



## Adaptable Design Strategies for Market Housing

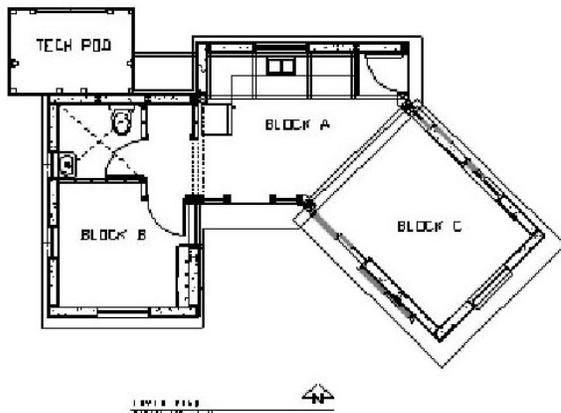
In our home state of Colorado, the thirty-mile drive from Boulder to Denver formerly passed through beautiful open prairies along the majestic foothills of the Rocky Mountains. In just a few short years, as our state's population has grown, these open spaces have been overtaken by a series of sprawling housing developments. Such projects have become widespread across the nation, and while they may address a growing need for housing stock, they are too often blind to climate, insensitive to the landscape, and unnecessarily resource-depletive. If we are to make a dent in the consumptive practices of the residential building market, it is here that we must begin.

Our Decathlon project demonstrates that efficient and environmentally-conscious housing can be built today - with quality, for large markets - without compromising the lifestyle or aesthetic standards of the modern homeowner. This house is our inaugural BASE + ("Base plus") building - an acronym for our mission to work towards Building A Sustainable Environment - and draws from five core project goals: market acceptance, energy efficiency, adaptability, minimal waste, and quick construction.



The key to BASE + is the development of a construction methodology for repeatable, site-specific housing that showcases renewable energy systems and environmentally sound building products.

This is accomplished with a handful of basic strategies, the core of which is modularity. Modular construction is highly flexible, for architectural diversity, and lends itself easily to factory fabrication - ensuring quality control and material efficiency. Breaking the housing program into subcomponents allows efficient shipping and quick site construction. The resulting building blocks are shallow in plan - encouraging better daylight penetration, shorter natural ventilation paths, and direct-gain passive solar strategies. Well-insulated envelopes, featuring Structural Insulated Panels (SIPs), are tightly constructed to inhibit infiltration, maintain comfort, and limit demand on conditioning equipment. Design layouts adhere to four-foot building increments to conform to standard material widths for components such as SIPs, interior sheathing, and standing-seam roofing. Space conditioning is provided with efficient systems that utilize energy recovery ventilation to maintain indoor air-quality.





All mechanical equipment, lights and appliances, are market-ready, off-the-shelf products that are available now at affordable prices. Energy harvesting systems, such as solar electric (PV), and solar thermal, may be added to BASE + buildings for additional energy benefits.

Our Solar Decathlon house shows the application of the BASE + strategies to the unique parameters of the competition and the Washington, D.C. climate. The building's form, balancing proper solar orientation with the opportunities offered by a corner lot, responds to its site with a canted southeastern living module that welcomes the pedestrian. Guiding visitors towards the central entry, the geometry establishes an outdoor deck embraced by the home's three main modules. Surrounded by the building's patio doors and primary windows, this area becomes a gathering point for occupants and solar energy alike - merging indoor and outdoor spaces to enhance the feel and performance of the compact design. At the building's perimeter, high performance windows are carefully configured to address daylighting, view, and solar gains - responding uniquely to each orientation - with predominant glazing areas facing south and southeast to encourage passive winter heating and minimize unwanted summer gains.

Awning clerestories, centrally located at the building's highest point, work in concert with operable windows along each facade to promote natural ventilation. Solar shading is provided by a combination of fixed overhangs and movable shading louvers that allow occupants to optimize performance. At the northwest corner of the building is the TechPod - a fourth module dedicated to energy and equipment - that organizes the building's infrastructure and eases monitoring, maintenance, and system legibility.

Throughout the design process, a balance was continually struck between market appeal, optimal performance, and competition requirements. Evaluation of these sometimes-competing objectives was based on a variety of metrics, including design juries and software simulation. A good example of this process involved the rotation of the office / living room module from East-West to Northwest-Southeast. The architectural benefits of this rotation, as previously mentioned, include the creation of the entry courtyard and the interior-exterior spatial connection. It also serves to break the occasionally monotonous convention of East-West solar architecture. Yet doing so also rotates the module's windows and roof-mounted PV array - affecting energy collection, daylighting, and solar shading. The rotation of the PV array 45 degrees west of south, though perhaps unconventional, turns out to have a somewhat limited affect on annual performance (2-3% reduction), while better matching afternoon loads to local solar availability (hazy mornings, clearer afternoons). The CU team feels that a small reduction in energy collection and more difficult shading is a small price to pay compared to the rewards of having a house that will change the public's mind about energy efficiency and solar power.