

**Omer Tugrul  
KARAGUZEL**



**Lawful Permanent Resident of the U.S. (Green Card Holder)**

**Assistant Professor**, PhD-BEM, LEED AP BD+C, WELL AP  
Center for Building Performance & Diagnostics (CBPD)

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**Bio-Summary**

- Author of [\*The Praxis of Performance Modeling\*](#)
- Doctoral degree in building performance and diagnostics (BPD) (simulation-based studies)
- Significant technical proficiency in whole-building energy modeling and parametric environmental design tools (practical – research – teaching level experiences)
- In-depth working knowledge of green building certification schemes (LEED & WELL)
- Working knowledge of ASHRAE Standards (90.1, 55, 62.1, 189, and 209)
- Deep understanding of high-performance architectural and mechanical-electrical systems
- Hands-on experience in energy metering for model calibration and validation
- Experienced in developing customized data analytics and enhanced data visualizations
- Graduate level research experience in high-performance & sustainable design strategies
- Track record of peer reviewed technical writing and presentations at international conferences
- U.S. Department of Energy's scientific reviewer for Building Energy Modeling (BEM) program
- Energy modeling expert in a team winning ASHRAE's a net zero-energy commercial office design competition.
- Worked as an Energy Modeling Manager for a large size engineering consultancy firm in the U.S.

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**Professional &  
Academic  
Qualifications**

**LEED Accredited Professional (LEED AP BD+C)**

U.S. Green Building Council (Credential ID 11210357-AP-BD+C)

**WELL Accredited Professional (WELL AP)**

The International Well Building Institute, U.S. (AP# 00000-19905)

**Ph.D. in Building Performance & Diagnostics** (Honor) (2008 ~ 2013)

Graduate Program of Building Performance and Diagnostics (BPD),

School of Architecture, Carnegie Mellon University, PA, U.S.

Ph.D. Thesis: "*Simulation-Based Parametric Analysis High-Performance Buildings with On-Site Renewable Energy Systems*"

**M.Sc. in Building Science** (Honor) (2001 ~ 2003)

Graduate Program of Building Sciences (BS),

Department of Architecture, Orta Dogu Teknik Universitesi, Ankara, Turkey

Sustainable Environmental Design, AA School of Architecture, London, U.K.

Master Thesis: "*The Effects of Passive Solar Energy Systems on the Thermal Performance of Residential Buildings: An Analysis Using Energy-10*"

**Bachelor of Architecture (BArch)** (Honor) (1997 ~ 2001)

Department of Architecture, Orta Dogu Teknik Universitesi, Ankara, Turkey

**Registered Architect** (2001)

The Chamber of Architects of Turkey

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## Professional Appointments

### **Scientific Reviewer for the U.S. Department of Energy (DOE)**

April 2015, April 2016, March 2017, May 2018, June 2018, April 2021

Served for the U.S. DOE - Building Technologies Office (BTO) as a peer and merit reviewer to evaluate multimillion-dollar funding applications by national research laboratories (PNNL, LBNL, NREL, ORNL, ANL) for Building Energy Modeling (BEM), Emerging Technologies (ET) and Commercial Buildings Integration (CBI) programs.

### **Advisor for Software Development** (September ~ December 2017)

BuildSim Inc., Pittsburgh, PA, U.S. (<https://www.buildsim.io>)

### **Building Energy Modeling (BEM) Consultant** (May ~ August 2017)

Evolve EA, Pittsburgh, PA, U.S. (<http://www.evolveea.com>)

### **Energy Modeling Manager** (2013 ~ 2014) (Left job due to Visa Expiration)

IMEG Corps, Chicago, IL, U.S. (<http://www.imegcorp.com/about.html>)

### **Environmental Impact Consultant** (2007)

Baku-Tbilisi-Ceyhan (BTC) Oil Pipeline Company, Ankara, Turkey

### **Part-Time Architect** (2006 ~ 2007)

Akkan Design & Construction Inc., Ankara, Turkey

### **Architect** (2004 ~ 2005)

Promet Architecture and Restoration, Ankara, Turkey

(<https://www.prometproje.com>)

### **Field Architect** (2001)

Sagalassos Archeological Research Project, Burdur, Turkey

Conducted by The Katholieke Universiteit Leuven (KU Leuven), Belgium

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## Academic Appointments

### **Assistant Teaching Professor** (2016 ~ To Date)

School of Architecture, Carnegie Mellon University, PA, U.S.

48-116 Building Physics (BP) (Undergraduate)

48-300 3<sup>rd</sup> Year Design Studio (Simulation Module) (Undergraduate)

48-305 3<sup>rd</sup> Year Design Studio (Simulation Module) (Undergraduate)

48-722 Building Performance Modeling (BPM) (Graduate)

48-721 Building Controls and Diagnostics (BCD) (Graduate)

48-733 Environmental Performance Simulations (EPS) (Graduate)

### **Post-Doctoral Researcher/Research Associate III** (2014 ~ 2016)

Center for Building Performance and Diagnostics (CBPD)

School of Architecture, Carnegie Mellon University, PA, U.S.

Research: Computational (Bayesian-based) methods for the calibration of whole-building energy models with on-site systems data. Multi-objective (Genetic) optimizations for high-performance and cost-effective design solutions.

Courses Assisted:

48-721 Building Controls and Diagnostics (Graduate)

48-722 Building Performance Modeling (Graduate)

48-116 Building Physics (Undergraduate)

**Graduate Researcher** (2008 ~ 2013)

Center for Building Performance and Diagnostics (CBPD)  
School of Architecture, Carnegie Mellon University, PA, U.S.

