



## TEAM ILLINOIS

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN  
ILLINOIS SOLAR DECATHLON

## RENU HOUSE

A RENEWABLE, ECONOMICAL,  
NOURISHING, & UNIVERSAL HOME

# ARCHITECTURE NARRATIVE

## 1. INTRODUCTION

Illinois Solar Decathlon is an interdisciplinary registered student organization at the University of Illinois at Urbana-Champaign seeking to lead innovation in design and construction to advance towards an environmentally sustainable future. We are thrilled to present our latest project, RENU House.

RENU House is a 1,510 SF energy net-zero home. RENU represents the four guiding principles of our design and construction processes: Renewable, Economical, Nourishing, and Universal.



### **R**ENEWABLE

The most important feature of the project is energy net-zero status, but we have also striven to reduce the effect on the surrounding environment in every other aspect of the home.

### **E**CONOMICAL

Sustainable developments must be financially feasible to be adopted. We have prioritized cost efficiency in every design choice to ensure the home remains affordable for our target clients.

### **N**OURISHING

The design seeks to encourage fulfilling lifestyles by prioritizing accessibility for all abilities and emphasizing the mental and physical health of occupants.

### **U**NIVERSAL

This design can be replicated in similar small-town markets across the United States, potentially bringing sustainable innovation to communities throughout America.

RENU House is nestled in the village of Rantoul, Illinois, a town of roughly 12,000 people fifteen miles north of the University of Illinois at Urbana-Champaign. Illinois Solar Decathlon has partnered with the Village of Rantoul Urban Planning Committee and the local Champaign County chapter of Habitat for Humanity for the build, consistently communicating with local stakeholders to ensure the home meets the needs of the occupants while effectively integrating into the small-town community.

RENU House was designed to be a family residence, and can accommodate a diverse range of family dynamics such as a single parent or multigenerational household. Upon completion of the Department of Energy Solar Decathlon competition, the home will be fully donated to a local Habitat for Humanity family in need: Elonda, a single mother and intermittent wheelchair user, and her adult daughter, Monae, who is pregnant with her first child.



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## 2. ARCHITECTURE

### 2.1 Concept

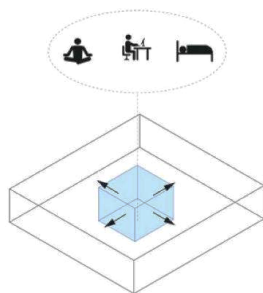
The architectural approach to RENU House was centered around three design principles that guided the architectural decisions.

1. Achieving net-zero energy performance and making the home as accessible as possible for people with all abilities.
2. Creating a feasible template for housing development by balancing high performance, comfort, cost, and construction.
3. Implementing innovative design solutions that will alleviate some of the challenges that raising children, working, and maintaining a home pose for a single parent or multigenerational family structure.

RENU House is located in a #5 climate zone, meaning the home will experience hot and cold weather extremes that require energy intensive heating and cooling. To mitigate demand and consider the programmatic goals, the house was designed at a relatively small 1,510 square feet, but the combination and flexibility of critical spaces creates an experience to make the home feel larger than it is.

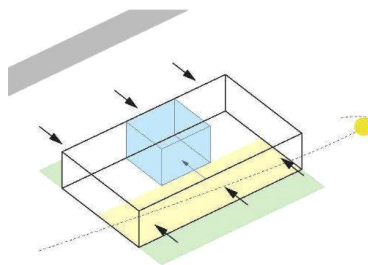
### 2.2 Design

The shape of the volume is primarily driven by the ideal proportions for sun exposure in combination with programmatic function. By extruding a section of the volume on the southern face, the communal spaces of the home such as the living room, dining room, and kitchen interlock with one another on the floor plan on the southern face of the home with an oversized window and glass patio door. Each zone has a different relationship to one another, creating a greater collection of spatial experiences within a small amount of space with the addition of good daylighting and passive warming.



