

SOLAR DECATHLON V

4D Home¹¹

TEAM MASSACHUSETTS

This free-standing superstructure—an external frame—supports solar panels, acting as an upgrade for new or existing homes.



Homeowners adding solar PV or thermal systems are often stymied when they discover that their home's roof is not strong enough to support panels, or faces the wrong way for optimal performance. Plus, every roof penetration is an invitation to spring a leak.

Massachusetts College of Art and Design and University of Massachusetts at Lowell joined forces to become Team Massachusetts. The team developed a free-standing superstructure (they called it a trellis), which provides PV/thermal panel support—offset from the home structure—and shading for the home.

TEAM: Team Massachusetts has 56 members, including Spencer Culhane, Architecture and Project Manager/Primary Student Contact. Team Web site: <http://4dhome.us/team/>

4D Home's exoskeleton of reclaimed wood beams supports PV and hot water systems, and also shades the roof. This system could also solve problems on existing homes, such as poor solar orientation, leaks and inadequate roof structure to support PV.

Designed to meet passive house standards, 4D has both blown-in fiberglass and closed cell polyurethane spray-foam insulation. R-values are high: R-56 in walls, R-57 in floors and R-64 in the roof.



Bookcase crossing. A movable bookcase slides easily to reconfigure the home's interior space.

This completely eliminates worries about weight or orientation or leaks. Done right, the structure also adds architectural interest to homes—existing or new. As an operating bonus, adding air space under

PV panels helps them run cooler and more efficiently.

The 945-sq.-ft. 4D Home boldly asserts solar creds in contrast to Purdue's similarly-sized but deliberately understated

GREEN FEATURES

- > **Superstructure.** This framework overtopping the home supports and ventilates solar panels, shades the home and minimizes the potential for roof leaks.
- > **PV Panels.** The home has a 28-panel PV array of mono-crystalline silicon cells.
- > **Solar Hot Water.** Hybrid-solar hot water collectors attach to the back of the PV panels and capture the panels' excess heat. Heated water collects in the solar hot water tank to provide 90% of domestic hot water.
- > **Super Insulation.** A combination of fiberglass and closed-cell polyurethane spray foam insulation result in R-56 walls, an R-57 floor and R-64 roof.

MARKET STRATEGY

The 4D Home is a 945-sq.-ft., two-bedroom New England design for a family of three (mid-thirties couple

with young child) and \$100,000 annual household income.



A second sliding wall creates a flex space from grand dining to more intimate dining. It also creates a transition between a bedroom and home office.

INhome. Both two-bedroom homes are relatively affordable, 4D Home coming 4th in *affordability*, at estimated costs of just under \$268,000. Similarly, the two homes were also close in *market appeal*, with 4D fourth and INhome fifth among the 19 contestants.

4D Home employs a combination of fiberglass and closed-cell polyurethane spray foam insulation to achieve R-56 walls, an R-57 floor and R-64 roof. The home is so tight that it achieves 0.6 air changes per hour (ACH) at 50 pascal (Pa). To maintain healthy air exchange, a heat recovery ventilator (HRV) brings in fresh air, while recapturing as much as 85% of the exhausted air's thermal energy. Team Massachusetts did not achieve net-zero status during competition, but the team did take second place in the *energy balance* category.

The 4D structure also presents creative combinations of solar technologies. Hybrid-solar hot water collectors bootstrapped to the back of the PV panels capture the PV panels' excess heat. This double-solar heated water



(collected in the solar hot water tank) provides 90% of the domestic hot water.

Inside, opening or closing two central partition walls easily reconfigures the home. Open the walls to create expansive space for family celebration. Close them up to create more private spaces. The two bedrooms can be easily reconfigured to one bedroom with a home office. **GB**

DIGITAL ASSETS

- > Project Manual www.solardecathlon.gov/past/2011/pdfs/mass_manual.pdf
- > Construction Drawings www.solardecathlon.gov/past/2011/pdfs/mass_cd.pdf
- > Menu and Recipes www.solardecathlon.gov/past/2011/pdfs/mass_menu.pdf
- > Engineering Presentation (docs) www.solardecathlon.gov/past/2011/pdfs/2011_engineering_mass.pdf

Video Links

- > Video Walkthrough www.youtube.com/watch?feature=player_embedded&v=YEH1dAm4DEI
- > Architecture Presentation www.solardecathlon.gov/videos_team_architecture.html#mass
- > Engineering Presentation www.solardecathlon.gov/videos_team_engineering.html#mass
- > Sales Presentation www.solardecathlon.gov/videos_team_sales.html#mass

FOR CLICKABLE URL LINKS, GO TO WWW.GREENBUILDERMAG.COM/DECATHLON