**Teaching Assistant** (2009 ~ 2012)

School of Architecture, Carnegie Mellon University, PA, U.S.  
48-722 Building Performance Modeling (Graduate)  
48-705 Architectural Design Studio: Systems Integration (Undergraduate)

**Adjunct Faculty** (2005 ~ 2008)

Department of Architecture, Gazi University, Ankara Turkey  
Courses Taught:  
Architectural Design Studio II-III-IV (Undergraduate)  
M-363 Computer Aided Environmental Analysis and Design (Undergraduate)

**Researcher** (2005 ~ 2008)

Sustainable Environmental Design Unit (SEDU)/Green Studio  
Coordinator(s): Prof. Dr. Gönül Utkutug  
Department of Architecture, Gazi University, Ankara Turkey

**Researcher** (2001 ~ 2004)

Kerkenes Eco-Center Project (<http://kerkenes.metu.edu.tr/keco/index.html>)  
Coordinator(s): Francoise Summers & Geoffrey Summers  
(In collaboration with Architectural Association (AA) School of Architecture, London, U.K. Funded by The British Council, U.K.)  
Department of Architecture, Orta Dogu Teknik Universitesi, Ankara, Turkey

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**Fields of  
Expertise**

**Simulation-Based Decision Support for High-Performance Building Design**

- [1] Whole-building energy performance modeling & simulations (Design development and code compliance).
  - [2] Parametric modeling and environmental performance modeling & simulations (Early design support for solar-thermal-daylighting, thermal & visual comfort air-flow analysis, natural ventilation and climate analyses).
  - [4] Third-party certification of Green & Healthy Buildings (LEED-WELL-LBC rating systems approach).
  - [3] On-site energy and environmental performance monitoring-verification and post-occupancy evaluation (POE) protocols.
  - [4] Human-centered design and operation of built environments (Occupant comfort, health and well-being in relation to design-construction and operation of built environments).
  - [5] Data analytics-advanced visualizations to decision making under constraints (managerial decision making with optimization, sensitivity and uncertainty analyses and life cycle costing (LCC) analysis).
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**Projects  
Participated**

**~ Carnegie Mellon University, PA, U.S.**

**[1] International Energy Agency (IEA) – Energy in Buildings and Communities (EBC) – Annex 66: Definition and Simulation of Occupant Behavior in Buildings** Subtask E: Applications in Building Design and Operations

<https://annex66.org>

Funding Source: International Energy Agency – IEA

January 2015 ~ August 2017

**[2] Development of Computational Methods for the Calibration of Whole Building Energy Models.** Joint Research: TOSHIBA Corporation and Carnegie Mellon University.

Funding Source: TOSHIBA Corporation

January 2015 ~ August 2016

**[3] Consortium for Building Energy Innovation (CBEI)** formerly known as Energy Efficient Buildings (EEB) Hub and GPIC.

The U.S. Department of Energy (DOE) Award # EE0004261

<http://cbei.psu.edu>

Year I, Task 2.2: Models for Integrated Building Design

Year II, Task 4.4: Integrated Technologies and Decision Support Systems

Year IV, Task 2.1: Modeling and Simulation (EEB Hub Design Advisor)

Year V, Task 5.1: Retrofit Demonstrations (The U.S. Army – Ft. Belvoir Building 357 Retrofit Project)

Funding Source: The U.S. Department of Energy

January 2011 ~ January 2016

**[4] Development of a Comprehensive Energy Performance Database for Large Office Buildings: A Parametric Framework for Glazing Performance Analysis under Varying Climatic Conditions**

Online Web-Tool Developed from the Results of the Project:

<http://glassenergyanalysis.vitroglazings.com>

Funding Source: PPG Industries, U.S.

April 2011 ~ September 2012

**[5] Pittsburgh Mellon Arena Urban Redevelopment Project**

Funding Source: Urban Design Associates – UDA, Pittsburgh, U.S.

August 2011 ~ December 2011

**[6] Energy – Daylighting – Solar Power Simulation Model Development of a Zero Energy Research Building** (Center for Sustainable Landscapes (CSL) – Phipps Conservatory, Pittsburgh, PA)

Funding Source: The National Science Foundation (NSF), EFRI-SEED, U.S.

January 2011 ~ August 2011 and January 2012

**[7] Simulation-Based Performance Assessment of a Low-Energy Residence with an Unconventional HVAC System** (Pingry School Headmaster's Residence, NJ)

Funding Source: The Stone House Group, U.S.

March 2010 ~ September 2010

**[8] Energy and Sustainable Performance Modeling and Analysis for Tianjin Eco-City Residential Development**

Funding Source: Tiong Seng – Tianjin Project Management and Consultation Co. Ltd., P.R. China

September 2009 ~ February 2010

**[9] Simulation-Based Performance Assessment of a Housing Project: Project Oak, Voorhees, NJ**

Funding Source: Wu & Associates Inc., NJ, U.S.

September 2009 ~ January 2010

**[10] Energy and Sustainable Performance Modeling and Analysis for a Medical Research Laboratory Building (Sun Yat-Sun Cancer Research Center)**

Funding Source: NBBJ, Columbus, U.S.

