# Building Science Education for Buffalo: A University-Community Partnership

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**ABSTRACT**

Buffalo, New York—which has the oldest housing stock in the nation, with 60% of homes built before 1940 (ACS 2019)—faces critical challenges in decarbonizing its residential buildings and enhancing its resilience to climate change. A highly skilled labor force of building professionals and skilled tradespeople is needed to meet statewide goals of advancing climate equity and a just transition, promoting renewable energy generation, and improving building energy efficiency.

A blended academic and workforce training framework developed through a university-community partnership equips students with in-demand skills in building science and high-performance design and construction. Rather than focusing on the training of design professionals in isolation, as is traditional of academic programs, this initiative integrates trades and architecture student training and is developed from shared practice-based training modules using six pre-1940 2-unit apartment homes—a common industrial vernacular style in Buffalo—as a real-world learning tool.

Across four graduate architecture courses at the University at Buffalo, nearly 400 participants gained hands-on skills in Passive House methods, energy modeling, and residential weatherization. In addition, since the summer of 2024, 30 community trainees completed the course at the People United for Sustainable Housing (PUSH) Sustainable Workforce Training Center (SWTC), with 68% securing employment in building trades within six months.

This case demonstrates how university-community partnerships and training programs can bridge gaps in skills and knowledge between design professionals and construction trades to better align design intent and construction practices and provide scalable models for decarbonizing Rust Belt cities like Buffalo, New York.

## Introduction and Problem Statement

An overwhelming majority of construction activity in the United States centers around the existing building stock. However, architecture and planning education typically prepares students for new construction. This gap represents a fundamental failure to ready students for professional practice (Tomlan 1994). This is a failure that carries particular consequences in older industrial cities that have experienced sustained job and population loss over the past few decades (Mallach, A., and L. Brachman 2013). In this context, the dominant professional challenge is retrofitting, rehabilitating, and preserving what already exists. Understanding this need becomes important when considering the preservation of naturally occurring affordable housing (NOAHs) on which low-income residents depend.

Furthermore, energy efficiency projects in Rust Belt cities are often complicated by health issues (e.g., lead exposure) associated with an older housing stock. Buffalo has the oldest housing stock in the United States (ACS 2019). Compounding this issue, much of Buffalo is designated as an Environmental Justice Area (DEC 2020), where these environmental exposures disproportionately impact the well-being of low-income, minority, and refugee communities.

The University at Buffalo (UB) School of Architecture and People United for Sustainable Housing (PUSH) Buffalo developed a joint workforce and university curriculum on the realities of the existing building stock, providing green building education to both university students and residents of Western New York's environmental justice areas. This innovative, experiential learning model prepares trainees for decent, stable, and living-wage employment in energy efficiency and clean technology.

## Training Goals

This training framework seeks to contribute to meeting New York's climate goals, fill gaps in traditional workforce and university education, and address Buffalo's needs.

**NYS Climate Goals.** New York State's Climate Leadership and Community Protection Act (CLCPA) seeks to reduce statewide greenhouse gas emissions by 85% from 1990 levels by 2050, with specific targets to save 185 TBtu from buildings and industrial facilities through energy efficiency and building decarbonization, and electrify one million homes and make another million homes electric-ready by 2030 (New York State).

**Training and Education Gaps.** A skilled and knowledgeable workforce is required to effectively implement strategies to achieve these goals. However, adequate training in energy efficiency, decarbonized building technologies, and construction techniques remains relatively separate from traditional professional and trades education. Furthermore, the pathway to a career in building energy efficiency is typically indirect from many of the same traditional architecture programs.

Architectural education in the US is overseen by the National Architectural Accrediting Board (NAAB), which publishes Program Criteria (PC) and Student Learning Objectives and Outcomes Criteria (SC) that accredited architecture programs must demonstrate. These criteria are broad in scope and do not specifically address energy efficiency. Of the eight PCs and six SCs, energy efficiency can reasonably be included in the four criteria listed in Table 1. The breadth and depth of the required skills and knowledge architects need for licensure can often overshadow energy efficiency.