HUB SPACE

Flexible space centralized within the plan to allow for focus and connection to the rest of the home. Primarily used by single mother, but suitable for adaptations

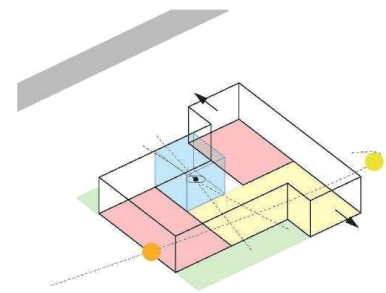


HUB SPACE

PORCH SPACES

FAMILY LIVING SPACES

Stretch the mass along East-West axis to expand sun exposure and increase floor space along Southern glazing. Create space for front and back porches.



HUB SPACE

PORCH SPACES

FAMILY LIVING SPACES

PRIVATE LIVING SPACES

Expand living and private spaces to allow for multi-directional daylighting and surround porches for visual connections between living spaces, hub space, and outdoors



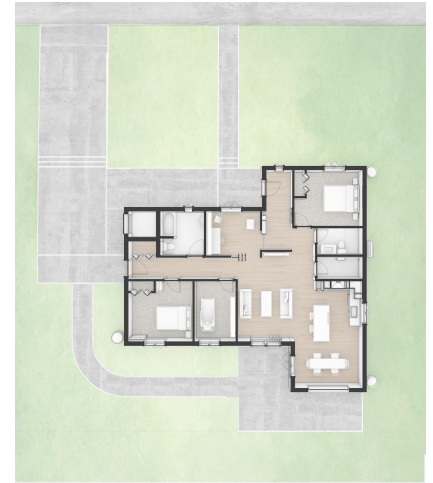
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Windows were placed with care in order to make every puncture in the building envelope as valuable as possible. Direct sunlight is prioritized for the family spaces and for two of the three bedrooms because we considered bedrooms as important personal spaces for children that should have high quality light. The layout was also designed so that at all times, if needed, a parent can see or hear the other occupants in the home. We believe this feature of the plan can help a parent feel comfortable and secure while focusing on work or managing other challenges of domestic care. Additionally, RENU House is designed to be especially durable so that minimal effort and resources have to be diverted into maintenance.



### 3. ARCHITECTURAL IMPLEMENTATION

#### 3.1 Site

Rantoul, Illinois is a medium-sized rural town with a depreciating population. The neighborhood is filled with one and two story single family homes and low rise apartment buildings. Most of the structures in the neighborhood were constructed in the mid-late 20th century creating a relatively consistent aesthetic. The aesthetic of RENU house does not try to change the composition of the neighborhood but instead complement the existing architectural traits. With respect to advanced building technology we took an “under-the-hood” approach to the design of the home, meaning the form of building is simple, however the technological components of the home are cutting edge. This strategy ensures that the exterior of the home does not stick out and alienate the home within the context.



#### 3.2 Construction

RENU uses a combination of conventional and advanced building materials to balance affordability, innovation, and the risk of maintenance problems. The structure of the home uses sustainably harvested lumber to form exterior load bearing walls and roof trusses. The walls and trusses were all prefabricated off-site in a conditioned space and then shipped to the site. This allows for an efficient on-site construction process bringing down labor cost. In order to achieve maximum accessibility we chose a single story slab on grade foundation made from concrete. Despite being carbon intensive concrete will ensure the house remains safe and structurally sound for longer than any alternative suitable for our site while being highly cost prohibitive.





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The site grading posed some challenges for the ADA approach to the site, in order to maintain no more than a 5% slope the house is set back 35 feet and a side door was added for easier access from the driveway allowing someone with any range of ability to easily access the home. Additionally, the building footprint is situated at the middle of site creating a sizable front and back yards. The house includes an ADA compliant bathroom and circulation spaces are widened for wheelchair movement. Given that the home is a single story, the home features a 9ft ceiling height. This feature adds some additional stress for heating and cooling, however the added height makes the home feel larger and more spacious while maintaining a smaller footprint with little additional cost and complication to construction.





