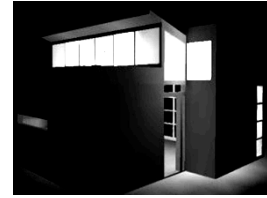


Overview

The **MorningStar Lighting Design** provided an opportunity to experiment and create bold design statements. The light fixtures, control systems and lighting applications used contribute significantly to the overall success of solar design.



MorningStar, PA at Night

Lighting Design Goals:

- **Maximize Daylighting:** High levels of both daytime habitation and passive daylighting combine to increase the value of the daylighting strategies while saving energy and improving living quality.
- **Explore LED Lighting and DC Power:** DC power produced by the solar energy system is utilized to operate the LED lighting system. Implementing this synergistic energy system will serve to assess the DC power needs of the home.
- **Implement Advanced Lighting Controls:** Energy use reduction is addressed by incorporating dimmers on the lighting control system to create “scenes” of minimal but appropriate lighting levels for specific activities or time of day.
- **Develop Weather-Based Lighting Controls:** Solar energy production is intimately related to weather. Our lighting design explores how occupants can be alerted to good, average, and poor solar days based on web-based weather data.
- **Deploy Diverse Luminaires:** Advancements in luminaires, ballasts, and lamp design create new arrangement opportunities using a diverse set of luminaires to introduce light in innovative ways while improving overall energy efficiency. Our design experiments with a diverse set of the latest energy efficient lamp sources.

Daylighting

Daylight enters the home through the clerestory windows on the north side of the home, the long vertical windows on the south side of the home, and through the skylight creating a north axis. This skylight splits the “Living Space” to shed light on the dinner table and desk area.

Full Height Vision Glass enables occupant interaction with the interior and exterior of the home, and full distribution of daylight. The bedroom’s east windows allow the bright morning sunlight to act as a natural alarm clock for the occupant.



MorningStar, PA Living Space Skylights

DC / LED Lighting System

A **dedicated DC power system** eliminates conversion losses from DC to AC by inverters. LEDs within the home are connected to an independent, dedicated DC power system. Power for the DC / LED system is provided by solar slates on the east and west facades of the Living Space and is stored in a sealed lead acid battery bank.



The DC / LED system provides aesthetic lighting in the clerestory, spot lighting to showcase mechanical equipment, and strip lighting for exterior ramp illumination.

Under.One.Sun

Control System

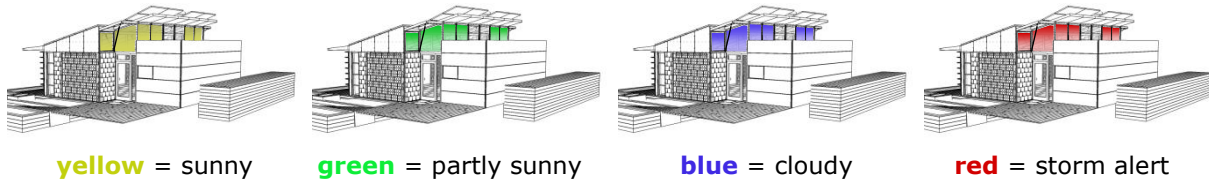
A **radio-based lighting control system** installed in the Living Space of the home provides ease of operation, flexibility, and energy efficiency. The intelligent, programmable system can create up to **15 different scenes** and can be remotely controlled through the internet, or manually by occupants.



Right: Radio Lighting Control

Weather-Based Lighting Controls

Digitally controlled LED lights are linked to streaming weather data and are housed within polycarbonate glazing panels. The panels' colors dynamically correspond to weather predictions. A soft glow is emitted to alert occupants and passers by of tomorrow's weather forecast and related solar energy production. This system contributes to the overall home design goal of engaging occupants in the management of energy use and production.



yellow = sunny

green = partly sunny

blue = cloudy

red = storm alert

Luminaires



A variety of energy efficient luminaires are featured in the MorningStar.

LED strip and spot fixtures are selected for both interior and exterior applications, and to accent specified architectural elements.

Low-voltage decorative pendants placed above the dining room table blend with the décor of the home and allow the table to be illuminated by daylight through the skylight above.

Surface mounted linear fluorescent up-lighting strip fixtures along the top of the fixed cabinets utilize high-lume dimming ballasts. These ballasts allow the lamps to provide between 1 and 100 percent of the 39 watt output.

LED desk lamp brings the latest energy efficient and directional light source into the interior of the house.

Top: Decorative Pendant; Bottom: Color Burst LED Light

Future

In 2011, the MorningStar was placed on a permanent foundation at the Center for Sustainability. At this location, the MorningStar is used as a teaching, outreach and research facility.

Further research endeavors at the permanent location of the MorningStar will include:

- The effects of weather-based lighting feedback on occupant behavior.
- Advanced applications of the lighting control system through integration with mechanical systems controls and lighting.
- Optimization of daylighting / solar gain / thermal performance through control of the thermal blinds based on both mechanical and lighting control systems integration.
- Assessments of the long term performance of the DC / LED lighting system and load matching solar energy production with time-of-use lighting loads.