

## Overview

- Affordability
- Transportability
- Constructability
- Adaptability
- Durability
- Sustainability

Our Team synthesized the concepts listed to the left to create the MorningStar Home as a “house next door” prototype that can be fully integrated into the character of any community.

The MorningStar Home addresses the requirements to sustain life in a three part approach:

- 1.Living Space** – Heart of the Home – an open plan bathed in natural light in strategic locations; contains the dining/living room and bedroom.
- 2.Technical Core** – Brain of the Home – contains mechanical, kitchen, and bath systems.
- 3.Breezeway** – Lungs of the Home – the area for movement based on its axial east/west orientation between the Technical Core and the Living Space; contains the entry way

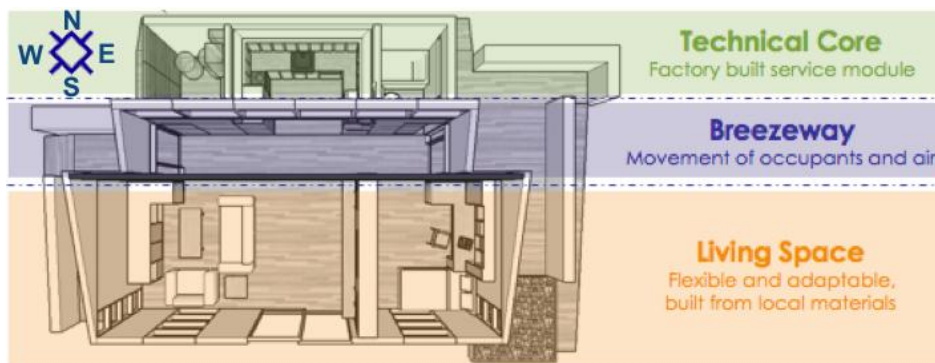
## Design

The MorningStar House addresses sustainability in two ways:

- 1.Economies of Scale:** the Team designed its Technical Core as a prefabricated standard module intended to be mass-produced and shipped to any location.
- 2.Ecological Footprint:** the Living Space and Breezeway are customized to reflect locally available “materials of opportunity” and building traditions by region.

Our team demonstrated this strategy by fabricating two homes for the 2007 Solar Decathlon:

- 1. MorningStar Pennsylvania** (exhibited in the competition) is clad in reclaimed Pennsylvania Black Slate and incorporates recycled Pennsylvania steel, Pennsylvania hardwood, and a Milk Bottle Wall, representative of the state’s dairy industry.
- 2. MorningStar Montana** (actual market prototype) features a strawbale Living Space.



Milk Bottle Wall



Moveable Wall

## Living Space

The layered southern façade is an occupant-operated mobile energy membrane between the interior and exterior Living Space. Composed of local recycled steel and white oak harvested from Penn State’s Legacy Trees, the **Exterior Sliding Panels** (ESPs) allow the resident to regulate light penetration and solar heat gain. Adjusting the ESPs provides:

- Summer: shade from direct southern exposure in the living space
- Winter: sun for direct energy gain in the living space

The Milk Bottle wall, symbolic of Pennsylvania’s dairy industry, diffuses winter light and highlights a regional material.

The MorningStar’s built-in furniture, designed and crafted by Penn State students, includes the dining room table, closets, and shelves. Elm for these pieces was **sustainably harvested** from an American Elm tree at the University’s Allen Street Mall. This green space is famous for one of the oldest and largest American Elm groves in the world. The interior “Moveable Wall” provides spatial adaptability. This structure separates the bedroom and dining/living room, and shifts east/west to adjust the size of each room based on the spatial preferences of the occupant.

# Under.One.Sun

## Technical Core

The Technical Core, a **compact energy management system**, includes the kitchen, bathroom, and mechanical room, and its associated system controls and plumbing. It is designed to be mass-produced and shipped based on the economies of scale model. The systems unit is clad in brilliant blue Trespa to identify it as the prefabricated component of the home while providing a “pressure equalizing” rain screen.

## Breezeway

The Breezeway is **the seam** between the Technical Core and the Living Space, an east/west axis that serves as **an airy meeting place** between the home’s two main areas. Naturally occurring breezes, coupled with the height of the Breezeway and the operable clerestory windows, channel air along the axis forming an “ecotone.”

## Materials

To support the concept of adaptability, the competition home features materials characteristic of Central Pennsylvania:

- **Pennsylvania Black Slate:** historically influenced U.S. architecture; compliments the Solar Slate BIPV System
- **Pennsylvania Bluestone:** nationally sought after materials
- **Recycled Steel:** represents Pennsylvania’s steel industry
- **Native hardwood:** celebrates Pennsylvania’s forests and skilled craftsmen



Pennsylvania Black Slate

## Site

The MorningStar’s sustainable site design demonstrates how technologies can integrate energy savings and nurture a healthy ecosystem. It is designed to provide the homeowner with **several alternatives** to the energy and labor intensive American lawn: a Rain Garden, a Meadow Garden, an Audubon Garden (attractive to wildlife) and a Bio-intensive Vegetable Garden. This new iteration cleans and stores rainwater for irrigation, incorporates low-chemical and low-petroleum usage, thereby contributing to public health and safety. The garden aesthetic is dominated by native, **Penn State varieties**, including a *Brassica oleracea* (cabbage).



Left to Right: *Beta vulgaris* (Beets), *Symphyotrichum novae-angliae* (New England Aster), and *Andropogon gerardii* (Blue Bluestem)

## Construction & Transportation

The MorningStar design-build concept combines the economic advantages of prefabrication with the merits of on-site construction. To speed construction in Washington D.C., the **Living Space component was pre-assembled** and married to the Technical Core. A hinged roof and forklift-friendly components were employed to further streamline construction.

**Student and volunteer-friendly** components were incorporated throughout the home to reduce the need for skilled labor and encourage participation in a safe and enjoyable construction process.



## Safety

**Safety of team members, guests, and the public is the primary objective** of all prefabrication, preassembly, transportation, and construction activities for the Penn State Solar Decathlon Team.