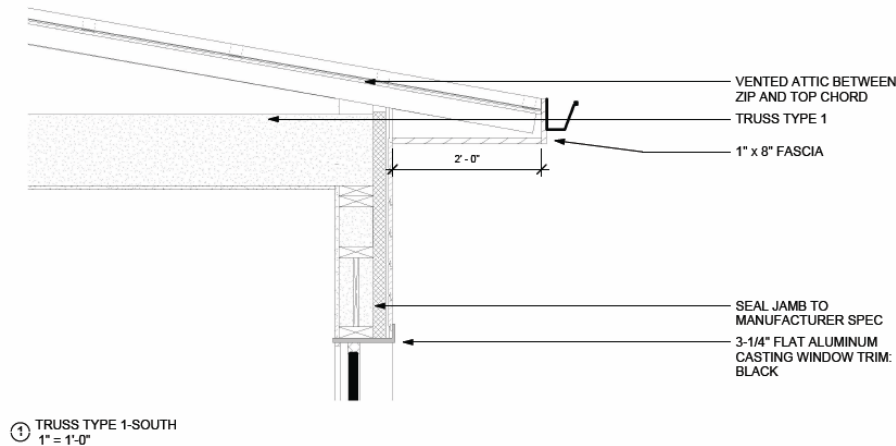
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The roof design is an asymmetrical gable roof truss system that provides simple and cost efficient construction, ample area for a large south facing PV array, good resistance to snow and rain, and cohesion with the surrounding homes. The southern soffits are extended to provide partial shading in the peak summer months for living spaces.



The thermally compressed bamboo siding that was used for the home only came in one color, dark brown. This guided the decision to make the exterior window and roof trim black creating an overall darker colored home. This proved beneficial as the aluminum exterior trim was easily matched with light fixtures, hardware, and other accents because black is a common finish for building products. The result is a consistent color palette throughout the home. The interior sills of the windows were left to their natural wood color to bring out the essence of the material and provide an organic palette that would guide the selection of furniture and accessories.

### 3.3 Innovation

The most unique part of the home is the flex room which is carefully located adjacent to the intersection of the horizontal and vertical axis on the plan. This room was designed primarily for a working mother's office space, having a central location making supervision easy, however it can easily become a play area, study, or studio. This is made possible by two large openings into the flex room. The opening connecting the flex room and foyer is operated by a custom made sliding shelf that acts dually as a door and a storage for coats, shoes, and other daily objects.

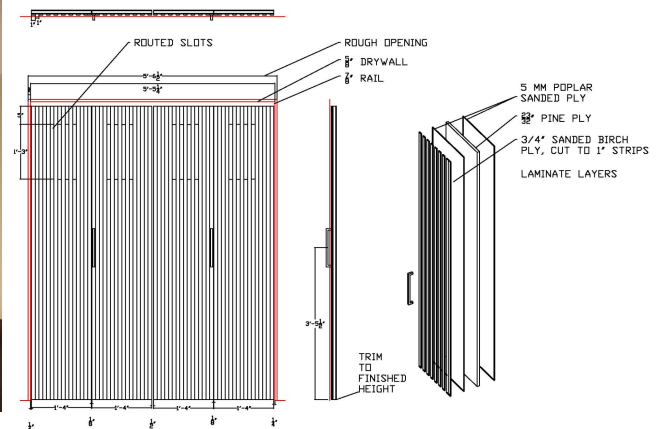
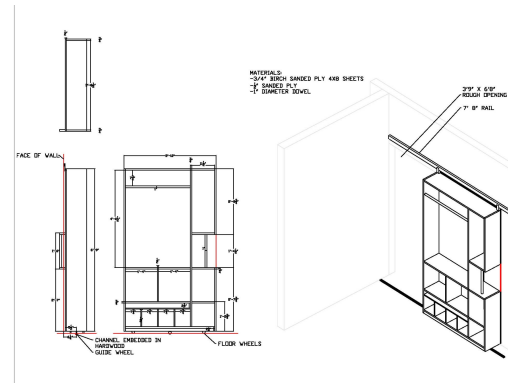


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The opening connecting the flex room to the living room is operated by a custom accordion door that acts as an aesthetic accent wall to the living room and features vents that allow sounds and air to flow through the door. The space is big enough and has the privacy capabilities of a bedroom, yet if completely opened, the room becomes an interesting moment of circulation. Additionally, these two small custom build projects provided a chance for our team to engage physically with the assembly of the home, however the simple designs could easily be replicated by carpenters with the manipulation of stock materials.

