Speaking Up: Conservation-Based Design-Build as Policy Maker

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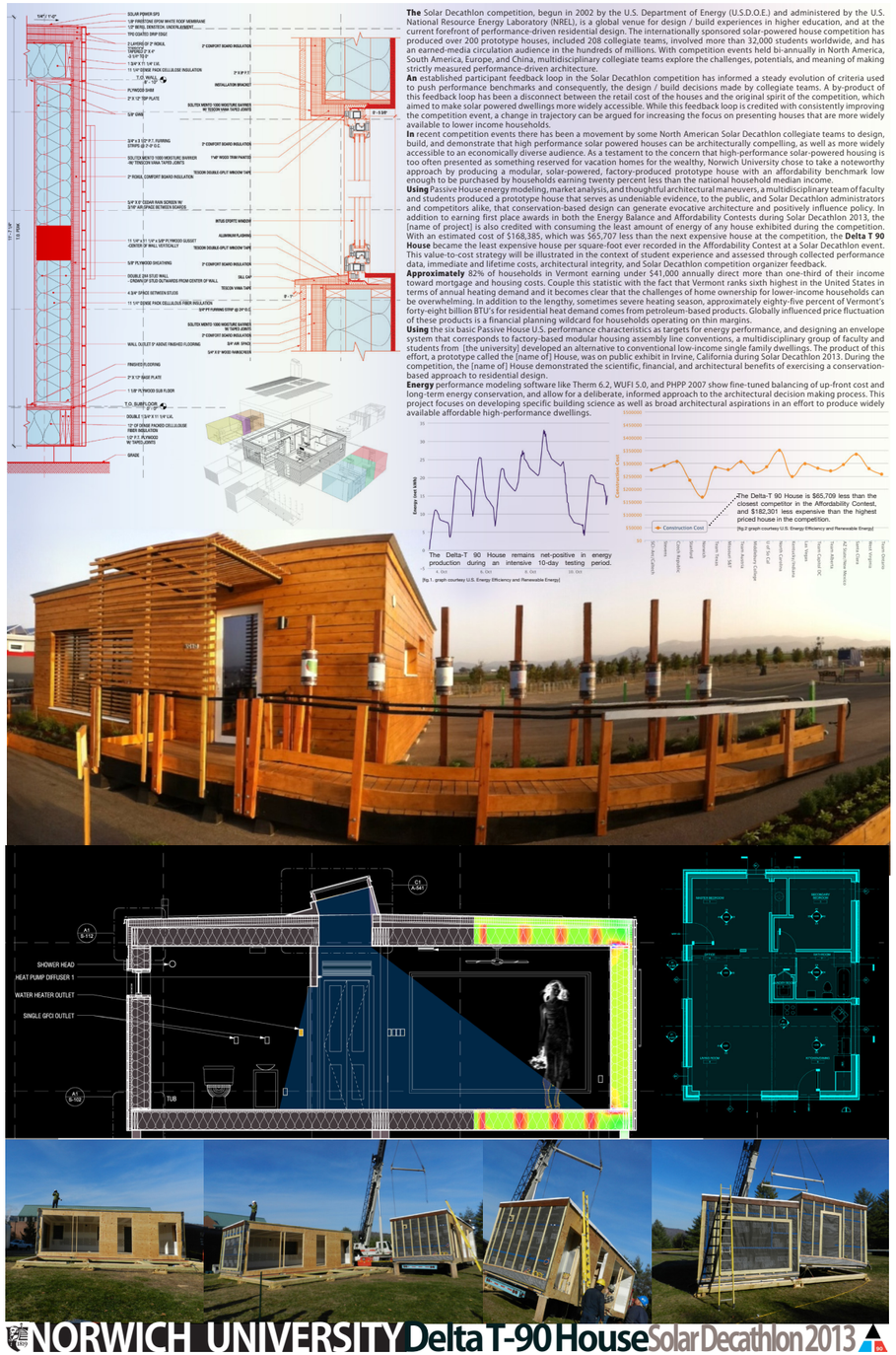
The Solar Decathlon competition, begun in 2002 by the U.S. Department of Energy (U.S.D.O.E.) and administered by the U.S. National Resource Energy Laboratory (NREL), is a global venue for design-build experiences in higher education, and at the current forefront of performance-driven residential design. The internationally sponsored solar-powered house competition has produced over 200 prototype houses, included 208 collegiate teams, involved more than 32,000 students worldwide, and has an earned-media circulation audience in the hundreds of millions. With competition events held biannually in North America, South America, Europe, and China, multidisciplinary collegiate teams explore the challenges, potentials, and meaning of making strictly measured performance-driven architecture.

