
# JURY NARRATIVES

**Washington State University**
**U.S. Department of Energy Solar Decathlon 2017**

# ARCHITECTURE

EnCity began by exploring issues and trends in urban housing. Out of this exploration came the idea to design an urban housing solution that would address issues of density, community, and emerging lifestyle trends. It was a given that the project would be designed as a high-performance home, but three additional guiding principles arose to guide the design. Those principles were to provide comfort, support the development of communities and to design to inspire change.

## DESIGN APPROACH

Fundamental to the any high-performance architecture, the design must cater to the climate and environment in which it will exist. For EnCity that broadly is the Pacific Northwest. However, there are significantly different climates depending on whether you are on the coast or inland in the more arid areas. EnCity was developed as a system whose envelope could adapt to these changes in climate by altering the makeup and material configuration.

Given climatic conditions the team worked to harvest and utilize renewable resources. Access to sun for a good portion of the year made harvesting solar energy a wise proposition. Water was also a resource that was available and faces significant pressure from overutilization. The team made a point to find strategies that would reduce our water footprint through conservation, collection, and reuse. The collection of sun for both daylighting and energy along with the collection of rainwater were primary drivers for the form of the buildings.

EnCity uses a blend of traditional passive design methods as well as advanced energy efficient and research technologies to achieve a high-performance design. Passivhaus design principles which focus on high R values, supreme airtightness, passive heating, and good indoor air quality, greatly impacted the design of EnCity. Other traditional passive design methods used include natural daylighting via windows and skylights, natural ventilation, and passive shading.

The team explored various materials that could be utilized for the project. Washington State University has a strong history of developing composite materials for the building industry. Our team considered several materials and strategies under development with keen eye toward lowering our carbon footprint and suitability for the contest. We focused primarily on materials that were available locally. Being in the Pacific Northwest which is blessed with significant wood resources, it is easy to understand our choice to focus on it as the primary building material. However, we sought out both traditional and innovative ways in which to utilize this material. One of the traditional ways was use of a traditional Japanese building skin, Shou Sugi Ban. It eliminates the need for weather sealants on exterior lumber, while also contributing to a natural aesthetic.

The team also manufactured our own composite decking material from recycled wind turbine blades. This product is an outcome of research on how to recycle this significant waste stream from the wind energy industry. The deck boards are durable and aesthetically pleasing and it was a rewarding experience for team members to manufacture the material ourselves.

Another of our strategies to lower our carbon footprint was to not ‘ship air’. We chose a ‘flat pack’ approach to allow denser use of the trucks and to reduce shipping costs when compared to oversized loads. This decision narrowed choices down significantly toward a modular prefab system that could be erected quickly. Initially the project was planned to utilize thin cross-laminated

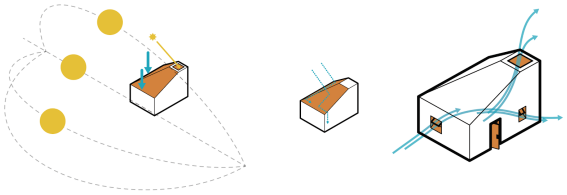
timber panels manufactured by students, however delays in equipment arrival forced a redesign of the structural system very late in the schedule. The final solution became a hybrid system that features prebuilt modules for bathrooms and mechanical rooms that have high density of infrastructure and labor. The structure and envelope were then developed as modular pre-assembled paneled units that can be quickly erected.

Given the climate, material and methodological considerations, the design was tailored to work on urban infill lots within cities. Working in this context requires an empathy to understand the concerns of neighbors and how the project will fit. The goal is to contribute to the neighborhood as a positive asset. In contrast, many higher density infill housing projects are viewed as detrimental due to lack of consideration of the developers with regards to parking, building scale and orientation to public ways. EnCity is designed at a scale that is compatible with the majority of single family housing. Careful consideration was taken to ensure that the entrances of individual homes would be oriented to the street with porches that engage the community.  Parking issues were also considered in a unique way. By including an electric vehicle as part of a shared resource for occupants it reduces the number of vehicles that must be accommodated.

Driven by our goal of comfort in an expanded sense, a smart home system was developed that would integrate mechanical systems and controls with machine learning in order for the home to learn the patterns of its occupants and seek ways to become more efficient.

