SECOND PLACE WINNER

E+ Row House
A proposal for an Energy Positive Urban Home

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Entry # B203

2013 Carbon Challenge
Project Location: Oliver Neighborhood, Baltimore, MD

Note: This presentation is formatted for 11"x17" paper
Existing Conditions & Project Goals

Introduction
Unique among American cities, the row house is ingrained in the culture and collective psyche of Baltimore. It defines the visual character of the city and was the predominant housing pattern for, rich and poor alike, from the city's founding in 1729 through the mid-twentieth century. With its precedent in English terrace housing, the row house was a simple housing module that could be adapted to a variety of site and societal conditions. Tens of thousands row houses were erected in Charm City over two hundred years, creating a city of home owners.

Row house construction largely ceased with the suburban flight of the mid Twentieth Century. Since this time, some neighborhoods suffered neglect and many row houses have fallen into disrepair or suffered the fate of the wrecking ball. However, from the late 20th century on, a resurgence in the urban population has led to the rehabilitation of thousands of row houses and even construction of new row houses in urban infill developments. The design of E+ Row House continues the great tradition of the Baltimore row house. It borrows from typical row house patterns, while updating them for the 21st century.

Project Site & Existing Conditions
The project is located on an infill site in the Oliver Neighborhood of Baltimore. One block from Broadway, a major thoroughfare originating in Fells Point, about 2 miles to the south. Located on N. Bethel, it is an excellent infill site with convenient access to nearby shopping and bus service on Federal St. The Oliver Neighborhood was hit hard by the mid 20th Century suburban flight and there are still numerous vacant buildings in the area. However, it is experiencing a rebirth through the City's Transform Baltimore initiative.

Building Program
E+ Row House is intended to house 3 working adults living in a roommate arrangement. It balances privacy with the ability to host gatherings and social events. The basic design can be adapted to a family home and could be placed on a variety of infill sites throughout Baltimore.

Project Goal
To create an affordable and energy positive / carbon negative contemporary urban home utilizing renewable energy and prefabrication technologies.
**Design Narrative**

**Design Approach**
The main focus of this project is to create an energy positive / carbon negative building: one that generates more energy than it consumes in the construction and operation of the home. This results in a negative carbon footprint, effectively retiring more carbon emissions than it generates. Therefore: \( E+ \text{ Row House} = - \text{CO2} \)

**Materials**
To achieve the goal of a carbon negative design, material selection is an integral part of the design. \( E+ \text{ Row House} \) integrates a cost effective panelized component system for the primary structure and façade elements. Since wood used in the construction of buildings is considered a carbon sink, wood products are used throughout the design. Panelized party walls carry the structural loads, prefabricated wood truss components are utilized for floor/roof modules and a façade component system consisting of Structural Insulated Panels (SIP’s), faced with spruce siding or brick, is utilized on the front and rear walls. These components can be fabricated off-site, thereby increasing quality control, reducing construction time and achieving affordability.

Where possible, reclaimed materials are utilized to further reduce the embodied energy in the building. Brick veneer utilizing reclaimed bricks, and reclaimed hard wood flooring can be sourced locally and plate steel window shades will be fabricated from local scrap yards.

**Energy Strategies**
The building design follows passive house principles for high insulation, low infiltration and efficient heating/cooling/lighting systems to lower operational energy needs. Additionally, the building controls solar heat gain, creates high daylight levels on the interior and facilitates natural ventilation to further reduce energy demands. A combined solar thermal / PV array on the roof not only generates the balance of required energy but is oversized to create a surplus that can be sold to the grid.

**Performance**
The embodied carbon content for constructing the home was analyzed with Athena Impact Estimator. The PV array was sized with NREL’s PV watts calculator, and a preliminary energy analysis was performed by the architect. The following is the estimated energy / carbon performance:

- **Carbon generated from the construction**: 70.84 Tonnes CO2
- **Estimated Annual Energy Use**: 4,000 kWh = 4.62 Tonnes CO2
  - Based on predicted HERS Score of 45 (excl. solar)
- **Estimated Annual Energy Production**: 7,877 kWh = 9 Tonnes CO2
  - Based on 7.5 kW equivalent PV and Solar Thermal arrays.
- **Balance**: +3,877 kWh = 4.5 Tonnes CO2 equivalent = $775/year sold to grid.
  - Based on current MD SREC rate of $0.20/kWh

**Carbon payback for initial construction = 16 years**

*Note: Athena software is unable to account for the reclaimed building materials utilized. It is estimated that the actual carbon footprint would be reduced by an additional 2.5 Tonnes for an approximate total of 68 Tonnes expended for construction.*
A Reinterpretation of the Baltimore Row House

Reinterpreted Row House

*E+ Row House* is a reinterpretation of the traditional Baltimore Row House. In order to fit into the unique place that is Baltimore, the design borrows from the vernacular and adapts these elements to fit the needs of a carbon negative, contemporary urban home.

Façade Rhythm

The best row house streetscapes feature alternating projecting and recessing elements. In a typical 3 bay row house, the entry is recessed while to bays are projected, forming a rhythm of solid and void elements.

