

University of Maryland

The name of Maryland's LEAFHouse connotes nature's solar collector—the leaf—as well as being an acronym for the number one project goal that emerged early during the team's branding process: “Leading Everyone to an Abundant Future.” The team's three intertwined goals are to advance sustainable design and construction, use nature as inspiration and mentor, and demonstrate that solar technology is practical for everyday life. In the team's view, the project: equates to a high quality of life with a light touch on nature; embraces the Chesapeake Bay watershed for a smart, adaptable home that is united with its context; demonstrates what happens when bio-inspired design savvy, traditional know-how, and cutting-edge technology join as integral parts of a sustainable lifestyle; and changes the rules of how buildings are designed and built, so that everyone can live in an efficient solar house such as this one.

What's Different?

- The team has extended the design to larger houses, aggregated into communities as a “Sears House” for the 21st century, made to order. Building 500 LEAFHouses powered by the sun is equivalent to removing about 570 cars from the road or planting about 870 acres of trees. The dimensions are rationalized to take advantage of standard material sizes. The houses are factory-built for the highest quality and to minimize waste.
- In Maryland, humidity is high in the summer. The home's dramatic liquid desiccant waterfall feature removes humidity with very little energy, greatly reducing the job of the air conditioner. Calcium chloride, a highly absorptive material, is mixed into the waterfall, where it captures moisture from the air.
- The Smart-House/Adaptive Control (SHAC) system saves energy the easy way by working with the homeowner to run the household. Sophisticated computer controls monitor energy production, internal needs, and external factors such as weather, to maximize energy efficiency.
- A grey-water filtration and irrigation system conserves precious water. Rainwater is collected from the roof, filtered by the green wall, and used to irrigate the garden. Grey water is collected from the sink, shower, and washing machine and is filtered and stored for use in yard maintenance or car washing.
- A drain-water heat recovery system recovers energy from water that runs down the shower drain, which can be used to preheat cold water going to other fixtures.
- The structure and daylighting strategies are joined in an integrated solution, with a central “stem” or spine providing daylight for the length of the house. All of the fixtures, including LED lamps, are wired to a Lutron Grafik Eye 3000, a centralized and zoned dimming and switching system that permits flexible lighting control as well as finely tuned adjustment.

Architecture, Interior Comfort

- The interior is connected to the outdoors and ties to the surrounding environment, both visually and physically. Engineering, architecture, and site design are interlinked: desiccant regenerators, solar power inverter, and condenser all help to shape the interior and exterior spaces.
- The house and site are conceived as a system and linked through water management. The “building-integrated storm water management system” is a vertical rain garden on the south side of the house.
- Transformability is built into the design, which allows the house to expand based on changing needs of homeowner. The space can be discrete for privacy or expansive for entertaining. Clever built-ins and furnishings maximize space. The house is also transformable to larger models and a variety of communities and lifestyles.

Heating and Cooling Systems

- The team followed the principle of “build tight, ventilate right.” LEAFHouse is insulated with 5.5 inches of soy-based spray foam insulation, installed with a blowing agent that is free of hydrochlorofluorocarbons.
- An energy recovery ventilator exchanges stale, interior air for fresh, outdoor air and saves energy by preserving indoor temperature and humidity levels.
A ductless, mini-split air-conditioning system has a SEER of 16.5, providing highly efficient cooling and dehumidification when needed. Its refrigerant is ozone-friendly R410a.
- A hydronic radiant floor heating system warms LEAFHouse. It is installed in Warmboard, a pre-routed plywood subfloor system that allows a faster response time in Maryland's mixed climate.

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Lighting (including Daylighting)

- LEAFHouse is naturally lit through a 22-foot expanse of glass on the south side of the house and a translucent polycarbonate ridge skylight that runs the length of the house. Louvered doors allow winter sun to be admitted and summer sun to be screened out.
- SHAC, LEAFHouse's smart house system, continually monitors interior lighting levels and responds to environmental conditions by balancing electric lighting with natural light.
- Electric light is produced using two of the most efficient sources available on the market: fluorescent and LED lighting.
- For lighting control, all of the fixtures are wired to a Lutron Grafik Eye 3000, a centralized dimming and switching system that permits flexible lighting control as well as finely tuned adjustment.

PV and Solar Thermal

- Both the solar electric and solar thermal arrays are mounted on a custom, flexible "industrial erector set" aluminum racking system that sits 9 inches above the roof surface at the same angle as the roof.
- At the heart of LEAFHouse is a sophisticated 7.1-kW PV power system using Sanyo HIP modules. The components of this 34-panel system will generate about 770 kWh per month.
- Apricus solar water heating tubes provide all the hot water for the house, including the hot water for the radiant floor.

Communications

- The Maryland team has taken advantage of its proximity to the competition site to magnify the impact of its entry and all the teams' efforts, and to showcase the competition's broader goals through outreach in the D.C. area, which is home to many trade, professional, industry, and regulatory agencies.
- LEAFHouse team members are "storming" Congress for a Lobbying Week. Meetings were conducted with the staff members of nearly a dozen House representatives on Capitol Hill.
- LEAFHouse is hosting visits from the Maryland Senate and House committees on the environment, in order to inform legislators about the goals of the competition, share the passion of the current and next generation of leaders, and to help change the (regulatory) "climate" for alternative energies and sustainable design construction.
- The LEAFHouse team has used its Web site (www.solarteam.org) as a venue to display its process, teach the public, and be a resource for the industry.

Budget

- Construction cost for LEAFHouse 800 (the competition model) is estimated at \$228/square foot for the 800-square-foot version, including decks. In the target region for the home, the Chesapeake Bay region, the cost for LEAFHouse1600 (the "starter model") is estimated at \$216/square foot, including decks.
- A Solar Decathlon house is similar to a Formula One racecar. It is the testing ground for many architectural and engineering innovations. The team's analysis shows that through the modularization and mass production of the house in many forms and settings, the house will cost \$180/square foot.

Future Plans

- LEAFHouse will return to the University of Maryland campus to house a local professional industry group as an educational demonstration house for the campus, academic, professional, and lay communities.

Kid's Corner

- The LEAFHouse tour will include interactive experiments to help kids learn and understand solar power, dehumidification, and photosynthesis.

Team Information

Web site: www.solarteam.org

Contact: Amy Gardner, AIA, LEED, turbine@umd.edu