Table 1. NAAB Program Criteria and Student Learning Objectives and Outcomes

| | |
|---|---|
| PC.3 Ecological Knowledge and Responsibility | How the Program instills in students a holistic understanding of the dynamic between built and natural environments, enabling future architects to **mitigate climate change** responsibly by leveraging ecological, advanced **building performance, adaptation, and resilience** principles in their work and advocacy activities. |

| | |
|---|---|
| SC.4 Technical Knowledge | How the program ensures that students understand the established and **emerging systems, technologies, and assemblies of building construction**, and the methods and criteria architects use to assess those technologies against the **design, economics, and performance objectives of projects**. |
| SC.5 Design Synthesis | How the program ensures that students develop the ability to make design decisions within architectural projects while demonstrating synthesis of user requirements, regulatory requirements, site conditions, and accessible design, and **consideration of the measurable environmental impacts of their design decisions.** |
| SC.6 Building Integration | How the program ensures that students develop the ability to make design decisions within architectural projects while demonstrating **integration of building envelope systems and assemblies**, structural systems, **environmental control systems**, life safety systems, and the **measurable outcomes of building performance.** |

**City of Buffalo Needs.** To adapt older cities to the effects of climate change, substantial investment in existing buildings is required. Cities like Buffalo are grappling with interconnected social, physical, and operational challenges stemming from the loss of economic opportunities and suburban flight, which have led to impoverished communities, reduced housing market demand, and increased abandonment (Mallach and Brachman 2013).

**Theoretical Framework**

Joint curriculum design and collaboration between a university and a community partner offer several advantages for addressing problems that arise in traditional forms of architectural practice related to citizen participation. Sherry Arnstein conceptualized levels of citizen participation from high (citizen control) to low (non-participation) in Arnstein's Ladder of Participation (1969). When assessed through this lens, community engagement in architectural practice typically takes the form of informing or consulting the public. Arnstein argues that this kind of engagement merely fulfills procedural requirements and leaves embedded power structures unchanged (1969). By engaging in a collaborative effort with a community partner, community participation can shift to higher levels of citizen control.

Traditional architecture practice is further compromised in efforts related to sustainable development. Scott Campbell argues that planners—and, by extension, architects—need to negotiate three inherently conflicting goals: economic growth, environmental protection, and social equity (1996). However, because of the mode in which architectural practice works, usually for a paying client, it sits squarely in the economic growth portion of Campbell's Planner's triangle and therefore is part of the conflict with environmental protection and social equity. Figure 1 overlays Campbell's Planner's Triangle with the UB-PUSH training program goals, each aligned with its specific domain. The partnership between UB and PUSH attempts to work outside of the Planner's Triangle to holistically develop a green building and technology workforce in the community.

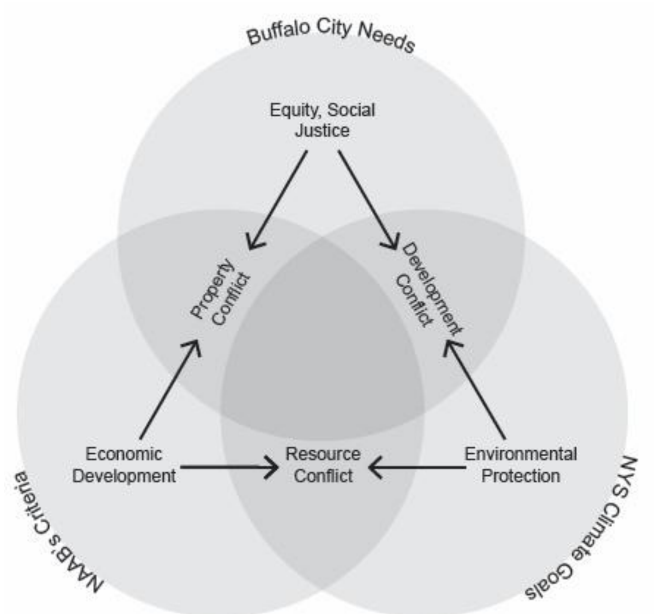


Figure 1. Overlay of Training Goals and Campbell's Planner's Triangle

## The University-Community Partnership

The partnership between UB and PUSH was formalized in 2019 through a Memorandum of Understanding (MOU) to collaborate on promoting equity and climate justice, improving housing energy performance, creating job opportunities, and enhancing education and training for students and local residents. Figure 2 is a logic model that describes the collective efforts and course development with respect to the previously stated training goals. During this time, PUSH was actively designing, building, and funding its Sustainable Workforce Training Center (SWTC), where one of the authors served as an advisor. The SWTC was envisioned to provide space for training local residents and supporting PUSH's energy-efficient community housing goals. While university-workforce center partnerships are not uncommon, the focus on sustainability and green jobs is less common.

With a grant from the New York State Energy Research and Development Authority (NYSERDA) through Program Opportunity Notice (PON) 3981, UB and PUSH purchased tools and equipment and funded stipends for trainees and graduate students for curriculum development in energy efficiency and clean technology. UB faculty and graduate students developed the Residential Energy Efficiency Training (REET) curriculum for local community members. Technology areas included high-efficiency heating, ventilation, and air conditioning (HVAC), water heating, building electrification/heat pump technologies, insulation and air sealing, high-efficiency lighting and controls, building automation controls, smart grid, and energy storage. In parallel with these efforts, UB developed three classes for its architecture students that were directly influenced by the UB-PUSH Partnership. These included a (1) new Passive House design studio and seminar, (2) a new residential weatherization course, and (3) a revised core graduate environmental systems course focused on building performance and energy modeling.

