Building Materials for Energy Efficiency: Adaptable Educational Modules

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Scope of Work

This project serves to educate students at Iowa's post-secondary institutions through the development of educational modules that will cover building materials and their use in the building envelope for improved energy efficiency in the residential and commercial building sectors. This will be achieved by addressing a range of necessary topics, including (1) materials, both conventional and emerging, used in building envelopes; (2) a fundamental understanding of the roles of the building envelope and its impact on building energy performance; and (3) best practices for the design and construction of building envelopes. Successful completion of this course will provide students with both "fundamental" and "practical" knowledge needed to effectively apply energy efficiency strategies not only for improving the existing buildings, but also for designing a new generation of buildings that will promote craftsmanship, sustainability, and resilience in the state of Iowa. Considering the interdisciplinary nature of the subjects that will be discussed in the course, it is expected that it will appeal to students in fields such as civil, mechanical, construction, environmental, and materials engineering; materials science; and construction and architectural technologies. Given the affiliations of (i) PI Shafei to the ISU's Department of Civil, Construction and Environmental Engineering (CCEE) and Department of Materials Science and Engineering (MSE), (ii) Co-PI Cetin to the ISU's Department of Civil, Construction and Environmental Engineering (CCEE) and Department of Mechanical Engineering (ME), and (iii) Co-PI Greathouse to the KCC's Department of Construction Management (CM) and Architecture, Construction, and Engineering (ACE) Academy, we anticipate to have a direct access to a diverse pool of approximately 750 ACE Academy students, 300 KCC students, and 250 ISU students. The Energy Systems program at ISU has also been supportive of including the proposed course in their curriculum (see letter of support). With flexibility designed into the educational modules, the instructors from the other universities and community colleges in Iowa will also be able to adapt the course in such a way that it fits the requirements of their respective programs and the background of their students.

The educational modules will be delivered in a variety of digital formats, allowing for easy dissemination and wide distribution. The course materials will include PowerPoint presentations, video recordings, handouts, website links, journal and review articles, and simulations for visualization. The course will also benefit from an extensive set of hands-on activities. One of the planned activities is to use the Mobile Diagnostic Lab, which can be conveniently moved to the location of instruction. This is a unique facility to conduct the tests to evaluate various building envelope materials' performance. In addition, field trips and seminars will be organized to make the students familiar with the state-of-the-practice and provide them with the points of contact for future engagement with professional practitioners in the state of Iowa. For the implementation of this course in other locations, a list of local contacts will be developed enabling other institutions to plan their own hands-on activities and field trips.