

Solar Folder

Team Zero

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Project Background

Major problems with current solar panel systems:

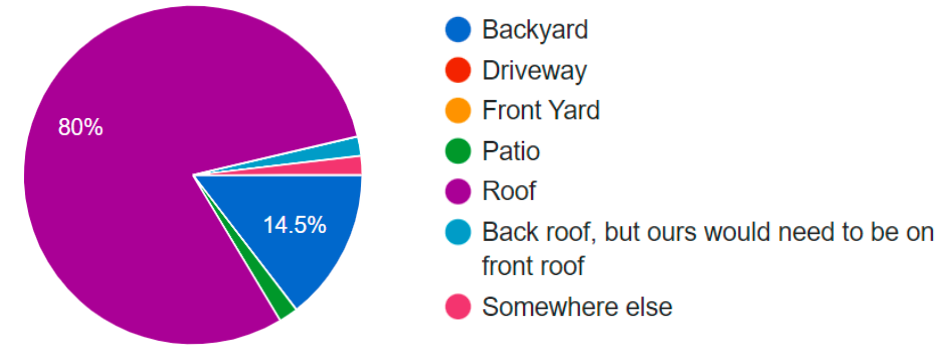
1. High upfront costs (typically \$20,000-\$30,000)
2. Difficulty of installation
3. Many homes unsuitable for solar



Project Goal

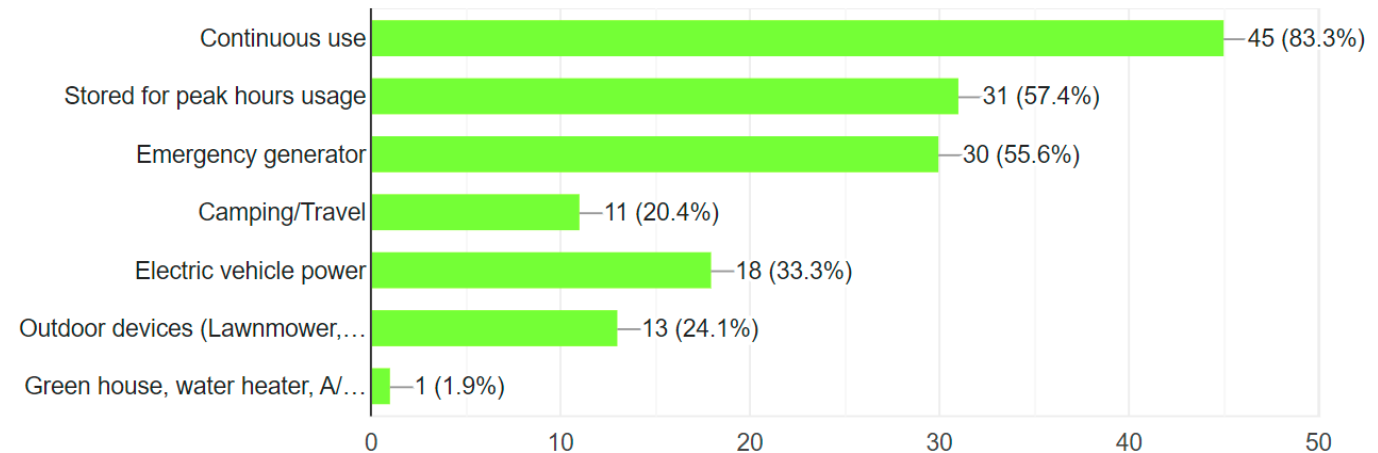
- Affordable
- Easy to install
- Multipurpose
 - continuous use, storage, backup power generation, charging station
- Introduces new customers to clean energy

What is the ideal location for this semi-permanent device?