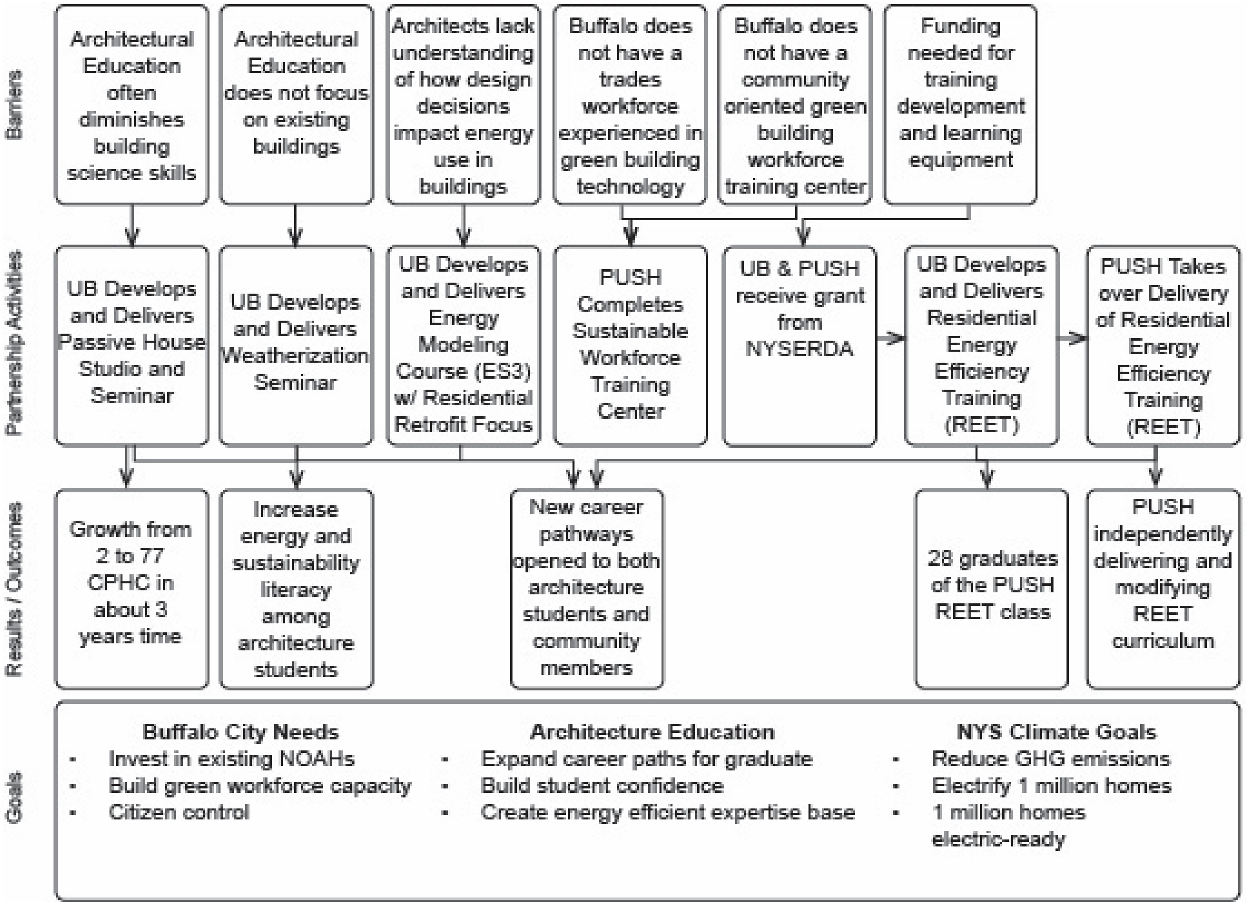


Figure 2. UB-PUSH Partnership Logic Model

## Curriculum Design

In the summer of 2023, funding from the NYSERDA PON 3981 grant was used to pay four graduate students to develop and record lectures, write activities, and build props such as game boards and scale-model houses for hands-on learning. For the Passive House, Residential Weatherization, and REET classes, the learning model was flipped: students watched recorded lectures outside of class and then took a quiz on the material at the beginning of class to hold them accountable. Class time was used for structured activities to synthesize this information. Activities that involved gamification or competition were particularly engaging for students. The curriculum content and delivery method were influenced by the *Weatherization Assistance Program* (WAP), a free federal initiative that helps income-eligible homeowners and renters lower their energy bills and improve home safety, and *Agents of Change,* a U.S. Department of Education funded program led by Alison G. Kwok at the University of Oregon that trained faculty and teaching assistants in architecture programs in building performance.

