



JURY NARRATIVES

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

INNOVATION

Various definitions describe innovation as change, creating new things, and thinking differently. At EnCity, we believe that, “innovation is not the result of thinking differently, it is the result of thinking deliberately about existing problems and unmet needs” (Andrew Razeghi). At EnCity, we thought deliberately about current problems and market needs and responded, designing a resilient urban community that adapts to meet societal and technological changes, creating a new dimension of performance.

From its inception EnCity was founded on the basis of entrepreneurship and innovation. In response to the increasing need for urban housing, the emerging tiny house movement, and a desire for a sense of community, EnCity takes a unique approach that challenges residents to rethink the space they live in. At an intersection between innovative materials, construction, technology, and new socio-cultural dynamic of tiny home pocket neighborhoods, EnCity breaks the mold of traditional city housing.

Throughout design and construction, we employed design thinking methodology, considering problems outside of the context of traditional solutions. We utilized customer discovery, multiple rounds of prototyping, analysis of prototype performance and continued collaboration in order to refine our design and ensure we addressed customers' needs and pain points.

Addressing existing problems and market needs, approaching city living in a new way, and utilizing cutting edge materials; innovation is sewn into the very fabric of EnCity and the community it creates, fostering collaboration and challenging the status quo.

COMFORT, COMMUNITY, AND CHANGE

The three pillars that EnCity is built on are comfort, community and change. While interconnected, each pillar has played an important role throughout the design in relation to innovation.

To form our foundation, we began with a focus on creating a comfortable living environment despite the challenge of being energy net-zero and highly efficient. Often times technology and efficiency appear mutually exclusive, opting for

efficient features becomes intrusive to potential customers. Keeping comfort in the forefront challenged us to arrive at innovative solutions, incorporating technology and finding efficiencies in ways that enhance residents' lives.

Finding a balance between comfort and technology led us to the challenge of creating a sense of community within the context of city living. Although the tiny house movement continues to gain momentum, one of the sticking points for many potential tiny home residents is the isolation that comes with such small living quarters. In order to combat this isolation, we arrived at an innovative solution combining private units, shared outdoor space, and a clubhouse building that not only creates community, but allows for optimal resource allocation between units. This combination of public shared space and privacy directly addresses concerns of isolation, sharing spaces, and the ability to entertain and host guests expressed during customer discovery.

With a strong basis of comfort and community, we sought ways to inspire change and innovation throughout our design. EnCity does not just change the idea of how housing can be more sustainable, it challenges ideas of how people live and interact. Not only does EnCity produce all of the energy it consumes and more, it promotes sharing of resources among the community and the potential for impact when sustainability is approached as a group rather than individually. Changing perspectives on living sustainably, ideas of traditional city housing, construction processes, and the way that people relate to one another, EnCity encourages change throughout its design, construction, and tour experience.

Together these three pillars and a focus on sustainability helped align us in our mission to challenge the norm and innovate through the creation of a unique net-zero community of tiny homes within the city.

INNOVATION STRATEGIES

Our overall strategy focused on reducing loads and embodied energy within the project wherever possible. The project incorporates time tested passive architectural design strategies while leveraging active technological systems where passive strategies leave off. We

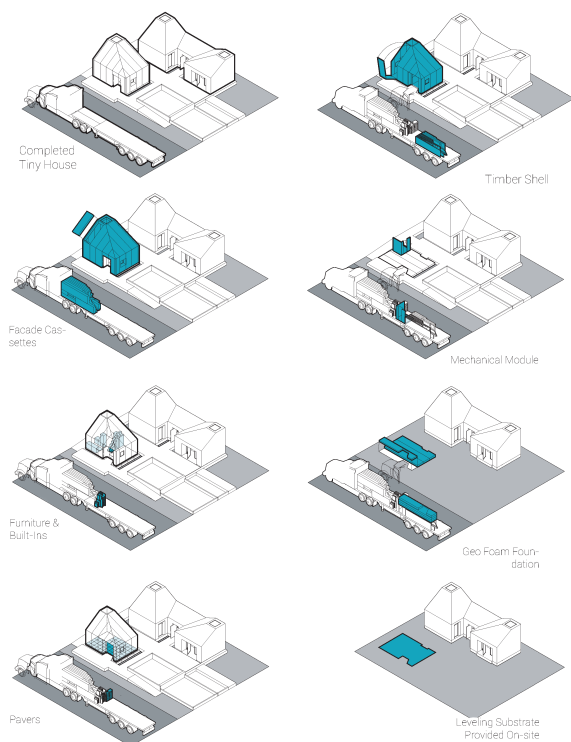
also sought locally sourced materials and equipment such as wood, our PV system and our water treatment systems which are all manufactured locally to reduce the embodied energy of the project. Starting from this baseline, we developed innovative solutions that contribute to a holistic design solution.

