



# Proposed MIT-Wentworth Research: Public Policy for Net Zero Homes and Affordability

## Overview

The Home Builders and Remodelers Association of Massachusetts, with support from the National Association of Home Builders, have teamed up with MIT's Center for Real Estate and the Wentworth Institute of Technology to conduct groundbreaking research and make actionable policy recommendations to simultaneously advance both climate policy and housing affordability, using Massachusetts as a case study, to: (1) conclusively establish that transitions to a "net zero" code will burden home construction in any jurisdiction with significant additional capital costs; (2) illustrate the real impacts that increased construction costs under net zero building codes would have on housing affordability and production; and (3) identify the existing and new "tools" that individual states and the federal government can adopt or enhance to offset increased housing costs and avoid adverse impacts on housing affordability and production. Without offsets, increased home construction costs impact not only new home construction, but also cause cascading adverse impacts on "move up" buyers and home sales.

Massachusetts has been a proven leader in climate policy, including 21<sup>st</sup> Century incentive programs that successfully advanced rooftop solar production, and with its recent adoptions of a roadmap to decarbonization and landmark climate law that, among other things, calls on state government to create a "net zero" energy "stretch code" that municipalities can adopt to limit carbon emissions from new homes. However, Massachusetts is also a national leader in home price escalations and housing shortage, which have led to economic and social crises including the overburdening of household budgets with housing costs, housing instability, and homelessness. Without mitigation, new requirements on home building in the interest of advancing climate policy will exacerbate the housing crisis.

The research will first provide an unbiased assessment of the costs associated with the transition of residential construction to a "net zero" model to reduce carbon emissions. Next, researchers will model the impact of these costs on both housing affordability and housing production. Finally, the report will present options for local, state, and federal policy initiatives and reforms – including a significantly more robust 45L federal tax credit (currently at only \$2,000/home constructed to enhanced energy efficiency standards), and revised Fannie and Freddie underwriting standards that would account for long-term energy savings and increase the "buying power" of homebuyers – that could advance the transition without adversely impacting housing affordability and intensifying the housing shortage. The research methods will include extensive interviews with a broad range of stakeholders, literature review, case studies, and financial and economic modeling. The federal and state cost mitigation tools will be of broad utility for housing and real estate stakeholders in all states considering adoption of net zero or "net zero ready" building codes.

The research project will include an advisory group comprised of industry representative co-sponsoring or supporting the study at leadership contribution levels. The cross-disciplinary research teams at MIT and Wentworth will periodically update and solicit industry insight from the advisory group, and researchers include academic stars in construction management, environmental engineering, modular design, sustainable urbanization, fair housing, urban theory, law, and urban planning. The professors leading the project have published extensively in peer-reviewed journals and have presented on national and international stages.

The project will begin immediately and conclude in January of 2023 with the publishing of the report and presentation of findings at the annual meeting of the National Association of Home Builders. The researchers will produce a preliminary report by June of 2022 that will be previewed to project co-sponsors, reviewed by a wide range of stakeholders and submitted to the Massachusetts Legislature and Executive Branch. We anticipate that industry/association co-sponsors will similarly distribute the report to state and local leadership in all states contemplating or advancing adoption of net zero codes.

The MIT-Wentworth Net Zero study is a first-of-its-kind and will establish broadly applicable bedrock principles at the intersection of housing and climate policy. Its utility will help shape those policy areas for years to come.

## **The Research Team**

### **MIT Center for Real Estate**

*Principal Investigator: Justin Steil, Associate Professor of Law and Urban Planning*

Professor Steil is the co-editor of three books and author of numerous articles on fair housing and urban theory. Before coming to MIT, Justin was a Fellow at the Furman Center for Real Estate and Urban Policy at New York University Law School. He has worked as a law clerk, an advocacy director, and an urban planner, among other roles. He has received multiple awards for teaching and public service. Justin received a B.A. from Harvard College, a M.Sc. from the London School of Economics, a J.D. from Columbia Law School, and a Ph.D. from the Columbia Graduate School of Arts and Sciences.

*Co-Principal Investigator: Siqi Zheng, Professor of Urban and Real Estate Sustainability*

Professor Zheng is faculty director of the MIT Center for Real Estate. She established MIT Sustainable Urbanization Lab and MIT China Future City Lab. She serves on the Board of American Real Estate and Urban Economics Association (AREUEA), and is an editor of several journals on real estate economics and environmental economics. She has published articles in many peer reviewed international journals, and had co-authored a book on economic growth and the environment. She received her Ph.D. from Tsinghua University, and did post-doc research at the Graduate School of Design at Harvard University.