Cornice, Steps & Base

Baltimore is known for its marble steps, the focal point for social interaction on the street. These are often integrated into a white marble base as well. *E+ Row House* will utilize reclaimed marble steps integrated into a white stucco base. The classical cornice is transformed into a streamlined stucco cornice with overhanging PV array.
A Reinterpretation of the Baltimore Row House

Window Proportions
Most row houses feature windows with an elongated vertical proportion, sometimes with several different window sizes on a given home. Since the main façade of E+ Row House faces west, these proportions are exaggerated to increase solar protection. Individual window units can be combined to create visual variety in the fenestration.

Solar Control Features
Simple awnings have been utilized on row houses over the years to control excess solar heat gain. E+ Row House utilizes sunshades constructed from reclaimed steel for the same purpose. These sunshades feature vertical fins and horizontal overhangs to combat the afternoon sun on the western façade. They also integrate a window box planter.

Floor Plan Organization
Traditional row houses had simple floor plans. On the first floor living rooms & kitchens are on the exterior walls, with dining rooms / stairs in the middle. On upper floors, bedrooms were on the exterior with bathrooms & stairs in the center. While simple these plans resulted in dark interior spaces. E+ Row House borrows this basic arrangement, but elongates the home to accommodate a light well in the center to provide natural light and ventilation to the inner core of the home.

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Site Plan

Key
1. Typ. Row House Unit – 9 Total
2. Back Yard
3. Carport
4. Alley

Scale: 1" = 40'

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Floor Plans

Total Heated Area:
2,275 SF

Key
1. Entry Vestibule
2. Living Room
3. Dining Room
4. Kitchen
5. Pantry
6. Powder Room
7. Back Deck
8. Back Yard
9. Carport
10. Bedroom
11. Balcony
12. Closet
13. Bathroom
14. Light well – Dinning Below
15. Lounge
16. Roof Deck

First Floor Plan

Second Floor Plan

Third Floor Plan

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Elevations

Bethel Streetscape Elevation
Scale: 1/16" = 1'-0"

Front Elevation Detail (West)
- Balcony
- Glu-lam header
- Reclaimed steel sun shades / planter boxes

Solar Thermal & PV Array
- 34'-6" T.O. Array

3rd Floor
- 22'-6"
- Glu-lam Entry canopy
- SIP/Brick façade component system
- Reclaimed Marble Steps
- 12'-6"
- 2nd Floor
- 2'-6"
- 1st Floor
- 0'-0"
- Grade

Rear Elevation Detail (East)
- Wood windows w/ Low – E glazing
- Roof Deck
- Spruce Bevel Siding
- Back Deck
- Yard Walls

Scale: 1/8" = 1'-0"

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Building Components

Base Wall Component:
Standard 4’x10’ SIP (8”) w/ reclaimed veneer brick over waterproof air barrier membrane

Fenestration Component:
Wood windows w/ Low – E glazing and reclaimed steel sun shades / planter boxes

Floor: Reclaimed wood floor w/ 5/8” OSB Subfloor

Roof / Floor Component: 20” D. wood trusses w/ parallam rim boards and Glu-lam Headers

Wall Component: 2x6 panelized framing bearing walls w/ 2 layers type "x" gypsum board for fire assembly between units

Assembled façade Component System

Assembled Structural Component System

Façade Component System

Combined Component Systems

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Longitudinal Section thru Light Well

Key
1. Living Room
2. Dining Room
3. Kitchen
4. Back Deck
5. Back Yard
6. Carport
7. Bedroom
8. Bathroom
9. Light well
10. Lounge
11. Roof Deck
12. Basement – unfinished for mechanical & storage

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Sections

Transverse Section thru Light Well & Stairs, showing multiple units.

Longitudinal Section showing Facade

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**Sustainable Design**

- **Central Skylight:** Polycarbonate assembly filled with aerogel (R-20) and operable sidelites. Creates interior light well and facilitates stack effect ventilation.
- **Solar Array:** Combined solar thermal and photovoltaic (7 kW). Also acts as a shading device to lower solar heat gain through roof.
- **Roof Assembly:** EPDM with extruded polystyrene (R-50)
- **Facade Component System:** 8" SIP (R-38) with reclaimed brick veneer. Reclaimed steel sun shades protect western windows from solar heat gain and operable windows provide natural ventilation.
- **Operable Fenestration:** Balcony doors and transom windows provide natural ventilation.
- **Solar Thermal Hot Water:** Thermal storage tank pre-heats domestic hot water. Tankless on-demand heater kicks in as needed.
- **Air – Air Heatpump HVAC System:** Thermal storage supplies a pre-heat coil in the HVAC system during heating mode. Main supply ducts run through chases in closer walls.
- **Solar Thermal Storage Tank:** Roof mounted solar thermal array heats tank water via heat exchanger. Hot water supplies both DHW and HVAC system.

**E+ Row House**

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Aerial Views

View of E+ Row House block - from Southwest.

View of E+ Row House block - From Northwest

Rear view of E+ Row House block - From Northeast

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Streetscape Views

View s of E+ Row House block - From Bethel St.

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Façade Component System

View s of E+ Row House block Façade Component System showing various configurations of sun shades / window boxes.

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Interior Views

3rd floor view of light well towards lounge / roof deck

View of light well from 1st floor

View of typical bedroom towards balcony door.

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