The REET course curriculum was developed and planned in the summer of 2023 by authors Rajkovich and Lubniewski, and graduate architecture students. The first class was taught in the summer of 2024 by author Lubniewski and a graduate student, Briana Egan, with support from PUSH Staff, Richard Hanaburgh, Workforce and Recruitment Manager, and Catherine Colella, Workforce Development and Recruitment Coordinator. The curriculum was then handed off to PUSH, and the second class was taught in the summer of 2025 by Hanaburgh and Colella. Improvements since 2024 primarily include a more targeted recruiting effort, focusing on participants over 18 who are ready to enter the workforce.

In addition to the REET class, a summary of the four courses discussed is presented in Table 2 below.

Table 2. Overview of Courses Taught

| | Passive House (PH) | Residential Weatherization (RW) | Residential Energy Efficiency Training (REET) | Environmental Systems 3 (ES3) |
|---|---|---|---|---|
| Course Type | Studio or seminar | Seminar | Workforce training | Lecture & lab |
| Instructor | Rajkovich | Rajkovich, Lubniewski | Lubniewski, Egan Hanaburgh & Colella | Heckman & Lubniewski |
| Location | UB | UB | PUSH SWTC | UB |
| # Students | 13-18 | 16-18 | 14 | 52-79 |
| Times taught | 5 | 4 | 2 | 3 |
| Type of student | Graduate architecture students interested in energy efficiency, clean technology, and community engagement | Graduate architecture students interested in energy efficiency, clean technology, and community engagement | Western New York residents from disadvantaged communities and/or priority populations, workers entering the field and/or reskilling/up-skilling existing workers | Graduate architecture students |
| Concepts taught | Passive House certification (CPHC), energy efficiency (EE) and clean technology (CT) for residential buildings, principles of climate leadership and community protection | energy audit, hands-on training and building science skills development, resilience, energy efficiency (EE) and clean technology (CT) for residential buildings, weatherization | Hands-on training and building science skills development, resilience, energy efficiency (EE) and clean technology (CT) | Energy modeling, simulation, building science skills for residential buildings, resilience, electrification |

### Integrative Approach

The working relationship between UB and PUSH produced benefits for students, trainees, and staff. UB Passive House studio students engaged with PUSH staff at several critical points throughout the semester, gaining local knowledge of the community and receiving design feedback for their renovation proposals. UB graduate students expanded their knowledge and skills while developing curriculum for REET and Residential Weatherization. PUSH staff and trainees benefited from access to the developed curriculum and UB staff. Students, faculty, staff, and trainees benefited from NYSERDA funding for equipment, stipends, and fees.

### PUSH Owned Houses as Learning Laboratories

A benefit of the partnership was access to six vacant houses owned by PUSH. These homes were used as learning laboratories for several of the classes. These provided learning opportunities in the studio, for example, allowing students to tour each house, measure it, and document its condition. Students also grappled with the challenges of the urban fabric and density (close proximity to neighbors, fire-protection setbacks, and window placement), as well as with determining whether the structures were worth saving and renovating at all. Discussions were also held about the cost of renovating versus demolishing and building new.

The learning outcomes from the first two studio classes served as resources for a subsequent class: Environmental Systems 3 (ES3). Students in ES3 used the existing drawings and photographs of the six houses as starting points for their final energy modeling group projects.

## Implementation

Table 3 describes when each class was taught and how many times it was taught.

Table 3. Course Timeline

| Year | Semester | Course name | Instructor | Total students | Partner |
|---|---|---|---|---|---|
| 2022 | Fall | PH (Studio) | Rajkovich | 13 | PUSH |
| 2023 | Spring | PH (Studio) | Rajkovich | 17 | PUSH |
| | Summer | (Course Prep) | Rajkovich & Lubniewski | | |
| | Fall | PH (Seminar) | Rajkovich | 18 | |
| 2024 | Spring | RW | Rajkovich | 18 | |
| | Spring | ES3 | Heckman & Lubniewski | 79 | |
| | Summer | REET | Lubniewski, Egan, Hanaburgh | 14 | PUSH |
| | Fall | PH (Seminar) | Rajkovich | 19 | |
| 2025 | Spring | ES3 | Heckman & Lubniewski | 75 | |
| | Spring | RW | Rajkovich | 19 | |
| | Summer | REET | Hanaburgh, Colella | 14 | PUSH |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | Fall | PH (Studio) | Rajkovich | 14 | |
| | Fall | RW | Lubniewski | 16 | Coles House |
| 2026 | Spring | ES3 | Lubniewski | 52 | |
| | Spring | RW | Rajkovich | 12 | Solar Decathlon |

