future Smart and Connected Communities.” *21<sup>st</sup> Century Energy Transition Symposium*, Denver, CO, April 1-2, 2019.
- P-4. **Van Lieshout, Kathryn G,** Owen RW Dennis, Joy G Anderson, Kevin B Shelburne, Bradley S Davidson. “Intensity rankings of plyometric exercises using joint power absorption.” *American College of Sports Medicine Annual Meeting*, Indianapolis, IN, May 28-June 1, 2013.

## Non-Peer Reviewed Technical Reports

- R-1. **Van Lieshout, Kathryn G.** 2015. “Environmental impact and indoor environmental quality assessment of Pinoleville Pomo Nation demonstration home: An implementation of life cycle assessment and culturally-inspired design.” Master’s Thesis. *University of California, Berkeley*. [10.13140/RG.2.2.14890.90564](https://doi.org/10.13140/RG.2.2.14890.90564).
- R-2. Final Report (co-authored with Alice Agogino (PI) and student team). 2015. “Advanced UX Development Based on Innovative Technology: Integrating UX Design with the Internet of Things.” Samsung Electronics Co., Ltd. DMC R&D Center.
- R-3. Agogino, Alice (PI). **Kathryn Van Lieshout,** Chandrayee Basu, Kyunam Kim, Julien Caubel, Elizabeth Cheng, Aparna Dhinakaran. 2014. “Model Predictive Smart Lighting Commissioning System for Emerging Demand Management.” Energy Innovations Small Grant Program: Final Report. California Energy Commission.

## Presentation Sessions & Invited Talks

- T-1. “Equation-Based Modeling and Ecosystem Biomimicry of Integrated Building Energy Systems.” *Research Seminar*, Department of Civil, Architectural and Environmental Engineering, Drexel University, May 26, 2023.
- T-2. “BICEPS – Biomimetic Integrated Community Energy and Power Systems.” *U.S. Department of Energy Building Technologies Office (BTO) Peer Review*, Arlington, VA, April 24-28, 2023.
- T-3. “Advancements in Multidomain Modeling and System-Level Biomimicry for the Comprehensive Design of District Energy Systems.” *Research Seminar*, Department of Systems Engineering, Colorado State University, February 2, 2023.
- T-4. “District Heating and Cooling.” *Invited Lecture*, AE 597, Department of Architectural Engineering, Pennsylvania State University, Virtual, November 8, 2022.
- T-5. “A Fast and Accurate Modeling Approach for Water and Steam Thermodynamics with Practical Applications in District Heating System Simulation.” *The 2022 Building Performance Analysis Conference and SimBuild*, Seminar 5: Open Source Modeling for District Energy Systems, Chicago, IL, September 14, 2022.
- T-6. “Ecosystem-Level Biomimicry for the Built Environment: Adopting Systems Ecology Principles for the Control of Heterogeneous Energy Systems.” *The 5th International Conference on Building Energy and Environment*, Montreal, Canada, July 28, 2022.
- T-7. “Virtual Testbed for Optimized Planning of Smart, Sustainable, and Connected Communities.” *The 2022 IEEE Power & Energy Society General Meeting*, Denver, CO, July 19, 2022.
- T-8. “From Furnaces to Forests: Innovations in Modeling and Simulation for the Transition of Legacy District Energy Systems to Integrated Biomimetic Designs.” *Research Seminar*, Department of

Mechanical Engineering & Mechanics, Drexel University, Virtual, December 20, 2021.

- T-9. "A Case Study on Condenser Water Supply Temperature Optimization with a District Cooling Plant." *The 14<sup>th</sup> International Modelica Conference*, Virtual, September 23, 2021.
- T-10. "Modeling and Simulation of District Cooling Systems with Modelica." *IBPSA-USA Denver Chapter: Student Presentations*, Virtual, May 20, 2021.
- T-11. "A Modeling Framework to Evaluate Energy, Transportation, and Communication Interdependence in Smart and Connected Communities." *The American Modelica Conference*, Virtual, September 22-24, 2020.
- T-12. "A Modeling Framework to Evaluate Energy, Transportation, and Communication Interdependence in Smart and Connected Communities." *IBPSA-USA Denver Chapter: Student Presentations*, Golden, CO, November 21, 2019.
- T-13. "Enhancing the Implementation of a First-order Equivalent Thermal Parameter Model to Enable Accurate and Robust Building Thermal Response Prediction." *Building Simulation Conference*. Rome, Italy, September 2-4, 2019.
- T-14. "A Modeling Framework to Evaluate Energy, Transportation, and Communication Interdependence in Smart and Connected Communities." *Intelligent Building Operations Workshop*, Boulder, CO, August 7-9, 2019.
- T-15. "Leveraging life cycle assessment to evaluate environmental impacts of green cleaning products." *22nd CIRP Conference on Life Cycle Engineering*, Sydney, Australia, April 7-9, 2015.