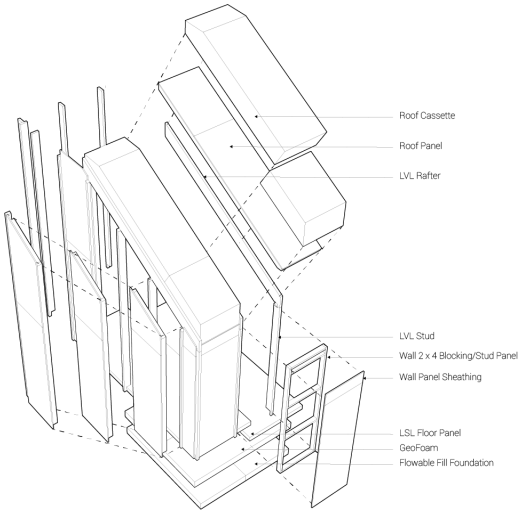
## DESIGN OUTCOMES

EnCity's form is an expression of collection of natural resources and passive strategies of ventilation. Likewise, the structural system forms the finished surfaces of the interior. Not only is the structure a unique aesthetic expression, it reduces the need for additional materials.



Likewise, its exterior spaces were shaped through the design goals and pragmatic needs for private, semi-private, and semi-public spaces.

These exterior spaces are created by and linked by decking and planters. Transitioning through these spaces of different privacy levels accommodates the needs of both the occupants but also the larger community.




Outdoor spaces between private homes and the clubhouse provide areas for community events and activities which establish a community bond.  Openings in each building are strategically placed to offer connections to the outdoors through views or physical access. Large glass doors allow the community building kitchen to expand onto the deck, connecting indoor

and outdoor spaces and creating a larger usable area.

Interior spaces are organized by function and the frequency with which each space is used. Tiny home spaces are designed and sized for an individual or couple, while the community space is sized for larger community and group events.

## FORM AND MATERIALITY

Elements of the home are linked together through materiality and motif to create a holistic design. Interior spaces are linked through visible timber paneling. This also increases occupant comfort through a natural and warm aesthetic. Similarly, furniture and casework also celebrate their means and material of construction. Interior walls are minimal in both units to create a fluid and continuous interior space. A Shou Sugi Ban rain screen establishes the exterior of both buildings, contrasting the warm natural wood of the interior and decking. By utilizing the same iconic form, the tiny home and clubhouse are linked together.  The distinct shape of the roof plane is mimicked to create a window buck which draws emphasis to openings along the building while passively shading glazing from harsh sunlight.

## NATURAL LIGHTING

Natural lighting is a critical element in the design of EnCity.  Large skylights at the peak of each roof capture daylight to illuminate interior spaces. This positively contributes to occupancy comfort by drawing a connection to the sky and by creating a memorable experience. In conjunction with the other windows It also reduces the need for electric lighting during typical daylight hours. Electric up-lighting is used to create an illuminated ceiling plane at night which is easy on the eyes and does not contribute to glare. Task lighting is located in kitchen and work spaces.

## ACHIEVING HIGH ENERGY EFFICIENCY

EnCity achieves energy efficiency through holistic design. From efficient daylighting via skylights and strategic window placement along with the smart control system being able to open and close windows for ventilation, electrical loads for lighting and ventilation are significantly reduced. High performance glazing is utilized to minimize heat loss in winter and reduce heat gain in summer. The design utilizes the thickness of its walls to provide some passive shading to reduce direct solar gain on east and west facing glazing. Heat recovery systems are employed in both the water and air systems to capture waste energy before it leaves the building reducing energy overall energy loads. on water heaters. Through wall heat recovery ventilators are used in each building for mechanical ventilation and to pre-condition incoming outdoor air. This reduces energy loads on the HVAC unit.

The roof slope is optimized for efficient solar panel performance and to direct the flow of runoff to a collection basin. A solar battery pack stores and saves excess solar energy for later use.

All of these elements combine to create spaces that are comfortable and conducive to community building between EnCity inhabitants but also with the surrounding neighborhood within which it is built. It is our wish that the layers of innovation and thoughtful design provide a meaningful impact that inspires lasting change towards a sustainable future.