**Passive House Seminar/ Studio**

**Approach to training/content delivery.** The Passive House Studio was conceived by Rajkovich as an urgent call for racial justice following the May 14, 2022, white supremacist attack on the Jefferson Street Tops supermarket in East Buffalo, a predominantly Black neighborhood, that killed ten people and injured three. The studio's broad objectives were to rebuild a world ravaged by three intersecting crises: climate change, racial oppression, and a lack of mutual care. Critical to the goal of the course name, "Green Reconstruction," was collaborating with a community partner, PUSH Buffalo. The UB studio and PUSH worked together to understand how building science principles can be used to repair vacant homes and bring quality housing to neighborhoods impacted by decades of redlining and disinvestment. While other architecture universities such as the University of Oregon, Rochester Institute of Technology, and Rhode Island School of Design offer Passive House training, a studio format and a local organization partnership is unique to the UB model.

To understand the building principles piece, students began the semester by studying and taking the exams for the Passive House Institute of the United States (Phius) Certified Passive House Consultant (CPHC) designation. Through partnership with the New York State Energy Research and Development Authority (NYSERDA), the class had access to the CPHC course materials, the online exam, and the take home exam that tests knowledge by applying it to a design prompt. The Phius Online Exam (45 questions, 3 hours) was administered by Phius, and tested key concepts, principles, and experiences from the Phius training materials. The exam was an open book exam, which encouraged students to take detailed study notes. To pass the online exam, students needed to score at least 57%. Students understood there may be an opportunity for make ups, though they may be charged a fee for this. For the Phius Design Exam, the design prompt was assigned in class and due two weeks later. This was an individual design project of a small residential or multi-family home that needed to meet the Phius 2021 standard. Students completed the design on up to 10 8 ½" x 11" pages, which were submitted to Phius for grading. Students worked collaboratively with the instructor and each other to learn concepts tested on the exam and peer-critiqued each other's design exam drafts. The Passive House Seminar class guided students through the CPHC training, but did not include a community partner or related design project.

**Residential Weatherization Seminar**

The Residential Weatherization Seminar discussed concepts of the house as a system, typical building assemblies, and mechanical systems. Students learned the fundamentals of weatherizing and conducting an energy audit of a low-rise building. Through an energy audit project, students learned to identify problems such as air leakage, moisture issues, and energy consumption in a single-family house.

Topics covered in class included an introduction to weatherization and energy fundamentals, health and safety, weatherization tools and materials, building science basics, attics and roofs, walls, foundations and floors, windows and doors, heating and cooling systems, heat pumps and domestic hot water systems, ventilation and household appliances, and mobile homes and multifamily housing.

**Approach to training/content delivery.** This class followed a flipped classroom format, in which students spent most of their class time on hands-on activities to reinforce concepts learned from pre-recorded lectures by Rajkovich and Lubniewski. These activities included using energy auditing tools, performing a blower door test, and using thermal imaging cameras, which are necessary skills for identifying and addressing problems in a house, such as energy consumption, air leakage, and moisture control issues. The semester-long project was an energy audit of a house, a valuable skill to have as the state shifts to a low-carbon economy. An energy audit is an inspection, survey, and analysis of an existing building to identify strategies for conserving energy or improving efficiency. Energy audits evaluate heating, cooling, insulation, lighting, and appliances, and provide recommendations to address health and safety issues, reduce utility bills, and improve occupant comfort. Both classes stressed the importance of talking with and learning from the home's occupants during the energy audit.

The instructors have experimented with different approaches to the energy audit assignment. In Rajkovich's 2024 and 2025 iterations, students worked in groups and conducted a semester-long energy audit of a house they had access to. This could be a house they lived in, or their parents' house. Site visits were completed outside of class time. Project outcomes focused on proposing energy conservation measures (ECMs) and conducting a cost analysis for the homeowner through simulation using the energy modeling software BEopt. In Lubniewski's 2025 iteration, the entire class conducted a semester-long energy audit of one house: the Robert T. Coles House and Studio. Site visits to the house were completed during class time. Groups of three to four students were formed within the class, and each group focused on a specific topic or location in the house, resulting in greater depth of understanding but less breadth. This house had some historic preservation considerations, and the project outcomes focused on discussing the constructability of ECMs, proposing envelope detail options to the client, and less on energy modeling and simulation. In Rajkovich's current 2026 iteration, the students are focusing on improvements to the 2015 UB Solar Decathlon prototype house.