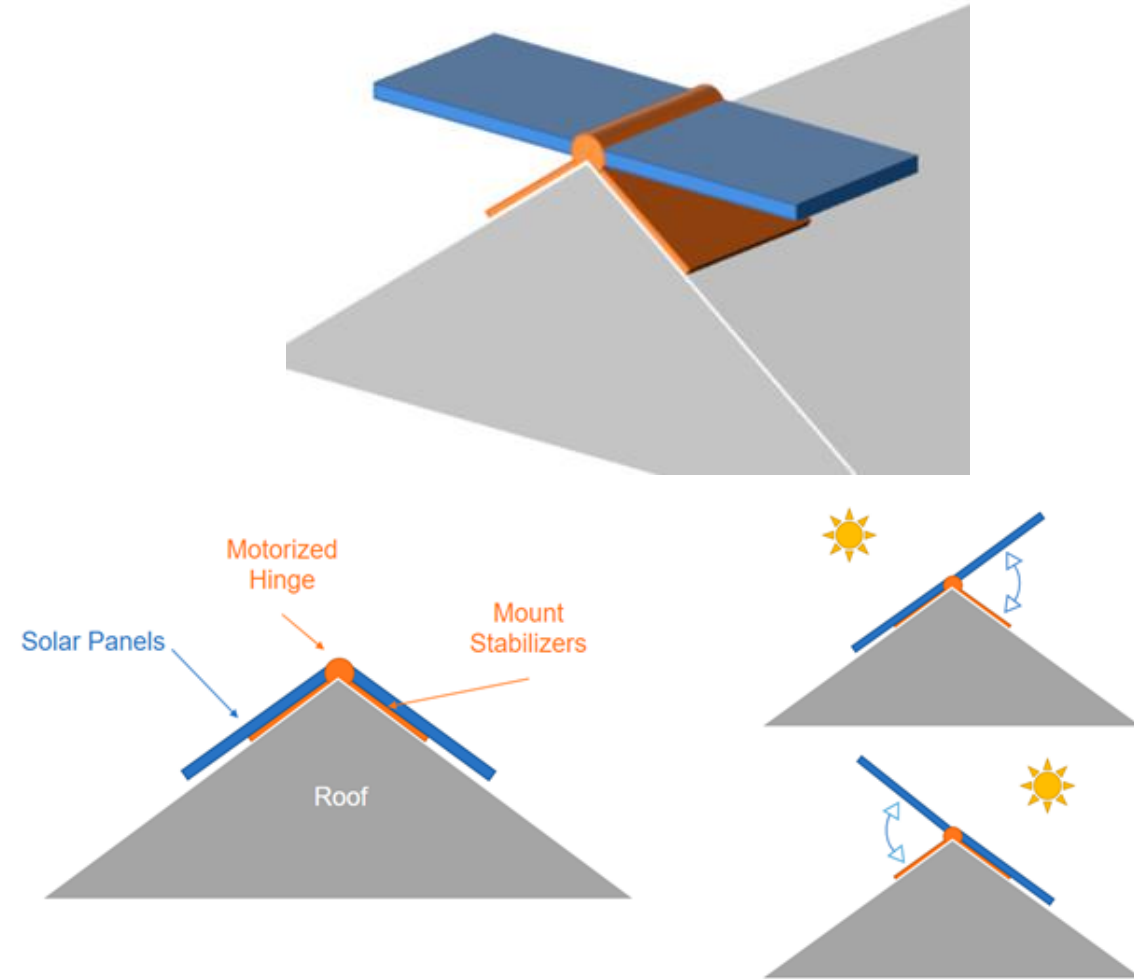
Which application areas would you use a solar power device for?

54 responses



Solution Concept

- 2 Panel Folding Design
- Motorized hinge allows sun tracking
- Expandable system
- DIY installation (no screws or nails)
- Roof and ground configurations
- Compatible with most solar panels
- Low Cost
- Addresses gap in market



