SOLAR DECATHLON

# 2007 Solar Decathlon
# Highlights of Team Innovations and Cutting-Edge Building Technologies

**Cornell University**
A unique feature of this house is the "Light Canopy," a streamlined framework of steel trusses that support a PV system, evacuated tubes for solar water heating, and a series of vegetated screens that provide shade in the summer. By design, the occupant can transform the canopy without house structural changes.

**Georgia Institute of Technology**
The roof is translucent, made possible by Aerogel insulation and ETFE (ethylene-tetrafluoraethylene), a translucent film with high corrosion and temperature resistance. ETFE has been used in large-scale buildings (e.g., the Eden Project, an environmental science center in England, and the Aquatics Center for the 2008 Beijing Olympics Beijing), but this represents its first residential application in the United States. The east and south walls of the house incorporate cellular polycarbonate panels that let in sunlight while being thermally efficient. “Nanogel” is temperature resistant, thermally efficient, and 1/100th the weight of glass.

**Lawrence Technological University**
The home is finished with RHEINZINK, a natural titanium zinc material that protects the edges of the home from water and other weather-related damage. RHEINZINK is neither coated nor painted and is 100% recyclable. The deck is made of a composite material named Xtendex, a combination of rice hulls, an agricultural waste product, and polymer. This strong but lightweight material needs no treatment, is resistant to mold and mildew, and is not susceptible to rotting.

**Penn State**
This house has a smoothly gliding room divider between the dining/living room and bedroom, which enables the dweller to open up the space in either room as needed. To support the concept of adaptability, the house features “materials of opportunity” characteristic of central Pennsylvania, including: Pennsylvania black slate (which historically influenced U.S. architecture; Pennsylvania bluestone (a nationally sought-after material); Pennsylvania recycled steel (represents PA’s steel industry); native hardwoods (celebrates PA’s forests and skilled craftsmen); and a milk bottle wall (displays the significance of dairy to the state).

**Santa Clara University:** The home features structural bamboo I-beams (patent pending)—the first of their kind in the nation. Bamboo, a fast-growing grass, is a sustainable resource because it retains its root structure after harvest and renews itself in 5–7 years, compared to the 30–50 years needed for hardwood trees.

**Team Montréal:** This house has a special structural steel frame, which offers great flexibility. You can “clip” the walls, furniture, and the PV system to the frame.

**Technische Universität Darmstadt:** Like the skin of an onion, the home is configured in layers that control different functions. Outside, a layer of wooden louvers provides shading and privacy protection and simultaneously generates electricity through integrated PV. The second layer is the thermal envelope, consisting of opaque, vacuum-insulated walls on the east and west sides and highly efficient, floor-to-ceiling windows on the north and south sides. The third layer is the central core, in which all vertical technical installations and the private

facilities are bundled. It is designed to use minimal space and allow maximum comfort by being adjustable in size and appearance through movable and illuminated walls and components.

**Universidad de Puerto Rico:** Sustainable materials are used throughout the house. 3-Form Ecoresin is used in the nucleus, studio, and bathroom and Plexwood sustainably harvested wood materials cover the walls and floors. Recycled plastic is used in an exterior screen that transforms to let light and ventilation in at different points. Also, the structural frame of the house is made of Extren fiberglass, which is recyclable and lightweight.

**University of Cincinnati:** This home features a decorative fence made of 120 evacuated tube solar thermal collectors, which showcases the tubes as both design and functional elements. The home's absorption-chilling system is used to both cool and heat the home and provide domestic hot water. This chiller is the key technological element this team worked into the design. An absorption chiller takes hot water from the evacuated tubes, runs an environmentally harmless compression/evaporation process, and produces cold water that is sent through the fan coil unit to create cool air.

**University of Colorado:** Members of this team integrated the PV and solar thermal system and have found it to be quite effective. The system recovers heat from the PV modules, but also rejects heat to the outdoors. A PV manufacturer has approached them to learn more about the system.

**University of Illinois:** The team developed a scalable “manufacturing” plant in which each of the three building modules (living room and office module, kitchen and dining room module, and bedroom and bathroom module) were sequentially constructed and rolled along a rail to a truck trailer for transport.
The building modules are self-contained, with individual solar energy collection systems and comfort-conditioning systems. More modules can similarly be “plugged” together to form a larger building with courtyards and larger room spaces.

**University of Maryland:** 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. The home's dramatic liquid desiccant waterfall 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.

**University of Texas at Austin:** The house has an exterior skin system that is customizable by the homeowner. The skin includes graphics and a dynamic polycarbonate cladding that creates an air space to ventilate the surface of the building. The structural system includes a series of moment frames (an especially strong frame designed to mitigate earthquake damage, as in "moment-resisting frame") that allow for an open interior plan that benefits superior ventilation and efficient lighting.