MISSOURI S&T
SOLAR HOUSE DESIGN TEAM

FLIGHT Home
SUBURBAN SINGLE-FAMILY HOUSING

“Freedom to Live Independently, Green Housing for Tomorrow”
Design Goals

**Accessibility**
Ensuring all spaces in the home are accessible for people with mobility-related disabilities

**Affordability**
Creating a cost-effective home for an occupant with a limited income

**Net-Zero**
Designing a home that generates energy from renewable sources to compensate for its energy consumption
Target Market

- A lower-limb amputee veteran between 25 and 40 years old
- Has a roommate or is developing a family
- Student pursuing a degree at Missouri S&T or a University Staff Member
FLIGHT Home Design Concept

*Freedom to Live Independently, Green Housing for Tomorrow*
Floor Plan

- Open floor plan
- Wheelchair-accessible in all spaces
- Polished concrete floor, consistent throughout home
- Sliding doors for easy access
- Appliances on lower elevations
- Can be expanded to accommodate growing family
- Strong use of daylighting
  to maximize sunlight penetration
**Magnesium Oxide Boards**
- Mold, fire, and water resistant
- Contain no volatile organic compounds (VOCs)
- R-Value of 43 or higher

**Denim Insulation**
- 85% recycled content
- Improve indoor air quality
- Superior sound absorption
- R-Value of 19
Seamless Steel Siding
- 100% recyclable
- Withstands up to 235 mph winds
- Low maintenance
- Resistant to extreme temperature fluctuations
- Fire and moisture resistant

Rib Steel Roof Panel
- Fading, corrosion, chipping and chalking-resistant coating
- Listed with ENERGY STAR
- Reflects sunlight before it is absorbed as heat
- Maintenance-free, resistant to termites, and repel moisture
Plumbing

- Hybrid Heat pump water heater
- Centralized water heater
Water Conservation

1.2 GPM  1.75 GPM  Dual Flush  Weather Tracking

1.5 GPM  Auto-Sensing Technology
Heating and Air Conditioning

- Ductless mini-split system
- Indoor units placed based on convenience
Ventilation

- Heat Recovery Ventilation - reduce heating/cooling loads and provide fresh air
- MERV 13 filters
Smart Technology

Tesla Powerwall 2

Lighting Controls

Kumo Thermostat
Renewable System

- **Production**: 10 kWh Array
- **Rectification**: 12 kWh Inverter
- **Storage**: 13.5 kWh Battery
- **Location**: 5.17 kWh/m²/day
Energy Analysis Report

HERS Index

Estimated Annual Energy Consumption*

<table>
<thead>
<tr>
<th>Energy Use (MBtu)</th>
<th>Rated Home Cost ($/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>18.6</td>
</tr>
<tr>
<td>Cooling</td>
<td>1.5</td>
</tr>
<tr>
<td>Water Heating</td>
<td>1.8</td>
</tr>
<tr>
<td>Lights &amp; Appliances</td>
<td>22.2</td>
</tr>
<tr>
<td>Photovoltaics</td>
<td>-45.7</td>
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<tr>
<td>Total</td>
<td>44.1</td>
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</tbody>
</table>

*Based on standard operating conditions

ERI with PV: -2
ERI without PV: 53

Annual Estimates

<table>
<thead>
<tr>
<th>Electric (kWh):</th>
<th>12,931.2</th>
<th>CO2 Emissions (Tons):</th>
<th>-0.4</th>
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</thead>
<tbody>
<tr>
<td>Natural Gas (Therms):</td>
<td>0.0</td>
<td>Energy Savings ($)**    :</td>
<td>N/A</td>
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</table>

**Based on the 2015 IECC R-406 Reference design home
## Estimated Construction Budget

<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Building</td>
<td>$143,400</td>
</tr>
<tr>
<td>Electrical</td>
<td>$34,760</td>
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<tr>
<td>Mechanical</td>
<td>$9,510</td>
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<tr>
<td>Plumbing</td>
<td>$2,980</td>
</tr>
<tr>
<td>Contingency</td>
<td>$8,940</td>
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<tr>
<td>Cost of Labor</td>
<td>$71,530</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$271,120</strong></td>
</tr>
<tr>
<td><strong>Cost Per Square Foot</strong></td>
<td><strong>$91</strong></td>
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</tbody>
</table>

*Typical grant from Veteran’s Affairs for a veteran with lower limb amputation: $80,000*
Conclusion

● **Accessibility**
  ○ All spaces in the home are accessible for people with different abilities

● **Affordability**
  ○ A cost-effective home for an occupant with a limited income

● **Positive Energy Home**
  ○ A home that produces more energy than it consumes

● **Sustainability**
  ○ Made with locally sourced materials which will ultimately reduce emissions that impact the environment