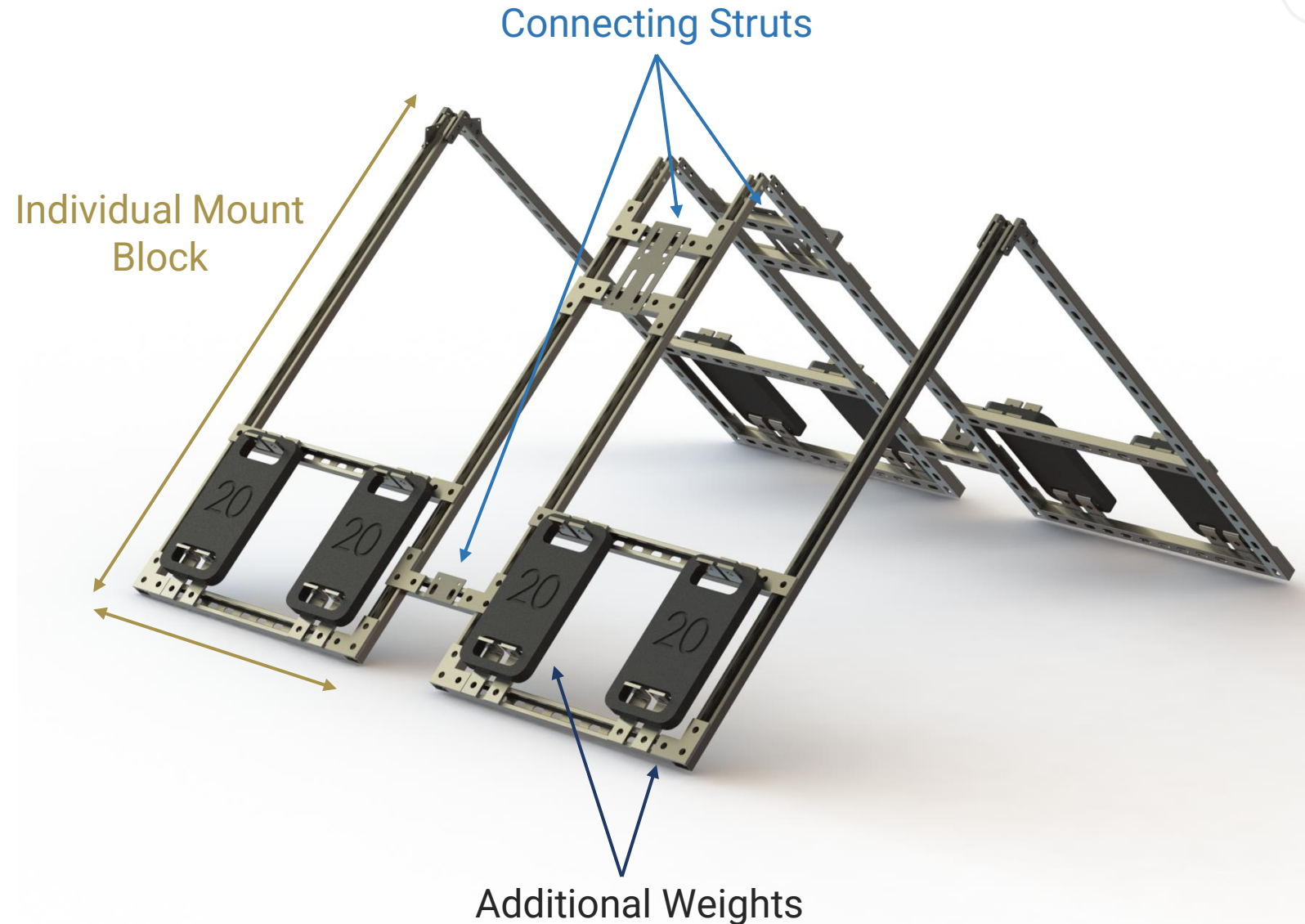
Mount System

Individual Mount Blocks

- Material: Galvanized Steel
- Weight of block: 6.5 kg
- Dimension of block: 4 ft x 2.25 ft

Assembly

- 4 individual mount blocks + connecting strut pieces
- Adjusts to all roof angles
- Ground or roof mounting
- Additional weights for various average wind and roof angles
- Can sustain 80 mph winds with deployed panels