STRUCTURE & MATERIALS

Selection of materials and structure was guided by our teams' specific goals, mission, geographical circumstances, current research at Washington State University, and sustainability.

MODULAR CONSTRUCTION & FLAT PACK

Additionally, our overall approach to construction of structure and material selection was guided by the necessity to transport and construct/deconstruct quickly at the competition. In order to accomplish this, we have employed an innovative modular construction and flat pack system, eliminating empty space when shipping to optimize transportation.



Our modular construction consists of a geofoam foundation, nail laminated and LSL floor slabs, structural frame and infill panel along with facade cassettes that include

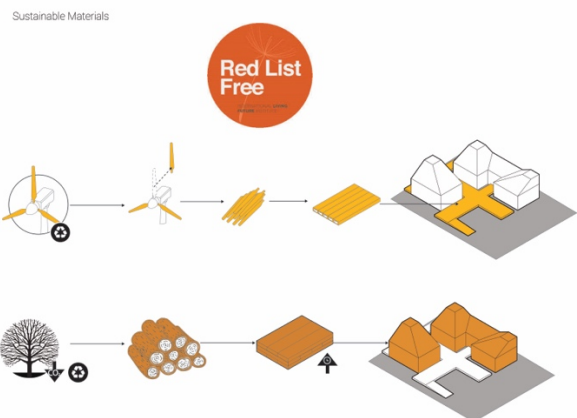
insulation. The system is designed to be flat packed and ready to be assembled on site.

While a traditional wall assembly sandwiches the insulation in-between the sheathing and interior finish and enclosing the structural elements, our wall system puts all of the insulation on exterior of the wall which allows for the structure to be the finish. This saves time and materials and provides a unique aesthetic quality. This also provides the added benefit of reducing thermal bridging to enhance the overall performance of the wall.

A liquid applied water/air membrane is applied to the exterior of the structural frame. Facade cassettes filled with mineral wool insulation and faced with the Shou Sugi ban siding are attached to the frame. Roofing cassettes include an additional roofing membrane.

RECYCLED COMPOSITE DECKING

The "dirty" secret of clean wind energy is the thousands of old turbine blades that sit in wind turbine graveyards once they have been replaced or upgraded. As one of the twelve states that produce over 80% of the United States wind energy, Washington State has various wind farms and thus many old turbine blades. Researchers at Washington State University noticed this wasted byproduct of wind energy generation and created a composite material utilizing recycled wind turbine blades, this product makes up our decking material, performing like Trex decking, it is extremely durable, engineered to last a lifetime.



HIGH PERFORMANCE WINDOWS

EnCity has custom high performance and airtight Schuco windows, doors, and skylights. With extremely high R-values and solar heat gain coefficients, these windows, doors, and skylights contributed to the tight envelope and were essential in achieving airtightness.

TECHNOLOGY

EnCity incorporates various innovative technologies in its design. Unique technological innovations include ventilation/air quality and water capture and treatment.

HEATING VENTILATION & AIR CONDITIONING

Our passive design and tight envelope allow for minimal air leakage throughout the year keeping heating and cooling loads down. Mechanized windows programmed to retrieve weather data, sense air pressure, and open/close accordingly allows for proper cross ventilation without need of an air conditioning unit except at peak summer temperatures.

Ventilation within the buildings utilize heat recovery technology to efficiently capture energy before it leaves the envelope. This is done via ducted and through wall ventilation units. The through wall units are utilized to reduce ductwork and excess noise. Together the windows and HRV systems provide almost all the ventilation necessary, minimizing energy draw.