January 2009 ~ September 2009

**[11] Building Codes and Standards Web-Site Development**

Funding Source: Ministry of Constructions, P.R. China

August 2008 ~ January 2009

**~ Gazi University, Ankara, Turkey**

**[12] Integration of Building Energy Performance Assessment into Architectural Design Studio**

Funding Source: Gazi University, Ankara, Turkey

May 2006 ~ June 2008

**~ Orta Dogu Teknik Universitesi, Ankara, Turkey**

**[13] Analyzing Environmental Performance of Autoclaved Aerated Concrete Blocks, Straw-bale Blocks, and Mud-plaster Finish in Hybrid Wall Constructions**

Funding Source: Kerkenes Eco-Center Project, Ankara, Turkey

May 2008 ~ August 2008

**[14] Environmental Renovation of the Solar House at METU with Computer-Based Analysis and Design Techniques**

Funding Source: Kerkenes Eco-Center Project, Ankara, Turkey

March 2003 ~ June 2004

**[15] Comparative Studies of Traditional and Contemporary Constructions in Turkey (Kerkenes Eco-Center Project)**

Funding Source: The British Council, U.K.

September 2002 ~ November 2003

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**Projects  
Coordinated**

**~ Current Projects**

**[1] Virtual Information-Fabric Infrastructure (VIFI) for Data-Driven Decisions from Non-Shareable Distributed Data (2016 ~ 2020)**

**Project Role:** Co-PI

**Funding Agency:** The National Science Foundation (NSF) – Data Infrastructure Building Blocks (DIBBs) Program (NSF 16-530)

**Budget/Duration:** \$100K/4 years (Total Budget: \$4M)

**Leading Organization:** UNC Charlotte, NC (Prof. William Tolone)

[2] Predictive Modeling for Sustainable Human-Building Ecosystems (SHBE) (#1664881) (2016 ~ 2019 w/ no cost extension)

**Project Role:** Co-PI

**Funding Agency:** The National Science Foundation (NSF) - Research Coordination Network (RCN) (NSF 16-64)

**Budget/Duration:** \$44K/2 years (Total Budget: \$500K)

**Leading Organization:** NOVA Southeastern University, FL (Prof. Yong Tao)

[3] RCN-SEES: International Workshop of Integration of Social Science Models into Building Design Processes for Sustainable Human-Building Ecosystems (SHBE) (#1664881) (2018 ~ 2020)

**Project Role:** Co-Organizer

**Funding Agency:** The National Science Foundation (NSF) - Research Coordination Network (RCN) (NSF 16-64)

**Budget/Duration:** \$43.6K/2 years (Total Budget: \$43.6K)

**Leading Organization:** NOVA Southeastern University, FL (Prof. Yong Tao)

### ~ Proposed Projects

[1] A cloud-based HVAC supervisory control system coupling deep reinforcement learning with the Spawn of EnergyPlus (2019 ~ 2021)

**Project Role:** PI

**Funding Agency:** The U.S. Department of Energy (DE-FOA-0001825)

**Budget/Duration:** \$963,000 (2 Years)

**Leading Organization:** CMU (Dr. O. Tugrul Karaguzel)

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## Publications

### ~ Book Chapters

[1] Lam, K.P., Zhao, J., Zhang, R., **Karaguzel, O.T.** “System Integration for Interoperable Data Models of Building Scale Ecosystem” In “Analytics for Building-Scale Sustainable Ecosystems (BSSE). Edited by Yong, X., Tao & Yi Jiang. Published by: Begell House, New York. 2013. ISBN: 978-56700-2798-9.

### ~ Peer-Reviewed Journals

[1] Zhang, R., **Karaguzel, O.T.** “Development and Calibration of Reduced-Order Building Energy Models by Coupling with High-Order Simulations”. *Global Journal of Advanced Engineering Technology and Sciences*. 7(2). 2020. Online ISSN: 2349-0292

[2] Lu, S., **Karaguzel, O.T.**, Cochran Hameen, E. “Simulation Study of Infiltration Effects on Demand Controlled Ventilation System with High-Variant Occupancy Schedules”. *ASHRAE Transactions*, 125 (1). Pp 571-578. 2019.

[3] **Karaguzel, O.T.**, Elhambakey, M., Zhu, Y., Hong, T., Tolone, W.J., Khalefa, M., Das Bhattacharjee, S., Cho, I., Dou, W., Wang, H., Lu, S. “An Open Computing Infrastructure for Sharing Data Analytics to Support Building Energy Simulations”. *Journal of Computing in Civil Engineering (JCCE)*. Special Collection on Next Generation of Disruptive Building and Infrastructure Design and Engineering Technologies. 33 (6). 2019.

[4] Talele, S., Traylor, C., Laura, A., Curley, C., Chen C.F., Day, J., Feiock, R., Hadzikadic, M., Tolone, W., Ingman, S., Yeatts, D., **Karaguzel, O.T.**, Lam, K.P.,



Menassa, C., Pevnitskaya, S., Spiegelhalter, T., Yan, W., Zhu, Y., Tao, Y. “Energy Modelling and Data Infrastructure for Sustainable Human-Building Ecosystems (SHBE) – A Review”. *Frontiers in Energy* (2018). Online ISSN: 2095-1698.

[5] Xu, W., Chong, A., **Karaguzel, O.T.**, Lam, K.P. “Improving Evolutionary Algorithm Performance for Integer Type Multi-Objective Building System Design Optimization” *Energy and Buildings*. 2016. Vol. 127, Issue. 1, pp. 714-729. <http://dx.doi.org/10.1016/j.enbuild.2016.06.043>

[6] Zhao, J., Lam, K.P., Ydstie, B.E., **Karaguzel, O.T.** “EnergyPlus Model-based Predictive Control within Design Build-Operate Energy Information Infrastructure”. *Journal of Building Performance Simulation*. May, 2014. Taylor and Francis, UK.