Actuation System

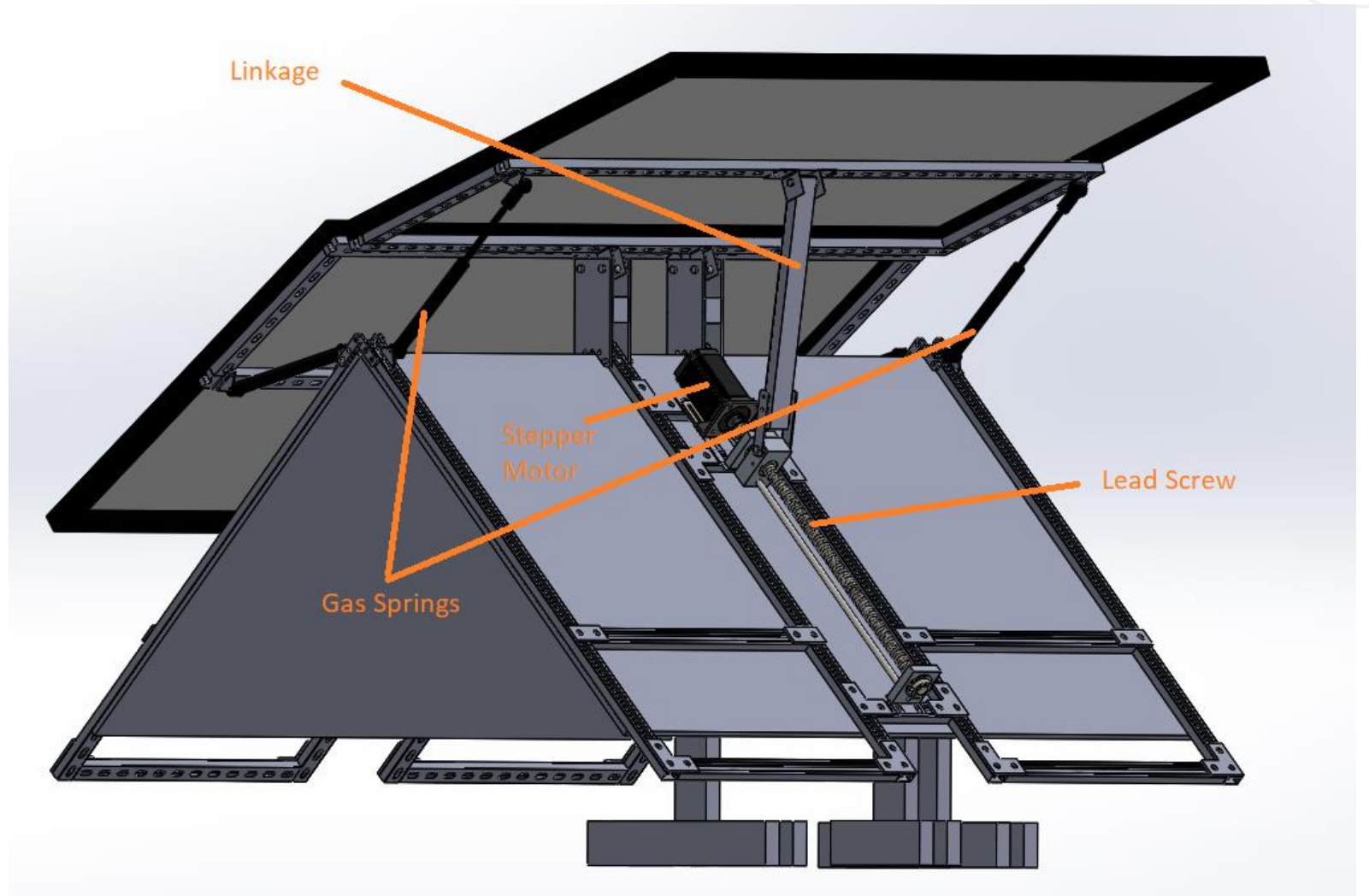
Single Linkage Lead Screw

- Lifts panel under 80MPH wind speed
- Self locking

Gas Springs

- Damping
- Panel weight offset