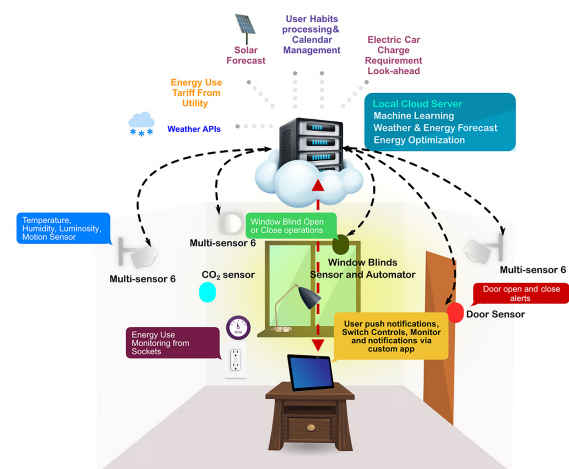
WATER CAPTURE & TREATMENT

As the only team from the Pacific Northwest, EnCity's roof is designed to capture our abundant rainwater through custom in wall gutters. Due to the fact that Washington state has the strictest water reuse standards which require a 4-step treatment process, EnCity utilizes the Imber InRoom Reuse system. The Imber InRoom Reuse is an innovative, patent-pending compact self-contained water treatment system. Designed to adhere to Washington State standards, the system takes in water from sinks, washing machines, air handling units, and storm water that then enters individual stages for filtration, coagulation, oxidation and disinfection producing WA Class A reuse water suitable for reuse within the home and irrigation.

In addition to water treatment, EnCity has an innovative Sanden hot water heater that utilizes CO2 as a natural alternative to other harmful chemical refrigerants and an outdoor heat pump unit for optimal energy usage. To minimize excess energy draw from continually heating water we have designed a structured plumbing recirculation loop with a motion sensor activated when a resident stands in front of a faucet to ensure that hot water is delivered quickly with minimal water and energy wasted.

INTEGRATION OF SYSTEMS

Although EnCity utilizes various technological innovations, its intuitive user interface allows for seamless interaction with the home. While most home control systems require multiple apps to control things such as lights and temperature our smart home system differentiates itself by integrating all of our technological innovations into a single mobile application. This allows residents to monitor and control everything from lighting, temperature, humidity, windows and reserving the clubhouse to solar panel power generation, battery level, and energy balance from tablets within the home.



Besides providing the resident information and control over house features, the smart home system functions within the context of a smart city. Employing machine learning the system begins to learn residents' habits and adapt to optimize and schedule energy draws, charging of the battery, and sharing energy and resources between units. In addition to scheduling energy draws, the smart home system suggests energy saving habits to the residents, allowing them to accept and apply or

deny the suggestion, providing another layer of control while teaching residents and changing habits. This adaptive system is customizable per user and adds convenience throughout the home.

LIFETIME OF INNOVATIONS

Design decisions throughout EnCity were made with sustainability in mind, carefully choosing products and designing details based on performance. This careful selection of high grade and durable products combined with the adaptability and machine learning of the smart home system allows EnCity to adapt to residents, ensuring optimal conditions within the home and optimizing the longevity of the innovations and the lifetime of the house itself.

IMPACT POTENTIAL

The innovations throughout EnCity have both immediate and long-term impact potential.

EnCity has the potential to capture and reuse renewable resources minimizing our negative impact on the environment through a reduction in space utilized and our carbon and water footprints. Besides the tangible impacts, EnCity has the potential to change perspectives. Through its energy saving suggestions, EnCity encourages residents to think differently about the larger impact of their habits.

EnCity challenges the status quo, providing private spaces while creating vibrant communities, avoiding isolation, and changing interpersonal dynamics and communication. Creating these new socio-cultural dynamic challenges residents to think about how they utilize space and interact with both the environment and those around them. These interactions and changing dynamics foster the development of resilient communities locally and resilient cities regionally.

In addition to the environmental, social, and cultural dynamics, EnCity has potential for impact commercially. The potential for scalability of the concept through various applications creates an opportunity to create a larger network of resilient communities. Amidst the surge of green and sustainable building, EnCity acts as a model demonstrating a unique and innovative response to market demands