**Technical skills developed through projects.** In each version of the class, students developed technical skills that will serve them in potential careers as architects, building scientists, and energy auditors. Over the semester, the energy audit project was divided into six phases: Visual Inspection, Health and Safety, Envelope, Systems, Baseload, and Conclusion and Recommendations. Students learned different skills in each phase, such as measuring and drawing existing conditions, systematically documenting using photographs and thermal cameras, using smoke pens to identify air leakage, developing a holistic plan or approach to improve the house, drawing proposed changes in detail drawings, and running simulations using

BEopt software. Students practiced using the blower door test during prior class demonstrations and, in some instances, for their energy audits.

Beyond technical skills, students were also coached in soft skills to give them confidence in interacting with clients or homeowners with respect and professionalism. Students also practiced verbally and graphically communicating technical concepts in ways that were understandable to homeowners who may lack knowledge of building science. Final presentation audiences included industry experts, other faculty, homeowners, and community members.

**Environmental Systems 3 – Energy Modeling**

**Approach to training/content delivery.** Environmental Systems 3 is the terminal course and a sequence of required courses for Architecture students at the University at Buffalo. Students typically take the class in their first year of graduate school. For the first two years, the course was co-taught by two instructors and one teaching assistant; in the third year, it was taught by one instructor with two teaching assistants. This class was divided into two sequences. The first focused on energy modeling skill-building and energy literacy through a series of lab activities, accompanying lectures, and readings. These labs allowed students to learn the BEopt modeling tool, work through various modeling scenarios, explore the relationships among design, technical development, and energy use, while becoming familiar with modeling data inputs and outputs. The second half of the courses centered on a group synthesis project in which students designed a residential building and thought through design and energy decisions simultaneously. Lectures during this phase took the form of guest lectures by professionals working in energy efficiency, energy modeling, and sustainability in buildings, exposing students to alternative career paths for architecture graduates.

**Technical skills developed through projects.** The technical skills developed beyond energy modeling in BEopt included skills in building assemblies, data management, analysis, and representation. Students learned how to manage climate and energy data in Excel and produce graphs and charts to clearly communicate energy and climate information. Students were also able to understand the energy impacts of their design decisions and learned how to read cut sheets for different insulation materials to support product selection. Students also had to translate their energy model envelope inputs into realistic wall assemblies and consider constructability.

**Residential Energy Efficiency Training – Workforce**

**Approach to training/content delivery.** The REET class is six weeks long and meets for 30 hours a week. There were no assignments outside of class time. Classes were held at the PUSH SWTC. Field trips, walking tours, and site visits were also part of the curriculum. The REET class taught at PUSH SWTC used the same pre-recorded lecture videos as the Residential Weatherization class. The 50-minute videos were shown in class and were followed by a guided discussion. Conversation, dialogue, and references to local building and neighborhood examples they could see in person were more effective than a traditional lecture-and-slides format alone. Topics that were introduced in lectures were expanded upon in a corresponding activity. In addition to concepts in residential energy efficiency, each week on “Motivation Monday,” students received training in practical job-getting skills, including using the Microsoft Office Suite, resume and cover letter writing, and mock interviews.

There were two instructors delivering content, taking turns leading different pieces, while the other instructor would provide one-on-one guidance to students needing more help. At times, more than two instructors were needed to help the class run smoothly due to complex activities, travel logistics, or the need for more one-on-one instruction.

**Technical skills developed through projects.** Technical skills developed through projects included practice using tools in energy efficiency and clean technology, such as the blower door, smoke pens, and thermal cameras. Other technical skills learned included construction-related math, measuring and hand-sketching a building's existing conditions, and using a tape measure. Students also learned computer and presentation skills by creating a PowerPoint slide presentation of their energy audit project and verbally presenting their findings to an audience.

## Outcomes & Lessons Learned

To date, the classes have had 380 students enrolled, though not all of them were unique students. Most of these were UB graduate architecture students. One was a faculty member, and two were PUSH staff being trained to teach their REET class. The REET has been taught twice (Summer 2024 and 2025), with 14 students in each class. The target demographic recruited by PUSH for the REET was local residents from Disadvantaged Communities (census tracts identified by New York’s Climate Act) and Priority Populations as defined by NYSERDA.

