

Overview

The development of a marketable prototype version of a competition home is an important challenge for Decathlon Teams. The Penn State Team utilized this opportunity to design and build an **actual marketable prototype** in a community representative of the target housing market. The MorningStar Montana was constructed in June and July of 2007 on the Northern Cheyenne Indian Reservation. The testing of our design-build process confirmed our design concept, therefore providing actual costs for our economic analysis.

Goals:

- **Livability:** Our central floor plan allows for comfortable movement between different spaces throughout the home, while engaging the occupants in seasonal adjustments.
- **Buildability:** The home combines the economies of manufactured housing with panelized components and details that engage volunteers and students in a community-built construction process.
- **Flexibility:** The MorningStar concept promotes regional, site specific, and personal adaptability. The prefabricated core joins a site-built living space made of regionally appropriate 'materials of opportunity' and site specific constraints along with the interest of occupants to interact with the home, allowing for reconfiguration.
- **Economic Viability:** The MorningStar Montana establishes the feasibility of solar energy in low-income communities and helps assess Energy Efficiency Measures (EEMs) with actual costs rather than assumptions.



Proof of Concept: Technical core built at Penn State and transported to Montana



Solar Angles: MorningStar Montana, at noon in July

Strategy

The Penn State Solar Decathlon Team presented a flexible market concept that can be applied and tested in different regions, including the Decathlon version at Penn State and the actual marketable prototype in Montana. The home in Lame Deer, Montana allows the team to conduct a rigorous economic analysis and assess consumer reactions on a completed marketable prototype home.

Target Market

The Penn State team's target market was the **Northern Cheyenne Indian Tribe**. Our completed prototype home, MorningStar Montana, responds to the challenging social, economic, and environmental needs of the Cheyenne community, while thoughtfully introducing and demonstrating appropriate solar energy and green building technologies. The MorningStar concept promotes building-centered community design that reflects local values, the use of regional "materials of opportunity," and the development of local building-based industries in the following ways:



Northern Cheyenne President and Housing Authority visit Penn State, March 2007

- Display of solar technologies combined with energy efficiency measures that will allow communities to implement them in new projects or to retrofit existing buildings.
- Inhabit this testing facility to ascertain how technologies perform and the economic viability for the given community.

Implementation

MorningStar Montana will serve as a temporary home for visiting faculty at the Chief Dull Knife College. Adapted as an affordable version of the competition home, it is now a 1,000 square foot home designed to accommodate a small family in two bedrooms.

Design Adaptation

The MorningStar concept is a hybrid prefabricated/site-built system composed of:

1. Prefabricated "Technical Core" - State College, PA
 - Employ scarce skilled labor, i.e. stable employment
 - Mass production to reduce costs and increase quality
 - Healthier and safer working conditions
2. Site-built "Living Space" - Lame Deer, MT
 - Panelized systems for easier and faster construction
 - Provide jobs for unskilled labor
 - Use of local resources
 - Promote volunteer and community participation

The design also incorporates a "Truth Window" to reveal the authentic contents of the wall; in this case strawbales are the "material of opportunity."

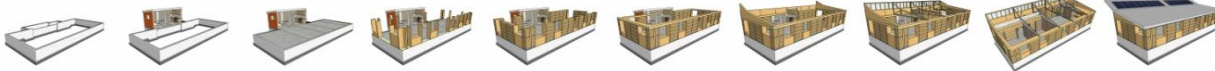


Above: Images from Construction; **Left:** MorningStar MT Floor Plan; **Below:** Construction Process

Blitz - Build Construction



The MorningStar concept supports an **inclusive construction process**. This goal was assessed through a three week volunteer "blitz-build" construction process.



Results

The MorningStar MT was completed by members of the 2007 Solar Decathlon Team, community volunteers, Penn State students, alumni, and faculty. This phase included ten days for construction of the core at Penn State followed by a three week blitz-build. The actual cost of the prototype home was **\$150,000** in materials. Many improvements for future versions of the process were also identified.



Team Member with Northern Cheyenne Youth

The completed home is now open to the community to assess initial reactions about the appeal and marketability of the home. This project also advances the partnership between Penn State and the Northern Cheyenne, and the efforts of the American Indian Housing Initiative (AIHI) at Penn State. This relationship adapts and deploys sustainable housing methods to address the housing challenges facing the Northern Cheyenne and other Indian Tribes in the U.S.

"This home gives us hope and direction for the future. We need more homes like this." - Lafe Haugen, Director of the Northern Cheyenne Housing Authority

In a collaborative effort between Penn State and the Northern Cheyenne Housing Authority, a plan is currently in progress to implement a new housing program on the Cheyenne Reservation. This plan will allow for the local construction of technical cores and the development of a community-built housing program to pursue the construction of more homes using the MorningStar concept.