## Teaching Experience

<b>Grader</b> , University of Colorado Boulder AREN 4890: <a href="#">Sustainable Building Design</a>	Fall '19, '20, '21
<b>Teaching Assistant</b> , University of Colorado Boulder AREN 4317: <a href="#">Architectural Engineering Design</a> AREN 3540: <a href="#">Illumination I</a>	Spring 2019 Fall 2018
<b>Graduate Student Instructor</b> , University of California, Berkeley ME 110: <a href="#">Intro to New Product Development</a> ME 107: <a href="#">Mechanical Engineering Laboratory</a>	Spring 2014 Fall 2013
<b>Academic Tutor</b> , Athletics and Recreation, University of Denver <ul style="list-style-type: none"> <li>- Tutored students in <a href="#">Differential Equations</a>, <a href="#">Calculus</a>, and <a href="#">Engineering Concepts</a></li> <li>- Taught class material that was missed due to athletic travel</li> </ul>	Jan 2011 – Jun 2012

## Select Research Projects

<b>Biomimetic Integrated Community Energy and Power System (BICEPS)</b> Sponsored by DOE IBUILD Graduate Research Fellowship <ul style="list-style-type: none"> <li>- Leveraged biomimicry of mature natural ecosystems to design and control interconnected energy systems</li> </ul>	Aug 2021 – Jul 2023
<b>Modernizing Cities via Smart Garden Alleys with Application in Makassar City</b> Collaboration with Virginia Tech, Universitas Gadjah Mada (Indonesia), and Institut Teknologi Bandung (Indonesia) <ul style="list-style-type: none"> <li>- Catalyzed the transformation of Makassar City's garden alleys into smart environments through sensor networks and machine learning to collect data related to air quality, microclimates, and other human factors</li> </ul>	Jul 2020 – Jul 2023
<b>Support for District Energy Simulation with Modelica</b> Collaboration with the NREL and LBNL <ul style="list-style-type: none"> <li>- Created a new software analysis platform with the Modelica language to enable developers of community-scale construction projects to effectively evaluate and optimize district heating and cooling systems</li> </ul>	Jan 2019 – Aug 2021



**BIGDATA: Collaborative Research: IA: Big Data Analytics for Optimized Planning of Smart, Sustainable, and Connected Communities**

Oct 2018 –  
Aug 2021

Collaboration with Virginia Tech

- Developed a new planning framework for smart, connected, and sustainable communities to achieve zero energy, zero outage, and zero congestions goals by optimally deciding how, when, and where to deploy or upgrade infrastructure systems

**Assessing Sustainability of Homes with the Pinoleville Pomo Nation**

Oct 2013 –  
May 2015

M.S. Project, Committee Alice Agogino and Daniel Kammen, UC Berkeley

- Designed a culturally inspired indoor environmental quality monitoring tool for tribal residents
- Developed and tested the mechanical, electrical, and software systems for the PV-powered sensors
- Evaluated the life cycle impacts of the home with geothermal heat pumps and grid-tied PV system

**Retrofitting Commercial Buildings with Smart Lighting Systems**

Jan 2014 –  
Oct 2014

Sponsored by the California Energy Commission, UC Berkeley

- Computed potential energy savings from using a smart lighting system for demand response
- Performed an LCA of the smart lighting sensors and assessed the effective environmental payback

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**Leadership**

**Conference Chair**

Aug 2019

Intelligent Building Operations Workshop, University of Colorado Boulder

- Session chair for Modeling and Assessment Tools

**Collegiate Athlete**

Aug 2009 – Nov 2012

Division I Women's Soccer Team, University of Denver

- Balanced intensive athletic duties of regular practice, games, and travel with a difficult course load
- Regular starter and leader to the team, finishing 22nd in the nation in senior season

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**Honors and Awards**

IBUILD Graduate Research Fellowship, **\$164,000** total, 2 years

2021-2023

*U.S. Department of Energy, Energy Efficiency and Renewable Energy, Building Technologies Office*

*Managed by Oak Ridge National Laboratory*

Borda Graduate Scholarship in Honor of Gifford H. Albright, Pennsylvania State University

2022

Gordon D. Kissinger Graduate Research Fellowship, Pennsylvania State University

2022

Harvey and Geraldine Brush Graduate Fellowship in Engineering, Pennsylvania State University

2022

Marlene & Joseph Borda Architectural Engineering Graduates Fellowship, Pennsylvania State University

2022

P.E.O. Scholar Award, **\$20,000** international merit-based award

2021

International Building Performance Simulation Association (IBPSA) Project 1 Scholarship Recipient

2019

The Link Foundation Energy Fellowship Program Honorable Mention

2019

Colorado Engineering Council Silver Medal & Certificate of Merit

2013

Pioneer Award

2013

*"The **highest honor** given to undergraduate students" at the University of Denver*

2013

Mechanical Engineering Departmental Distinction, University of Denver	2013
Taylor Achievement Award, Ortho Transmission, LLC	2010-2013
Hornbeck Scholar (7 quarters), University of Denver	2010-2013
Dean's List (8 quarters), University of Denver	2009-2013
A University of Denver Scholar-Athlete of the Year (4 years)	2012
NSCAA Scholar All-West Region Team	2012
Second Team All-WAC Selection	2011
Academic All-American First Team, Division I Women's Soccer	2011
Preseason All-Sun Belt Conference Team	2009-2011
Sun Belt Conference Commissioner's List (all 3 seasons)	2019
SBC All-Conference First Team	2009
DU Invitational All-Tournament Team	2009
CS360's Primetime Performers of the Week (9/15)	

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### Professional Associations

ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers	2017 – Present
IBPSA: International Building Performance Simulation Association	2019 – Present
ASEE: American Society of Engineering Education	2022 – Present
ASCE: American Society of Civil Engineers	2023 – Present