[7] **Karaguzel, O.T.**, Zhang, R., Lam, K.P. “Coupling of Whole-Building Energy Simulation and Multi-Dimensional Numerical Optimization for Minimizing the Life Cycle Costs of Office Buildings”. *International Journal of Building Simulation*. April, 2014. Vol. 7: 111-121.

#### ~ Peer-Reviewed Conferences

[1] Xie, J., Sawyer Omidfar, A., **Karaguzel, O.T.** “Glare-Based Strategies for Automated Roller Shades and Blinds in Office Buildings: A Literature Review”. In *Proceedings of the 5<sup>th</sup> Building Simulation and Optimization Virtual Conference*. BSO-V 2020. 21-22 September 2020. Loughborough, UK.

[2] Lu, S., Zhiang, Z., Cochran Hameen, E., Lartigue, B., **Karaguzel, O.T.** “Energy Co-Simulation of the Hybrid Cooling Control with Synthetic Thermal Preference Distributions”. In *Proceedings of the Symposium on Simulation in Architecture and Urban Design (SIMAUD 2020)*. January 2020.

[3] Lu, S., Cochran, E., **Karaguzel, O.T.** “Simulations of Dynamic Ventilation Operations with Real-time Occupancy Estimation”. *ACEEE 2018 Summer Study on Energy Efficiency in Buildings*. August 12-18, 2018, Pacific Grove, CA.

[4] Weili, X., **Karaguzel, O.T.**, Lam, K.P. “Using Adaptive Meta-Model Evolutionary Algorithm for Mixed-Integer Type Building Design Optimization”. In *Proceedings of the 15<sup>th</sup> International IBPSA Conference (IBPSA 2017)*, San Francisco, CA. 7-9 August 2017.

[5] Chong, A., Lam, K.P., Xu, W., **Karaguzel O.T.**, Mo, Y. “Imputation of Missing Values in Building Sensor Data”. In *Proceedings of ASHRAE and IBPSA-USA SimBuild 2016 Building Performance Modeling Conference*. Salt Lake City, UT. August 2016.

[6] Xu, W., Lam, K.P., Chong, A., **Karaguzel, O.T.** “Multi-Objective Optimization of Building Envelope, Lighting and HVAC Systems Design”. In *Proceedings of ASHRAE and IBPSA-USA SimBuild 2016 Building Performance Modeling Conference*. Salt Lake City, UT. August 2016.

[7] Zhao, J., Lam, K.P., **Karaguzel, O.T.**, Ahmadi, S. “Design-Build-Operate Energy Information Modeling (DBO-EIM) for Green Buildings: Case Study of a

Net Zero Energy Building”. In Proceedings of *International Building Performance Association (IBPSA) Asia Conference (ASim2012)*. Shanghai, China. November, 2012.

[8] **Karaguzel, O.T.**, Zhang, R., Lam, K.P. “Integrated Simulation Based Design Optimization of Office Building Envelopes for the Minimization of Life Cycle Costs”. In Proceedings of *The Second International Conference on Building Energy and Environment (COBEE 2012)*. Boulder, CO, U.S. August, 2012.

[9] **Karaguzel, O.T.**, Lam, K.P. “Development of Whole-Building Energy Performance Models as Benchmarks for Retrofit Projects”. In Proceedings of *The Winter Simulation Conference (WSC 2011)*. Phoenix, AR, U.S. December, 2011.

[10] **Karaguzel, O.T.**, Lam, K.P. “Whole-Building Performance Simulation of a Low-Energy Residence with an Unconventional HVAC system”. In Proceedings of *The International Building Performance Association (IBPSA) Building Simulation 2011 Conference*. Sydney, Australia. November, 2011.

[11] **Karaguzel, O.T.**, Toprakli, A.Y. “Upgrading the Design of an Existing Residential Unit to Net-Zero Energy Level through Computational Performance Modeling”. In Proceedings of the *International Graduate Symposium 2010*. Middle East Technical University, Ankara, Turkey. October, 2010.

[12] Dong, B., Yue, B.Y., **Karaguzel, O.T.** “Application of System Identification and Numerical Optimization to a Floor Radiant Heating Control in a Solar House”. In Proceedings of *CLIMA 2010 International Conference*, Antalya, Turkey. May, 2010.

[13] Elias-Ozkan, S.T., Summers, F., **Karaguzel, O.T.**, Taner, O. “Analyzing Environmental Performance of AAC Blocks, Strawbales, and Mud-plaster in Hybrid Wall Construction”. In Proceedings of *Passive and Low Energy Architecture Conference (PLEA 2008)*. Dublin, Ireland. October, 2008.

[14] **Karaguzel, O.T.** “Environmental Renovation of the Solar House in Middle East Technical University with Computer-Based Analysis and Design Techniques”. In Proceedings of *International Conference on Environment: Survival and Sustainability (ESS 2007)*. Near East University, Nicosia-Northern Cyprus. February, 2007.

[15] Summers, F., Gezer, N., **Karaguzel, O.T.**, Yannas, S., Somuncu, Y. “Comparative Studies of Traditional and Contemporary Construction in Turkey”. In Proceedings of *Passive and Low Energy Architecture Conference (PLEA 2003)*. Santiago, Chile. November, 2003.

#### ~ Scientific Reports for the Building Industry

[1] Chong, A., Weili, X., Lam, K.P., **Karaguzel, O.T.** “TOSHIBA-CMU Project Report Final: Development of Computational Methods for the Calibration and Optimization of Whole Building Energy Models”. Submitted to: TOSHIBA Inc. Carnegie Mellon University, PA, U.S. August 2017.