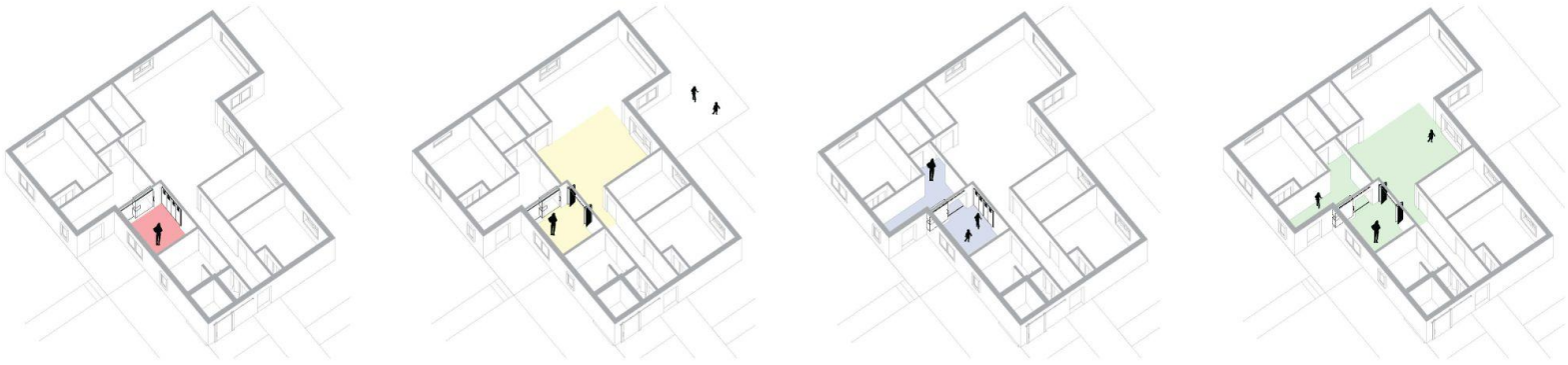


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All together, RENU House has a full slate of spatial possibilities and ways to experience life in the home despite having a low square footage. The home has a responsible impact on the neighborhood and makes an effort not to disrupt an existing neighborhood aesthetic. People with disabilities are able to live fully and comfortably in the home with little to no daily limitations. Illinois Solar Decathlon worked closely with Habitat for Humanity to ensure that after the competition, the home would actually serve a family. The habitat for humanity loan was granted to an elderly mother and working daughter who is expecting a child. Because of the abundance of accessibility, low maintenance design considerations, and innovative family centered plan, the soon to be trio will be comfortable at any level of physical ability and able to navigate the challenges of child development more easily than in a standard home. Overall, the RENU house will provide long lasting stability and comfort to a family in need.

## 4.0 LANDSCAPE ARCHITECTURE

### 4.1 Architectural Concept and Design

The grading of the land outside of the house works with the landforms as much as possible to create rain gardens that will reduce most water runoff from the site. In addition, the usage of already on-site soil and planting materials reduces the need to bring or remove materials from the site. The grading adapts to the existing site features and allows for fewer carbon emissions from transportation. The choice of permeable pavers for the hardscaping will improve site and soil quality and will also assist with managing water runoff.

The use of native plants and rain gardens is rather unique for this area as it is not seen much around the area, which can help bring more of a natural landscape to the site. The native plants introduced to this site can also be applied to other sites around the community.

Raised garden beds will allow the occupants to grow their own plants and it will be ADA accessible for the residents needs. It will allow the residents to continue their hobby of gardening while still taking into consideration their limited mobility.

### 4.2 Architectural Implementation

The implemented native plants, such as perennials, shrubs, and trees, will be both beautiful and improve the quality of the site's soil and the local ecosystem. The native plants are low maintenance and will not require the residents to be proactive in taking care of the plants. Additionally, the arrangement of the plants and trees will provide a positive landscape view from the comfort of the home and from the outdoors.