*Project Manager: Zhengzhen Tan, Research Scientist; Executive Director, MIT Sustainable Urbanization Lab; Director, China Future City Program*

Zhengzhen's research and teaching is focused on urbanization, digital innovation and entrepreneurship, and digital transformation in real estate sector. She is teaching two courses in MIT's School of Architecture and Planning and Sloan School of Management. Before joining MIT, Zhengzhen was an urban planner and urban designer in both public and private sector in Shanghai, Singapore, London, and Vancouver. She received a B.A. from Tongji University, Shanghai and M.A. from National University of Singapore.

### **Wentworth Institute of Technology**

*Principal Investigator: Payam Bakhshi, Associate Professor of Construction Management*

Dr. Payam Bakhshi is an Associate Professor of Construction Management at Wentworth Institute of Technology. His research has been focused on sustainable construction and resilience, risk management in infrastructure projects, probabilistic project schedule/cost estimate, project delivery methods, and emerging construction technology such as VR/AR and autonomous construction equipment. He has numerous peer-reviewed publications in these areas and has presented his works nationally and internationally. Prior to joining academia, he worked in the construction industry for several years as a Project Manager. He earned his Ph.D. in

Construction Management from Northeastern University, M.S. in Transportation Engineering from K. N. Toosi University of Technology, and B.S. in Civil Engineering from University of Tehran. He is a registered Professional Civil Engineer in the Commonwealth of Massachusetts and holds the Certificate of Management-Lean Construction (CM-Lean) from the Associated General Contractors of America (AGC). He is an active member of several professional societies such as Construction Management Association of America (CMAA) and New England Chapter, American Society of Civil Engineers (ASCE), and Lean Construction Institute (LCI). Also, he is currently the co-advisor for the National Association of Home Builders (NAHB) Student club at Wentworth.

*Co-Principal Investigator: Afshin Pourmokhtarian, Assistant Professor of Construction Management*

Dr. Afshin Pourmokhtarian is an Assistant Professor of Construction Management at Wentworth Institute of Technology. His research interests are the nexus of climate change, built environment, resiliency, sustainability, and urbanization, as well as safety and risk management and innovative technology such as VR/AR. He has published several peer reviewed journal articles and presented numerous times at national and international conferences on climate change impacts on the Northeastern United States, land use and land cover changes, hydrologic and ecosystem modeling, and the impacts of climate change on construction. He worked as a designer and Project Manager on multiple offshore infrastructures (e.g., breakwater, jetty, etc.) as well as structural steel and concrete buildings. Prior to joining WIT, he was a postdoctoral research associate for four years at Boston University and collaborated on multiple funded projects from NSF, EPA-STAR, MACROSYSTEM, and NEON. He received his Ph.D. from Syracuse University in Civil Engineering, and his M.S. and B.S. in Civil and Environmental Engineering and Civil Engineering from Tarbiat Modares University and University of Tehran, respectively. He is accredited in Leadership in Energy and Environmental Design (LEED). Also, he is an active member of several professional societies such as Construction Management Association of America (CMAA) and New England Chapter, Associated General Contractors of Massachusetts (AGCMA), Ecological Society of America (ESA), and American Geophysical Union (AGU).

*Co-Principal Investigator: John Cribbs, Assistant Professor of Construction Management and Associate Dean of the School of Management*

Dr. John Cribbs is currently the Associate Dean of the School of Management and an Assistant Professor of Construction Management. Dr. Cribbs earned his MArch degree from the Herberger Institute of Design and the Arts and his Ph.D. in Construction Management from the Del E. Webb School of Construction, both located within Arizona State University's flagship campus located in Tempe, AZ. His research focuses on modular design and construction techniques, sustainability of the built environment and more specifically, Building Information Modeling (BIM) workflows for enhanced quality control and labor time utilization for coordinated MEP and specialty trade equipment, from design-to-install, in retrofit environments. Before joining Wentworth, Dr. Cribbs served as a Principal at Green Ideas Building Science Consultants, based in Phoenix where he regularly engaged in BIM workflows for design/constructability/operations analysis, reporting and review with the full spectrum of project stakeholders. He has also taught both undergraduate and graduate level courses in design, construction management and Building Information Modeling at Arizona State University and the Frank Lloyd Wright School of Architecture (Taliesin West). Outside of the classroom, he is engaged with the Associated General Contractors of America (AGC), Massachusetts Chapter's, Virtual Design and Construction Group. Dr. Cribbs has presented on both the national and international stages discussing topics related to modular and offsite construction techniques, BIM and other data-centric design/construction workflows, pedagogical models for training the future of the construction industry and research specific findings that are scalable to the industry at large. He is a Leadership in Energy and Environmental Design (LEED) Accredited Professional (AP) in the Building Design and Construction (BD+C), Interior Design and Construction (ID+C) and Operations and Maintenance (O+M) specialties. Additionally, he holds an accreditation with the Construction Specifications Institute (CSI), as a Construction Documents Technologist (CDT).