Midwest: Re-Established
SOLAR DECATHLON DESIGN CHALLENGE

Ball State University
Urban Single-Family Residence

by

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Innovation
COMMUNITY PARTNERS
Englewood Community Development Corporation (ECDC) staff
ENGLEWOOD VILLAGE
Neighborhood near downtown Indianapolis affected by decades of disinvestment and decay
ENGLEWOOD CDC
Reinvestment in Englewood Village

ECDC Community Garden
ENGLEWOOD CDC
Reinvestment in Englewood Village

ECDC Rooftop Hockey

ECDC Rooftop PV Modules
PROJECT SITE
36 N Rural St. is one of forty vacant houses in Englewood
MARKET POTENTIAL
Significantly lower home value in Englewood than broader Indianapolis but on the upswing
PROJECT SITE
36 N Rural St. is one of 14,000 (estimated) vacant houses in Indianapolis
Design a scalable housing solution that cuts carbon emissions and waste, while limiting costs in every possible step of both construction processes and operations.
### Global Warming Potential Captured in Vacant Houses

<table>
<thead>
<tr>
<th>Embodied Carbon (tons CO2 eq.)</th>
<th>36 N Rural St.</th>
<th>Englewood vacant houses</th>
<th>Indianapolis vacant houses</th>
</tr>
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<tbody>
<tr>
<td>31.3</td>
<td>720</td>
<td>252,000</td>
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</table>
SCALABLE SOLUTIONS
Criteria for renovating vacant housing stock

Existing House

Is the foundation intact?

Yes

Was lead, asbestos, mold, or radon found?

Yes

Deconstruct house and use wood components to furnish new house

No

Abate as necessary, using Phase 1 funds

No

Is wood structure intact?

Yes

Selectively replace wood framing as necessary

No
SCALABLE IMPACTS
Phased approach to renovating vacant Indianapolis houses

--- PHASE 1 ---
Envelope: $70k-$80k
Yearly carbon cut by 50%
- Insulate exterior walls with R-36 continuous mineral wool
- Insulate roof with R-36 continuous mineral wool
- Insulate crawlspace with R-30 fiberglass
- Replace windows with U-0.30 and doors with R-20

--- PHASE 2 ---
Active systems: $35k-$40k
Yearly carbon cut by 75%
- Replace lighting with LED
- Replace appliances with Energy Star
- Add premium electric water heater
- Add rooftop PV system
- Replace HVAC with ductless VRF and DOAS with ERV

--- PHASE 3 ---
Renovations: $25k-$30k
- Redesign and renovate interior
- Add on as desired, adhering to standards of phases 1 and 2
- Add rentable unit
SCALABLE IMPACTS
Consequences of renovating 36 N Rural St. to net-zero

[Graph showing carbon emissions over time with phases labeled as Phase 1 and Phase 2.]
SCALABLE IMPACTS
Consequences of scaling up net-zero renovations

Existing house → Remove exterior envelope; Apply necessary exterior studs; Re-define roofline → Re-skin and re-roof

Apply ADA ramp → Update active systems; Apply solar panels; Replace appliances; Install VRF system → Renovate interior

Graph showing the decrease in carbon emissions over the number of houses renovated.

Carbon consequences if 5 houses are renovated each year for 20 years.
SCALABLE IMPACTS
Consequences of scaling up net-zero renovations
DESIGN CONCEPT
A contemporary residence with an emphasis on universal design and preservation of existing building stock
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• First floor is entirely ADA compliant

• Spacious rooms provide for complete accessibility.

• Multi-generational layout allows for independent design while giving peace of mind.
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A contemporary residence with an emphasis on universal design and preservation of existing building stock
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A contemporary residence with an emphasis on universal design and preservation of existing building stock

- Upper floor serves as a semi-independent living space
- Amenities include two bedrooms a common area, and a small kitchenette.
PERFECT WALL HOUSE
Rauser Design
“THE PERFECT WALL”

- Excellent air tightness (1 ACH50)
- R-36 continuous Rockwool insulation
- Make use of existing wall studs in an expressive way
ENERGY PERFORMANCE
Energy Rating Index

[Diagram showing energy savings index with categories like Hot water, Heating, Cooling, Lights, Large appliances, Miscellaneous, Net: -1.8, and PV generation.]

[Diagram on the right showing energy comparison between Existing house, Standard new home, Without solar, With solar, More energy, and Less energy with net savings of 150, 147.4, 43.5, 0, and -1.8.]
OPERATING SYSTEMS

PV Array
Lighting Plan

Light Fixture Plan

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Product Spec</th>
<th>Energy Use</th>
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<tbody>
<tr>
<td>Can</td>
<td>Downlight Gen II 2700k T24 LED Flush Mount</td>
<td>18.5 W</td>
<td></td>
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<tr>
<td>Pendant</td>
<td>AubreyTM 3 light pendant with LED bulbs</td>
<td>10 W</td>
<td></td>
</tr>
<tr>
<td>Sconce</td>
<td>JoelsonTM 2 light vanity light with LED bulbs</td>
<td>10 W</td>
<td></td>
</tr>
<tr>
<td>Fan w/ light</td>
<td>20” Henry LED ceiling fan</td>
<td>18 W (light)</td>
<td></td>
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<tr>
<td>Track lighting</td>
<td>CoreLine projector</td>
<td>24.5 W</td>
<td></td>
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<tr>
<td>Bathroom fan w/ light</td>
<td>GreenBuilder Series 80 CFM ceiling exhaust bath fan with LED light</td>
<td>11 W</td>
<td></td>
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<tr>
<td>Outlet</td>
<td></td>
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<table>
<thead>
<tr>
<th>Room</th>
<th>Sq. Ft.</th>
<th>Watts/Sq. Ft.</th>
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<tbody>
<tr>
<td>Living</td>
<td>239</td>
<td>0.93</td>
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<tr>
<td>Kitchen</td>
<td>234</td>
<td>0.87</td>
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<tr>
<td>Dining</td>
<td>102</td>
<td>0.10</td>
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<tr>
<td>Hallway</td>
<td>57</td>
<td>0.65</td>
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<tr>
<td>Bedroom 1</td>
<td>113</td>
<td>0.09</td>
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<tr>
<td>Bedroom 2</td>
<td>168</td>
<td>0.06</td>
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<tr>
<td>Restroom 1</td>
<td>90</td>
<td>0.34</td>
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<tr>
<td>Laundry</td>
<td>114</td>
<td>0.16</td>
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<tr>
<td>Restroom 2</td>
<td>62</td>
<td>0.5</td>
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<tr>
<td>Bedroom 3</td>
<td>136</td>
<td>0.07</td>
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<tr>
<td>Kitchenette</td>
<td>38</td>
<td>0.26</td>
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<tr>
<td>Common Area</td>
<td>184</td>
<td>0.05</td>
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<tr>
<td>Bedroom 4</td>
<td>133</td>
<td>0.07</td>
</tr>
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OPERATING SYSTEMS

HVAC System

First Floor

Second Floor

Bar chart showing energy consumption for Heating and Cooling, with categories for Renovation and Existing.
OPERATING SYSTEMS
Radon Mitigation

Zone 1

Zone 2

Site

Radon in Indiana
Design a scalable housing solution that cuts carbon emissions and waste, while limiting costs in every possible step of both construction processes and operations.