### Passive House Classes

To date, 73/75 of students received their CPHC designation. Additionally, UB has had three additional faculty earn their CPHC. Graduates of the program have since leveraged their CPHC designation to secure employment at firms specializing in Passive House services, including River Architects in Cold Spring, NY, and Sustainable Comfort in Syracuse, NY. Other CPHC graduates have found employment at traditional architecture firms, where they have received technical training or been entrusted with tasks that junior staff would not normally handle. Others are working in architecture-related settings, such as CannonDesign Facility Optimization Solutions (FOS), a multidisciplinary professional services and software consultancy that provides facility assessments, capital planning, asset tagging, and cost estimating. The class may have expanded students’ understanding of career opportunities or destigmatized non-traditional or architecture-adjacent career paths. For example, a top student with a great job offer from a leading local architecture firm chose to work at an HVAC engineering office instead. Students learned that they could have successful and rewarding careers in energy efficiency.

Instructors believe that the CPHC designation gives students confidence with technical issues in architecture early in their careers. The CPHC design exam and the Passive House Studio design project synthesize key concepts. The flipped classroom model allows for more hands-on learning and poses questions that challenge students’ knowledge.

**Studio vs. seminar format.** Student engagement was higher in the studio format than in the seminar format. Students communicated that having a project and a client to apply their passive house concepts to offered a more meaningful and engaging experience. When comparing the studio and seminar formats, student grades on the Phius CPHC online exam were higher in the seminar format than in the studio format. Students in the seminar treated the class more as a means of studying for the CPHC exam, whereas students in the studio knew they were also being evaluated on design work for the studio project.

**CPHC curriculum.** In both formats, it was clear that the existing Phius CPHC curriculum is intended for professionals and not designed for the university classroom, in both format and content. The instructor attempted to fill in the gaps with supplemental class activities and discussion. Most graduate students lack the professional experience assumed by the Phius curriculum. In an attempt to remedy this, the authors submitted a grant proposal with NYSERDA to create a supplementary college-level curriculum, but the proposal was unsuccessful. Meanwhile, Phius is internally working on revisions to the professional curriculum. The authors await Phius's updated iteration.

**Explosion of student interest.** The most telling sign of success in both the seminar and studio is that Dr. Rajkovich has never offered a class with more interest. Student demand exceeds class capacity. There is an unofficial two-year waitlist for students interested in taking the class.

**Community partner as client.** One benefit of teaching a class with PUSH as the client is that it changes the traditional professor-student relationship and power dynamic. Instead of trying to please their professor or earn an "A," students were motivated to meet their client's needs and saw their professor as a coach who guided and facilitated learning. If student effort did not meet the professor's expectations, the professor could ask, "Is that something you want to put in front of the client?"

**Incorporating credentials in the course**. The external CPHC exam fostered a coach-and-team dynamic, as the students were not graded by the professor but by an external entity. The financial opportunity provided by NYSERDA, paying the $2400 exam fee, was motivating for students, who knew that if they took the exam after graduating, they would need to self-fund the fee or find an employer who would do so.

**Environmental Systems 3**

**Students overemphasize software.** A lesson learned from teaching ES3 was that students overvalue learning software. Feedback from students has commonly requested the desire to learn additional energy modeling software beyond BEopt. The faculty have taken the approach of explaining to students that an important outcome of the class is not mastery of software but proficiency in understanding building performance concepts and metrics, and that this proficiency can be leveraged in any software in the future.

**Excel.** A surprising lesson was how few students had ever used Microsoft Excel. Many students said they had never used it, but after using it to manage model outputs and climate data, they had begun using it for assignments in other classes.

**Acted as a feeder class.** As a required course for all graduate students at UB, the ES3 course provided an opportunity to promote the Passive House and Weatherization courses. The 2024 iteration of the course focused on the six PUSH houses students in the original PH course investigated as part of their studio. Students in ES3 were provided existing condition documentation developed by the PH course in prior semesters and were directly exposed to Passive House concepts. The 2025 iteration of the ES3 focused on new construction across various climate zone, but incorporated  Passive House concepts at a very introductory level through guided modeling iterations of envelope assemblies In both versions of the course, class discussions often gravitated to PH concepts, providing instructors with the opportunity to encourage students who expressed interest in furthering their knowledge of building science and high-performance design to seek out either the Passive House or the Residential Weatherization course.

**REET Class**

To date, 68% of students who completed the REET class found placement within six months.

**Training audience appropriateness.** A key takeaway was that the curriculum was not designed for students under 18. The summer 2024 class had a handful of high school-aged students, ages 15-17, recruited from the Mayor's Summer Youth Program, who were unable to keep up with the older trainees or lacked the maturity and seriousness to meaningfully engage with the curriculum. They were sometimes disruptive to the other students' learning. Additionally, some recruited students were not interested in the subject matter or in finding a job in the field, which made engagement difficult.