[2] **Karaguzel, O.T.,** Lam, K.P. “Development of a Comprehensive Energy Performance Database for Large Office Buildings: Automating EnergyPlus Simulations in a Multi-Dimensional Parametric Search Framework”. Submitted to: PPG Industries. *Carnegie Mellon University, PA, U.S.* January 2013.

[3] **Karaguzel, O.T.,** Lam, K.P. “Simulation-Based Performance Assessment of “Pingry School Headmaster’s Residence, NJ with EnergyPlus””. Submitted to: Stone House Group LLC. *Carnegie Mellon University, PA, U.S.* August 2010.

[4] **Karaguzel, O.T.,** Lam, K.P. “A Parametric Energy Performance Analysis on Window Design with Energy Gauge”. Submitted to: Woo & Associates Ltd. *Carnegie Mellon University, PA, U.S.* May 2010.

[5] **Karaguzel, O.T.,** Lam, K.P. “Simulation Based Performance Assessment of a Housing Project: Project Oak, Voorhees, NJ”. Submitted to: Wu & Associates Inc., NJ, U.S. *Carnegie Mellon University, PA, U.S.* December 2009.

### ~ Scientific Reports for the U.S. DOE

#### Annual Technical Research Reports Submitted to U.S. DOE under GPIC/EEB Hub/CBEI Project Award # EE0004261 (2011-2016)

[1] Lam, K.P., **Karaguzel, O.T.,** Ramesh, S., Tetali, S., Zhang, Z. “Ft. Belvoir Building 357 Energy Modeling and Calibration”. *Carnegie Mellon University, PA, U.S.* January 2016.

[2] Lam, K.P., Zhang, R., **Karaguzel, O.T.,** Cochran, E., Zhao, J., Wang, H., Chong, A., Xu, W., Ding, C., “Industry Relevant Value Proposition of Deploying EnergyPlus Whole Building Energy Modeling Platform for Retrofit Project Decision Masking”. *Carnegie Mellon University, PA, U.S.* January 2015.

[3] **Karaguzel O.T.,** Zhang, R., Lam, K.P. “Coupling of Whole-Building Energy Simulation and Multi-Dimensional Numerical Optimization for Minimizing the Life Cycle Costs of Office Buildings”. *Carnegie Mellon University, PA, U.S.* January 2013.

[4] Zhang, R., **Karaguzel, O.T.,** Wang, H., Lam, K.P. “Development of a Web-Based Industry Products Data Acquisition and Schema Mapping Assistant Tool”. *Carnegie Mellon University, PA, U.S.* January 2013.

[5] **Karaguzel, O.T.,** Lam, K.P. “Whole-Building Energy Performance Modeling as Benchmark for Retrofit Projects: Building 661 Case”. *Carnegie Mellon University, PA, U.S.* January 2012.

[6] **Karaguzel, O.T.,** Lam, K.P. “Simulation-Based Parametric Analysis Part I: One-Factor-at-a-Time (OAT) Evaluation of Enclosure Measures for Building 661”. *Carnegie Mellon University, PA, U.S.* January 2012.

[7] **Karaguzel, O.T.,** Lam, K.P. “Simulation-Based Parametric Analysis Part II: Multi-Variate Exhaustive Evaluation of Enclosure Measures for Building 661”. *Carnegie Mellon University, PA, U.S.* January 2012.

[8] **Karaguzel, O.T.**, Lam, K.P. “Simulation-Based Parametric Analysis Part III: Optimization of Building Enclosure for Minimizing Life Cycle Costs”. *Carnegie Mellon University, PA, U.S.* January 2012.

[9] **Karaguzel, O.T.**, Lam, K.P. “Daylighting Simulations: Effects of Daylight Controls on Electric Lighting Energy Consumption: Building 661 Case”. *Carnegie Mellon University, PA, U.S.* January 2012.

[10] **Karaguzel, O.T.**, Lam, K.P. “Analysis of EnergyPlus-based Building Envelope Modeling”. *Carnegie Mellon University, PA, U.S.* January 2012.

[11] **Karaguzel, O.T.**, Lam, K.P. “Programs for Design Analysis Support and Simulation Integration”. *Carnegie Mellon University, PA, U.S.* January 2012.

[12] Lam, K.P., Zhang, R., Li, B., **Karaguzel, O.T.** “Evaluation of the Prevalent Building Energy and CFD Simulation Tools in the Building Industry”. *Carnegie Mellon University, PA, U.S.* January 2012.

[13] Lam, K.P., **Karaguzel, O.T.**, Zhang, R., Li, B., Wang, H. “Development of a Web-Based Survey Platform for the Evaluation of Building Performance Simulation Tools”. *Carnegie Mellon University, PA, U.S.* January 2012.

[14] Lam, K.P., **Karaguzel, O.T.**, Zhang, R., Zhao, J. “Identification and Analysis of Interoperability Gaps between NBIMS/Open Standards and Building Performance Simulation Tools”. *Carnegie Mellon University, PA, U.S.* January 2012.

~ **Scientific Reports for the British Council, U.K.**

[1] Summers, F., Elias-Ozkan, S.T., **Karaguzel, O.T.**, Cakmakli, A.B., Yannas, S., Gomez, M. “Wall Constructions that Optimize the Environmental Performance of Buildings a Comparative Study of Building Materials and Construction Techniques in Turkey”. *AA School of Architecture, London, U.K. and Orta Dogu Teknik Universitesi, Ankara, Turkey.* December 2003.

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**Invited Talks**  
**Seminars**  
**Panels**  
**Lectures**

[1] Panelist for NSF supported workshop on Urban Sustainability: Social Actors, Policy and Governance held at Florida State University, Tallahassee, FL (April 15-16, 2019).