An established participant feedback loop in the Solar Decathlon competition has informed a steady evolution of criteria used to push performance benchmarks and consequently, the design-build decisions made by collegiate teams. A by-product of this feedback loop has been a disconnect between the retail cost of the houses and the original spirit of the competition, which aimed to make solar powered dwellings more widely accessible. While this feedback loop is credited with consistently improving the competition event, a change in trajectory can be argued for increasing the focus on presenting houses that are more widely available to lower income households.

In recent competition events there has been a movement by some North American Solar Decathlon collegiate teams to design, build, and demonstrate that high performance solar powered houses can be architecturally compelling, as well as more widely accessible to an economically diverse audience. As a testament to the concern that high-performance solar-powered housing is too often presented as something reserved for vacation homes for the wealthy, [University Name] chose to take a noteworthy approach by producing a modular, solar-powered, factory-produced prototype house with an affordability benchmark low enough to be purchased by households earning twenty percent less than the national household median income.

Using Passive House energy modeling, market analysis, and thoughtful architectural maneuvers, a multidisciplinary team of faculty and students produced a prototype house that serves as undeniable evidence, to the public, and Solar Decathlon administrators and competitors alike, that conservation-based design can generate evocative architecture and positively influence policy. In addition to earning first place awards in both the Energy Balance and Affordability Contests during Solar Decathlon 2013, the [name of project] is also credited with consuming the least amount of energy of any house exhibited during the competition. With an estimated cost of $168,385, which was $65,707 less than the next expensive house at the competition, the [name of project] became the least expensive house per square-foot ever recorded in the Affordability Contest at a Solar Decathlon event. This value-to-cost strategy will be illustrated in the context of student experience and assessed through collected performance data, immediate and lifetime costs, architectural integrity, and Solar Decathlon competition organizer feedback.



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Approximately 82% of households in Vermont earning under $41,000 annually direct more than one-third of their income toward mortgage and housing costs. Couple this statistic with the fact that Vermont ranks sixth highest in the United States in terms of annual heating demand and it becomes clear that the challenges of home ownership for lower-income households can be overwhelming. In addition to the lengthy, sometimes severe heating season, approximately eighty-five percent of Vermont's forty-eight billion BTU's for residential heat demand comes from petroleum-based products. Globally influenced price fluctuation of these products is a financial planning wildcard for households operating on thin margins.

Using the six basic Passive House U.S. performance characteristics as targets for energy performance, and designing an envelope system that corresponds to factory-based modular housing assembly line conventions, a multidisciplinary group of faculty and students from [the university] developed an alternative to conventional low-income single family dwellings. The product of this effort, a prototype called the [name of] House, was on public exhibit in Irvine, California during Solar Decathlon 2013. During the competition, the [name of] House demonstrated the scientific, financial, and architectural benefits of exercising a conservation-based approach to residential design.

Energy performance modeling software like Therm 6.2, WUFI 5.0, and PHPP 2007 show fine-tuned balancing of up-front cost and long-term energy conservation, and allow for a deliberate, informed approach to the architectural decision making process. This project focuses on developing specific building science as well as broad architectural aspirations in an effort to produce widely available affordable high-performance dwellings.