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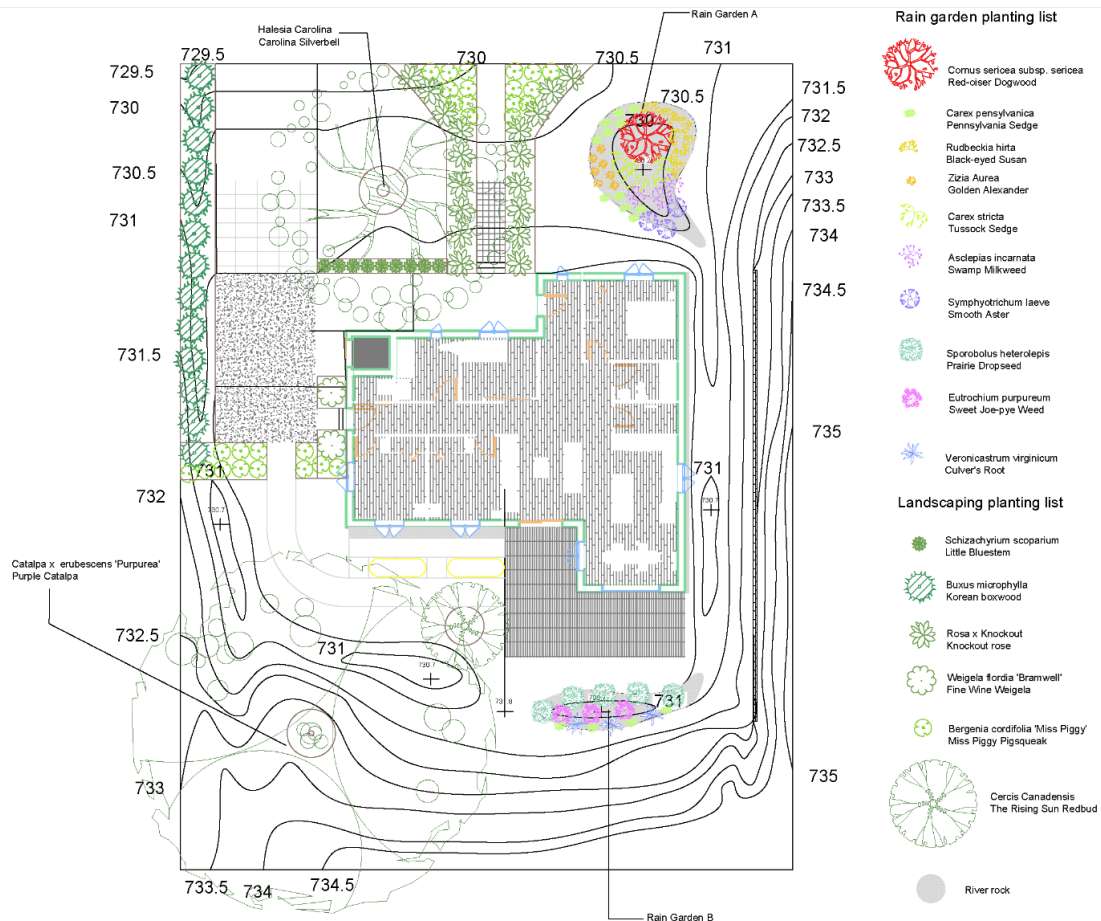
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The rain garden will function as a way to help reduce water runoff without the need for additional infrastructure and no maintenance other than that of the plants.

The back patio serves as a continuation of the Living, Dining, and Kitchen areas to create a more cohesive connection between the interior and exterior. The scale of hardscaping around the house maximizes the use potential of the outside area and allows for the inhabitants to enjoy the outdoors, using the least amount of materials possible while still remaining in a built environment.










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<b><u>Representation in Planting Plan</u></b>	<b><u>Plants Used in the Rain Garden</u></b>	<b><u>Benefits for Wildlife</u></b>
	<i>Comus Sericea Subsp. Sericea</i> Red-Osier Dogwood	Habitat for waterfowl, marsh birds, and small mammals
	<i>Carex Pensylvanica</i> Pennsylvania Sedge	Attracts birds
	<i>Zizia Aurea</i> Golden Alexander	Attracts nectar bees and butterflies
	<i>Rudbeckia Hirta</i> Black-eyed Susan	Attracts butterflies
	<i>Carex Stricta</i> Tussock Sedge	Habitat for rails and snipes
	<i>Asclepias Incarnata</i> Swamp Milkweed	Food source for butterflies
	<i>Symphyotrichum Laeve</i> Smooth Aster	Attracts birds and butterflies
	<i>Sporobolus Heterolepis</i> Prairie Dropseed	Provides cover for small mammals
	<i>Eutrochium Purpureum</i> Sweet Joe-pye Weed	Source of honey for pollinators
	<i>Veronicastrum Virginicum</i> Culver's Root	Used by butterflies and bees