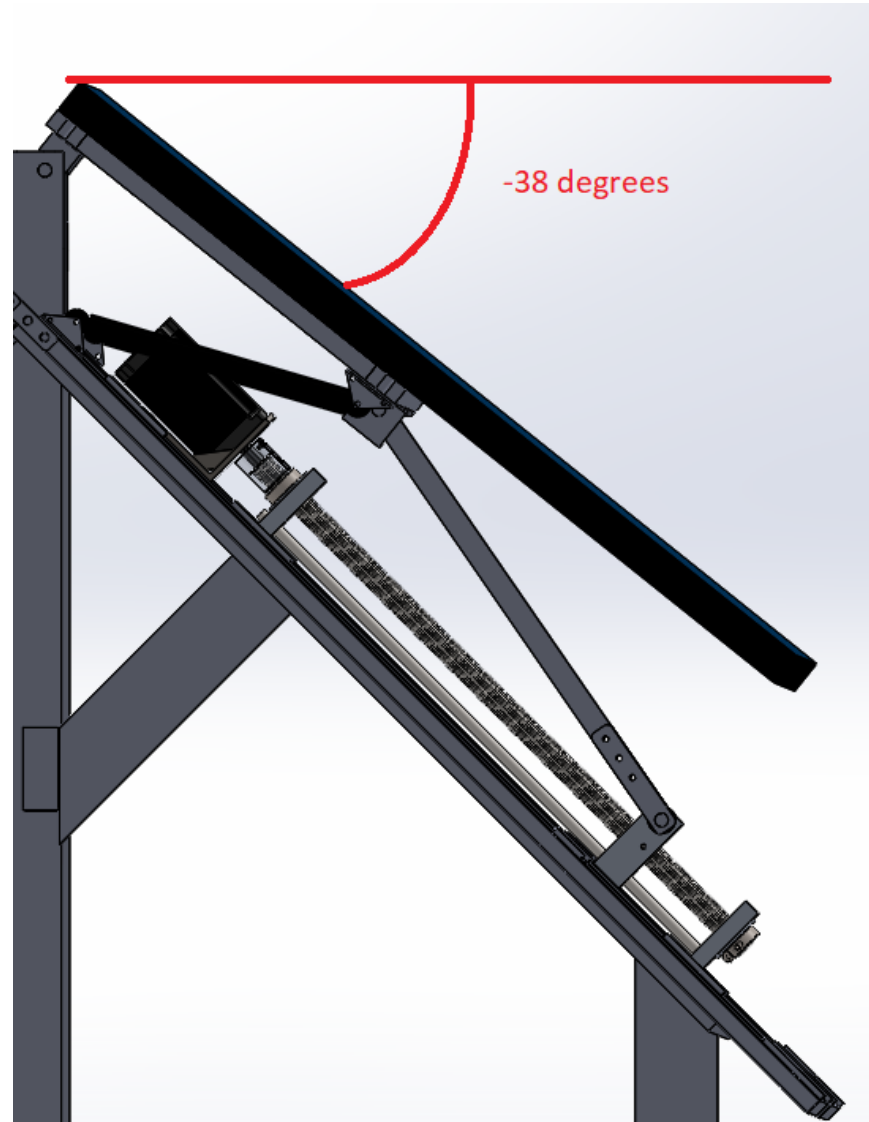
Direct Drive Stepper Motor



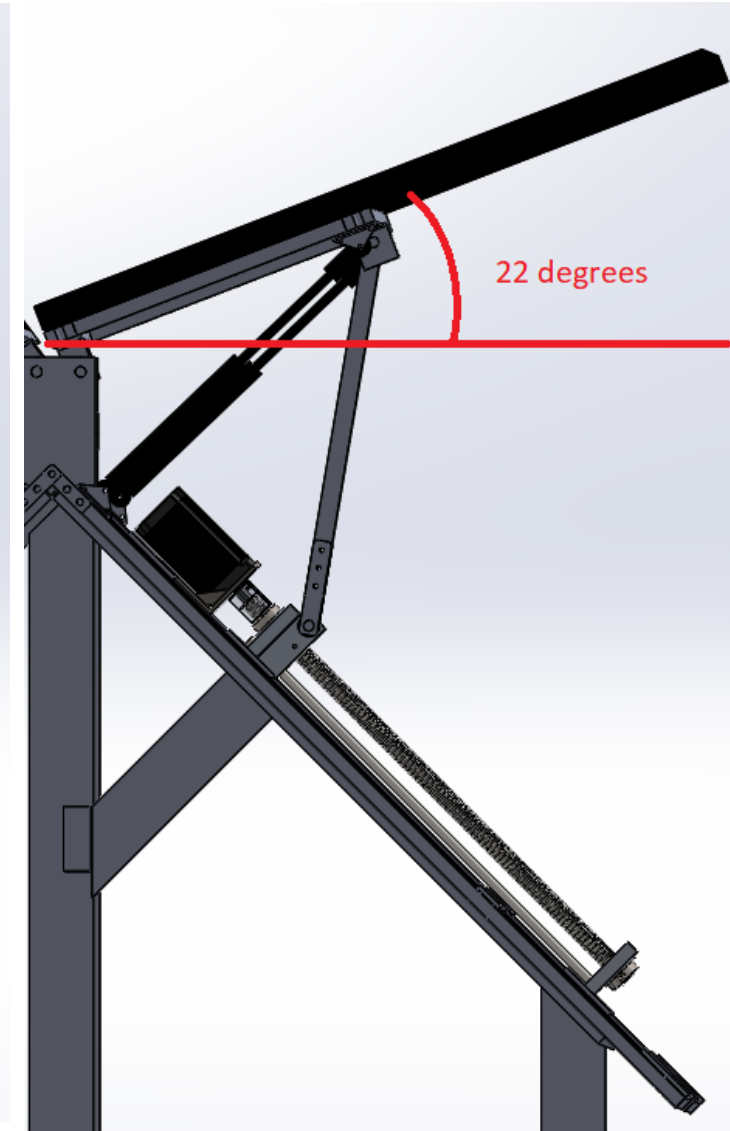
Actuation Range

Positions anywhere between 22 degrees to -38 degrees throughout the day

Lowest Position