**Topic:** “*Application of Virtual Information Fabric Infrastructure (VIFI) to Building Performance Simulations*”

[2] Guest Lecturer for the graduate course: S19 48-711 Paradigms of Research in Architecture offered by Dr. Joshua Lee at CMU School of Architecture. February 18<sup>th</sup>, 2019.

**Topic:** “*Simulation-Based Research in Architectural Sciences*”

[3] Academic Workshop Organizer for NSF-Research Coordination Network-Predictive Modeling Network for Sustainable Human Building Ecosystems (SHBE) Workshop VIII (NSF Award # 1664881) May 17<sup>th</sup>-18<sup>th</sup>, 2018 (School of Architecture, Carnegie Mellon University)

Workshop Theme: *“Integration of the Human Dimension in Product and Process Modeling in the Creation of Resilient and Sustainable Human-Building Ecosystems”*

[4] Guest Lecturer for the graduate course; 27-765 Optical and Thermal Energy Transport offered by Dr. Paul Ohodnicki of NETL for Energy Science Technology Policy (ESTP) program, Carnegie Mellon University, PA, U.S. April 19<sup>th</sup>, 2018

**Topic:** *“Empowering the Weakest Link: Computational Approaches to Evaluate Multi-Spectral Interactions of High-Performance Glazing Systems with Building Spaces”*

[5] Panelist for NSF-supported supported panel at the 3<sup>rd</sup> International Thermal and Fluids Engineering Conference (TFEC), Nova Southeastern University, Ft Lauderdale, FL. Panel Theme: Thermal Modeling and Sensing Technologies”. March 6<sup>th</sup>, 2018

**Topic:** *“Designing for Thermal Comfort: Coupling Simulation and Sensing for the Emergence of Autotelic Building Control Mechanisms”*

[6] Invited talk at the NSF-RCN SHBE Workshop VII at NOVA Southeastern University, FL, U.S. <https://www.shbe.org/about.html> June 5<sup>th</sup>, 2017

**Topic:** *“Design-Build-Operated Energy Information Modeling for Occupant-Oriented Model Predictive Controls: A Case Study of a Net Zero Energy Building”*

[7] Guest Lecturer for the graduate course; ARCH 615-Advanced Topics in Environmental Controls offered by Prof. JoonHo Choi of the School of Architecture, University of South California (USC), LA, U.S. April 27<sup>th</sup>, 2017

**Topic:** *“Simulation-Based Performance Assessment of a Low-Energy Residence with an Unconventional HVAC System”*

[8] Panelist for Informative Lecture Series to DELOS Research Labs, NY given by the Faculty of Center for Building Performance & Diagnostics (CBPD) of the School of Architecture, Carnegie Mellon University, PA, U.S. January 17<sup>th</sup>, 2017

**Topic:** *“Building Performance Simulation (BPS): With Focus on the Human Dimension”*

[9] Guest Lecturer for the graduate course; 24-622 Direct Solar and Thermal Energy Conversion offered by Dr. Sheng Shen of the Department of Mechanical Engineering, Carnegie Mellon University, PA, U.S. November 9<sup>th</sup>, 2016

**Topic:** *“Building Integrated Solar Photovoltaics: Beyond Instrumentality of Electricity Generation”*

[10] Panelist in the Design Charrette for the Renovation of the Roof of David Lawrence Convention Center (DLCC), Pittsburgh held by Indovina Associates Architects, Pittsburgh, PA, U.S. June 14<sup>th</sup>, 2016

**Topic:** *“Building Integrated Solar Photovoltaic Technologies”*

[11] Panelist in an international webinar (with 500 participants) on “Using Design Builder Optimization to Design a Net Zero Building” held by Design Builder Software company.

[https://www.youtube.com/watch?v=Mfi-2LLb0zw&list=PLPU58tWB1sVuKRjId69J6fsvTniWt\\_E1y&index=5&t=0s](https://www.youtube.com/watch?v=Mfi-2LLb0zw&list=PLPU58tWB1sVuKRjId69J6fsvTniWt_E1y&index=5&t=0s)

November 19<sup>th</sup>, 2015

**Topic:** “*Geometric Optimization of Solar Photovoltaic Systems using Parametric Modeling Techniques of Rhino and Grasshopper*”

[12] Energy Modeling Training for KJWW/IMEG Engineering Consultants, Rock Island, IL. August 20<sup>th</sup>, 2014

**Topic:** “*Energy Modeling with Design Builder and EnergyPlus Programs*”

[13] Lecture for the PPG Industries R&D Department. Pittsburgh, PA, U.S. February 1<sup>st</sup>, 2013

**Topic:** “*Theory and Practice of Computational Design Decision Support: An Integrated Framework for Optimizing Building Enclosure Design for the Minimization of Life Cycle Cost*”.

[14] Modeling Viewpoints WebEx: Strategies for Energy Modeling & Simulation. EEB Hub, Navy Yard, PA, U.S. August 7<sup>th</sup>, 2012

**Topic:** “*Simulation-based Design Decision Support Systems for Retrofit Projects: From Computational Methods to Graphical User Interfaces*”

[15] Seminar for a delegate of academicians from Tongji University, China. Carnegie Mellon University, PA, U.S. May 25<sup>th</sup>, 2011

**Topic:** “*Whole-Building Energy Modeling and Simulation for Performance-based Building Design Development*”.

[16] Seminar for Housing Development Administration of Turkey, Republic of Turkey Ministry of Housing. Orta Dogu Teknik Universitesi, Ankara Turkey. January 4<sup>th</sup>, 2008

**Topic:** “*The Significance of Environmental Monitoring and Computational Energy Simulation for the Design of Energy Efficient and Environmentally Sustainable Housing Development*”.

