



HouseZero: A First-of-its-kind, Ultra-efficient Retrofit

Harvard Kennedy School Energy Policy Seminar Series, Fall 2017

Monday, October 30, 2017

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Just how much energy efficiency can you gain in a house retrofit? The Center for Green Buildings and Cities at Harvard's Graduate School of Design is attempting to answer this question with a retrofit of a pre-1940's Cambridge house, aiming to minimize energy use while complying with Cambridge's requirements for preserving the look of the exterior of the original house. The idea, Malkawi explained, is to demonstrate what can be done, working with "one of the most challenging building types—existing homes—to achieve ultra energy efficiency."

Professor Ali Malkawi, Founding Director of the Harvard Center for Green Buildings and Cities, explained that this project fits with the Center's overall intention to move away from engineering dominated discussions towards design-driven solutions.

Malkawi outlined the key elements of the retrofit. The first efficiency upgrade, Malkawi explained, is "daylight autonomy." "If you know what you are doing," Makawi said, "you should not be using electrical light during the day." Secondly, the house is being re-designed to maximize natural ventilation, using specially designed windows. Heating and cooling will rely on this ventilation, along with thermal mass heat retention, and supplemented by a ground-source heat pump. Photovoltaic panels on the roof, in combination with storage batteries, are expected to make the house independent of the grid for up to three days at a time; however, some use of grid energy is expected to be needed, since battery storage capacity is limited by the available space. On a net basis, the house is expected to produce more electricity than it consumes.



None of this comes free, Malkawi acknowledged. However, the intention with this project is to demonstrate what can be achieved with existing technologies, some of which may be (or eventually become) cost effective for owners of existing homes.

One of the features of the project is the inclusion of extensive monitoring equipment to track the actual performance of the house. The intention is to commit to a year of operation of the house as retrofitted, measuring actual energy usage, temperature, and other factors, without changing any systems. After the first year, the house may be used to test additional energy efficiency technologies, and the existing technologies in use may be fine-tuned. The final building will include dedicated lab space for testing new energy efficiency technologies.

Malkawi spoke as part of the Kennedy School's Energy Policy Seminar Series, which is sponsored by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government.