Highest Position

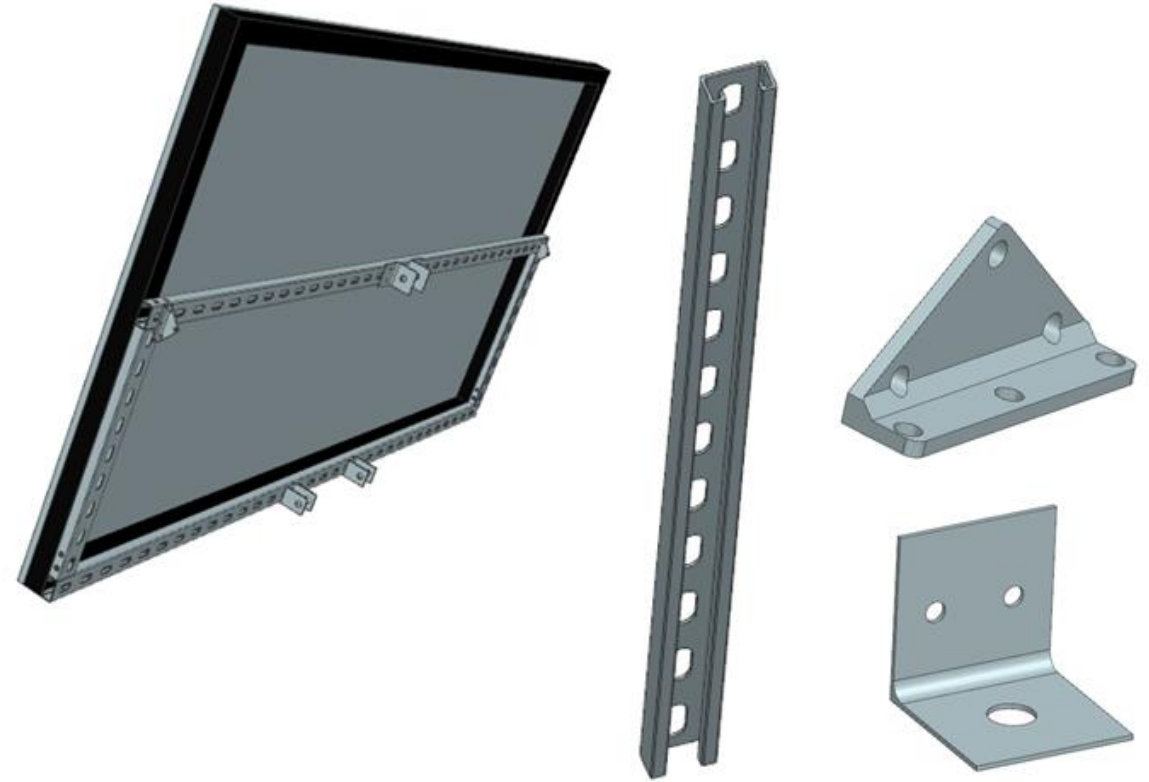


Hinge and Panel Design

- Designed to withstand heavy loads
- Allows various roof angles
- Quick install
- Waterjetted and welded