[17] Workshop on Renovation of METU Solar House.

University Members Association. Orta Dogu Teknik Universitesi, Ankara, Turkey. June 15<sup>th</sup>, 2004

**Topic:** “*Environmental Performance Assessment of Buildings: Computer Aided Environmental Design (CEAD) Techniques*”.

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## Teaching Record

48-116: **Building Physics (BP)**, Undergraduate Level, CMU

The goal of this course to introduce students to the theoretical foundations and computational approaches in the two major fields of building physics, building lighting and thermal performance. “Lighting” part introduces fundamental lighting principles of photometric quantification of light and luminous environment with effects on human visual comfort. This part also includes characterization of light from natural sources (sunlight) and artificial sources (electric lighting systems) along with the discussion of pertinent indoor lighting performance metrics, design and benchmarking methods, building codes and standards and state-of-the-art lighting simulation methods and tools. “Thermal” part is focused on building thermodynamics (heat and mass transfer mechanisms), indoor-outdoor thermal comfort in addition to analytical and simulation-based methods for the prediction of building thermal loads and energy consumption. This section also discusses building codes and standards for building energy efficiency.

**48-722: Building Performance Modeling (BPM), Graduate Level, CMU**

This course focuses on conceptual foundations and practical applications of advanced and integrated whole-building energy simulation programs with special focus on building envelope systems (opaque and transparent), electrical and mechanical systems (lighting and HVAC systems) and building integrated solar power systems. Students are engaged in project-based collaborative studies with emphasis on analytical and visual methods for the interpretation of highly technical performance data for enhanced inter-disciplinary communications. BPM course includes discussions of particular high-performance design solutions which exhibit innovative approaches to the use of whole-building energy simulation methods starting from early stages of design development. BPM course also discusses the Building Information Modeling (BIM) concept and its connectivity to Building Energy Modeling (BEM) with lectures dedicated to BIM-to-BEM approaches with contemporary workflows and their challenges.

**48-721: Building Controls and Diagnostics (BCD), Graduate Level, CMU**

This course introduces data sensing, acquisition and systematic analysis approaches dedicated to empirical evaluation of the environmental and occupational performance (thermal-visual-acoustical comfort) of the built environment (including mechanical and electrical systems) by considering interactions with occupants. While working on actual building cases, students acquire necessary skill sets to develop interactive dashboards, to conduct post occupancy evaluation and measurement (POE+M) protocols, and to develop advanced building control logics including model-based and human-in-the-loop feedback loops. BCD course puts emphasis on empirical methods of building diagnostics and controls not only to describe technological components but also to study their real-time behavior under dynamic climatic and occupational conditions.

**48-733: Environmental Performance Simulations (EPS), Graduate Level, CMU**

This course aims to introduce students to a range of evidence-based design approaches and computational techniques within the theme of passive environmental responsiveness for increased resiliency for human habitability with minimum reliance on mechanical-electrical systems. Students are encouraged to work in groups to systematically evaluate multi-domain environmental performance of actual building precedents using state-of-the-art architectural design and research oriented algorithmic/parametric modeling ecosystem of Rhino-Grasshopper with physics-based plug-ins of DIVA-ArchSim-Ladybug-Honeybee. Fundamental computational approaches introduced in EPS are thematically classified into sections following different bands of electromagnetic spectrum that are most relevant to human physical interactions (such as *solar, thermal, visible* radiation studies) in addition to *generation* studies for the design of building integrated renewable energy systems. Students acquire necessary skill sets and intuition to understand, analyze, and simulate thermodynamic and photometric interactions to be able to get instant quantitative feedback for informed design explorations.

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**Student  
Advising**

~ **PhD Thesis Committee Member** (Carnegie Mellon University)

**[1] Jiarong Xie;** Building Performance and Diagnostics (2018-2023)

Thesis: Effects of luminous environment on occupants' health and well-being

**[2] YoungJoo Son;** Building Performance and Diagnostics (2016 ~ 2021)

Thesis: Defining Visual Environmental Quality and Factors that Impact Occupant Satisfaction in Office Environments

Advisor: Vivian Loftness, SoA, CMU

[3] **Yujie Xu**; Building Performance and Diagnostics (2016 ~ 2021)

Thesis: “Data-Driven Energy Use Models for Retrofit Projects”

Advisor: Vivian Loftness, SoA, CMU

[4] **Siliang Lu**; Building Performance and Diagnostics (2014 ~ 2019)

Thesis: “An Integrative HVAC System Featuring Adaptive Personalized Cooling with Non-Intrusive Sensing Techniques”

Advisor: Erica Hameen Cochran, SoA, CMU

[5] **Chenlu Zhang**; Building Performance and Diagnostics (2014 ~ 2019)

Thesis: “Human in the Loop: A Bio-Sensing and Reinforcement Learning Approach for Personalized Thermal Comfort Controls in Offices”

Advisor: Vivian Loftness, SoA, CMU

~ **Masters/PhD Independent Study Supervisor** (Carnegie Mellon University)

[1] **Suzy Li** (PhD Student – BPD Program) – Fall 2018

~ **Master Thesis Co-Advisor** (Carnegie Mellon University)

[1] **Aakash Goliyan**; Building Performance and Diagnostics (2015 ~ 2017)

~ **PhD Qualification Examiner**

[1] **Bingqing Chen**; Civil and Environmental Engineering (January 2018)

Advisor: Prof. Burcu Akinci, CEE, CMU

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## Honors & Awards

### ~ Competition

[1] Energy modeling expert in the multi-disciplinary team of Design Builder who wins the “*Best Innovative Workflow*” award during Low-Down Show-down Zero-Energy Building Design Competition at American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE) Energy Modeling Conference, September 30<sup>th</sup>, 2015 at Atlanta, GA.