In response to lessons learned from the summer 2024 training, several changes were made. Trainees recruited for the summer of 2025 were mostly over 18, with one 17-year-old, and the majority were aged 30-45. Improving on recruitment methods, PUSH partnered with the Center for Employment (CEO) in Buffalo, an organization that provides immediate, effective, and comprehensive employment services exclusively to people recently released from incarceration (Center). Eight trainees spent six weeks with PUSH and two weeks with the CEO, completing their pre-apprenticeship program. These trainees benefited from resources and support from both organizations and quickly found employment in the trades after completing the programs.

**Meaningful and community-oriented projects.** During the first training in 2024, the final energy audit project was modified to meet the students where they were, with a scope of work that excited them. For example, one student was not interested in conducting an energy audit of the UB Solar Decathlon house but became highly motivated when instructors reframed the assignment to focus on his own house, which would provide quality-of-life improvements for him and his family.

Because PUSH is also a property manager, in the Summer 2025 REET course, they had access to four rental units within walking distance of the SWTC that students used for the energy audit project. Working on units in the community was more convenient and meaningful for the trainees than working on the UB Solar Decathlon House used in 2024.

**Training duration.** The initial eight-hour learning day was too long for the energy levels of both trainees and instructors. Learning new concepts, often technical in nature, or using math was often too mentally strenuous for an eight-hour day, especially for trainees not used to that schedule. Additionally, including 50-minute videos in the course made teaching easier for instructors; however, many students struggled to maintain focus or interest for that length. During the second offering of the course, the six-week model was kept, but the 30-hour week (plus lunch breaks) was adjusted to Monday through Thursday 8:30 am-4:00 pm and Friday 8:30-12:30. The shorter days were more manageable, and the half-day Friday still allowed time for students who missed class to make up time Friday afternoon. The shorter days also built time into the schedule for instructors to prepare, such as printing tasks, and to debrief on or modify lesson plans as needed before and after the scheduled class time.

**Training adaptation.** Since PUSH took control of the REET, the curriculum has remained largely unchanged. However, in the summer of 2025, REET incorporated the Occupational Safety and Health Administration (OSHA) 10 training to better prepare trainees for future jobs. Trainees who already had this training were given alternative tasks. Building on the job-readiness skill-building of 2024, additional efforts were made to help students envision careers and understand the opportunities available in the clean energy field. Instructors brought professionals and tradespeople to the SWTC to talk about their jobs and career paths and helped trainees map out pathways from entry-level to advanced positions, using the Green Buildings Career Map.

**Need for wraparound services.** Critical to the trainees' success were wraparound services and instructors who could connect with individuals on a personal level. Trainees need support in other parts of their lives, such as transportation, child care, and managing court dates. PUSH was able to provide free bus passes to trainees who needed them and refer them to people and services within PUSH that could help them, for example, find food-insecurity resources, free clothes for their family, or an after-school program their children could attend.

## Conclusions

By engaging with a community partner, a university can expose students to ideas that build a more community-centered architecture community. These experiences show students that their design skills can be in the service of a community rather than a profit. Through a collaborative approach, in which community feedback drives design decisions, the studio situates itself within the citizen-control portions of Arnstein’s Ladder and begins to draw in design professionals beyond the Campbell planners' triangle to achieve more effective, community-driven, sustainable solutions.

### Recommendations for Other Cities

This model is replicable in other cities. The following are key:

**Funding.** Funding from NYSERDA for curriculum development and the purchase of tools and equipment, such as blower doors, data loggers, and thermal cameras, was critical to securing the resources needed to create the hands-on curriculum.

**Partner with a community organization.** An established partnership with an organization embedded in the community, like PUSH, is required for replicability. When approached correctly, the community organization can gain access to technical expertise, and universities can work with the community partner to develop real-world learning scenarios for students.

**Dedicated community training space**. Having a workforce training space that is large enough and equipped with the right resources to host classes and trained instructors is also critical. As part of the planned handoff of the class from UB to PUSH, PUSH's two instructors completed UB's Residential Weatherization class before teaching the REET class in 2025.

**CPHC training financial barrier.** Currently, the fee for taking the Phius CPHC training is $2,400 per applicant. This is a significant barrier for students and professionals alike. Finding funding to help offset this cost for students is helpful in making this credential more accessible.

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AI-assisted Tools Disclosure
AI-assisted tools used: [Claude.AI, Grammarly]
Used for: [Paper outlining, thought organization, editing].
Extent: [outline generating, organizing meeting notes and discussions, light editing].
Human review: The authors reviewed and verified all content, calculations, and citations.