<https://www.ibpsa.us/news/designbuilder-team-wins-ashrae-energy-modeling-conference's-best-innovative-workflow-award>

### ~ Commendation

[1] Commendation for outstanding contribution in reviewing for *Energy & Buildings* journal (October 2016)

[2] Spring 2009 (QPA 4.05) and Fall 2009 (QPA 4.08), School of Architecture, Student Achievement Commendation, Carnegie Mellon University, PA, U.S.

### ~ Graduate Research Scholarships

[1] CBEI formerly known as Energy Efficient Buildings (EEB) Hub, The U.S. Department of Energy, U.S. (January 2011 ~ August 2013)

[2] PPG Industries, U.S. (April ~ September 2012)

[3] The Stone House Group, U.S. (March ~ September 2010)

[4] Wu & Associates, Inc., U.S. (September 2009 ~ January 2010)

[5] NBBJ, U.S. (January ~ September 2009)

[6] The British Council, U.K. (September 2003 ~ July 2004)

### ~ Graduate & Post-Doctoral Fellowships

[1] TOSHIBA Corporation, Japan. (Post-Doctoral Fellowship) (2014 ~ 2016)

[2] School of Architecture, Carnegie Mellon University, U.S. (August 2008 ~ August 2013)



[3] School of Architecture, Orta Dogu Teknik Universitesi, Turkey & Architectural Association (AA School of Architecture, London, U.K. (July 2001 ~ July 2004)

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## Service

~ **School level committee member** (SoA, Carnegie Mellon University)

[1] Graduate Application Review Committee Member (2017 - 2021)

~ **Technical Reviewer for Peer-Reviewed Journals**

[1] Reviewer, Journal of Building Simulation (2014 ~ Present)

[2] Reviewer, Energy and Buildings (2014 ~ Present)

[3] Reviewer, International Journal of Energy Research (2017 ~ Present)

[4] Reviewer, Canadian Journal of Civil Engineering (2016 ~ Present)

[5] Reviewer, Automation in Construction (2014 ~ Present)

[6] Reviewer, Building Performance Simulation (2015 ~ Present)

[7] Reviewer, Indoor and Built Environment (2018 ~ Present)

[8] Reviewer, Journal of Computing in Civil Engineering (2018~ Present)

[9] Reviewer, Perkins & Will Research Journal (2018 ~ Present)

~ **Membership in Professional Societies**

[1] International Building Performance Simulation Association (IBPSA) (2018)

[2] Society of Building Science Educators (SBSE) (2018)

[3] Social Science, Engineering, Computing Research in Energy Topics (SECRET) (2018)

~ **Certification**

[1] **Physical Science Responsible Conduct of Research**, January, 2016. Collaborative Institutional Training Initiative (CITI) certification on Social & Behavioral Research. Report ID: 16785654

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## Inventions & Patents

**Methods and Systems for Digital Information Modeling for Codes and Standards Compliance**

<https://patents.google.com/patent/US20140372859A1/en>

**Application Number:** US 2014/0372859 A1

**Type:** Application

**Filed:** June 13, 2014

**Issued:** December 18, 2014

**Assignee:** Carnegie Mellon University (A Pennsylvania Non-Profit Corporation)

**Inventors:** Khee Poh Lam, Jie Zhao, **O. Tugrul Karaguzel**, Rongpeng Zhang

**Automatic Building Energy Baseline Model Generation According to ASHRAE 90.1 Performance Rating Method**

Invention Disclosure (2016-158) Carnegie Mellon University

Center for Technology Transfer and Enterprise Creation

Inventors: Khee Poh Lam, Weili Xu, **O. Tugrul Karaguzel**, and Haopeng Wang

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## Outreach

~ **The Praxis of Performance Modeling**

A personal blog focusing on a broad range of practical topics in building performance modeling, simulation and analysis (with samples and workflows)

**First Launch:** March 1<sup>st</sup>, 2021 **Total Views:** 205 (March 31<sup>st</sup>, 2021)

<https://omerkaraguzelphd.wixsite.com/praxismodeling>

**Sample Topics:**

[1] The Quintessential Features and Approaches of Performance Modeling

- [2] Evidence-Based Design for Environmentally Sustainable Buildings
- [3] Air Infiltration 101
- [4] The Benefits of Reducing the Electric Lighting Energy
- [5] Benchmarking vs Baseline for Building Energy Models

~ **Instructional YouTube Videos** (on channel: Dr. Karaguzel)

**Total Views:** 24,628 (March 31<sup>st</sup>, 2021)

**Total Subscribers:** 210 (March 31<sup>st</sup>, 2021)

<https://www.youtube.com/channel/UCMoLiW7tlqPKdWk8RTO1tXQ/videos>

**Sample Tutorials:**

- [1] Creating a Thermal Insulation Material in IESVE
  - [2] Insulation Thickness Calculator
  - [3] How to Model a Super-Efficient House? An Energy Modeling Case
  - [4] Design Builder Rhino/Grasshopper Solar PV Optimization
  - [5] Global Algorithm Update
  - [6] Design Builder Solar PV Modeling Part 1-to-3
  - [7] Design Builder VAV Reheat with Water Cooled Chiller Part 1 and 2
  - [8] Design Builder CAV Reheat Air Cooled Chiller Part 1 and 2
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