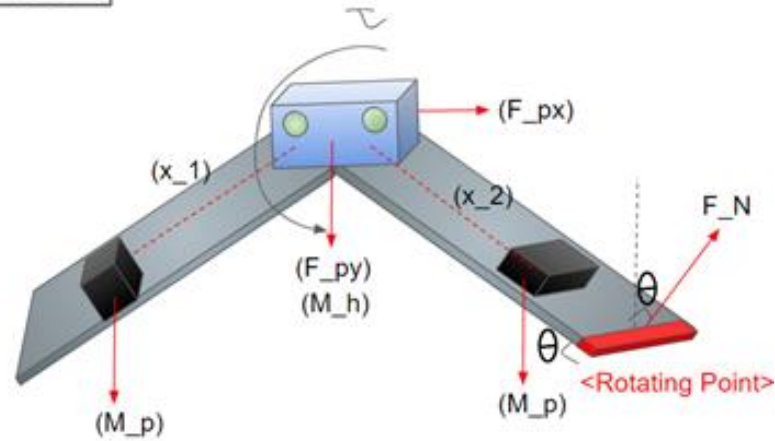
Hinges



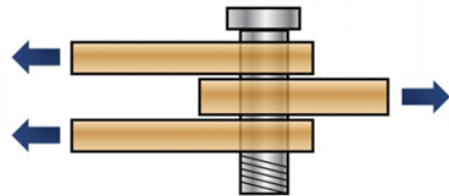
Panel
Struts

Design Calculations and Verifications

FBD



~1500N per side



DOUBLE-SHEAR JOINT

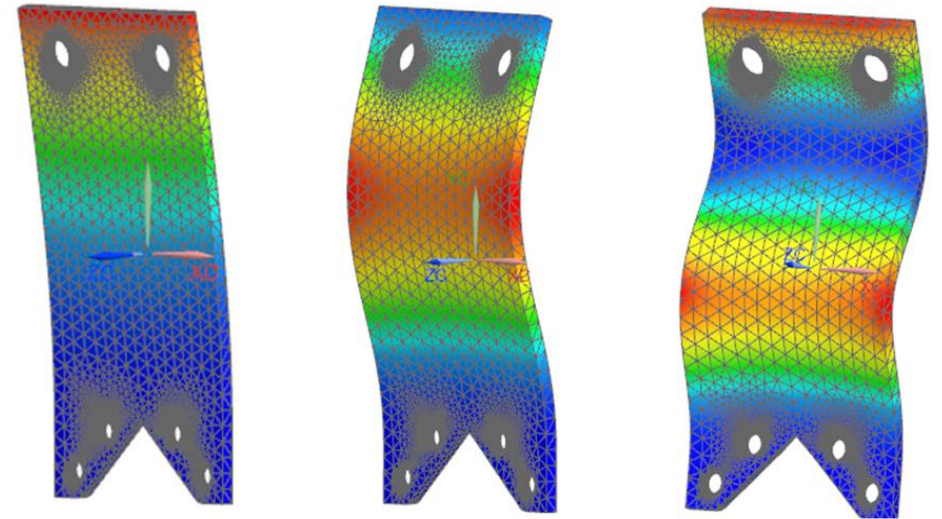
$$F_{total} = \frac{1500N}{2} = 750N$$

$$Safety\ Factor = 1.5 \quad Yield = 215\ MPa$$

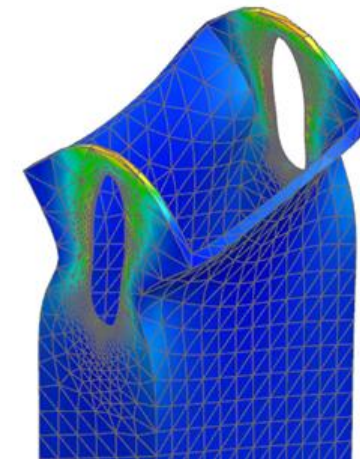
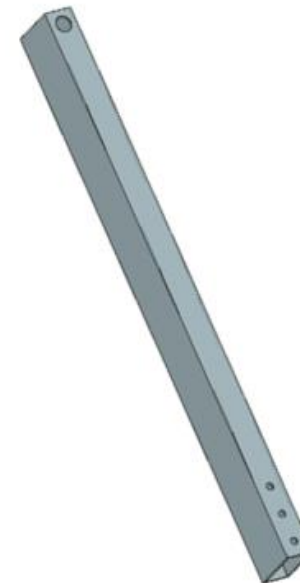
$$\tau_{allowable} = \frac{Yield}{Safety\ Factor}$$

$$V = \frac{F_{total}}{2} = 375N$$

$$D = \sqrt{\frac{4V}{\tau_{all}\pi}} = 2.5811mm$$



Hinge Buckling Modes

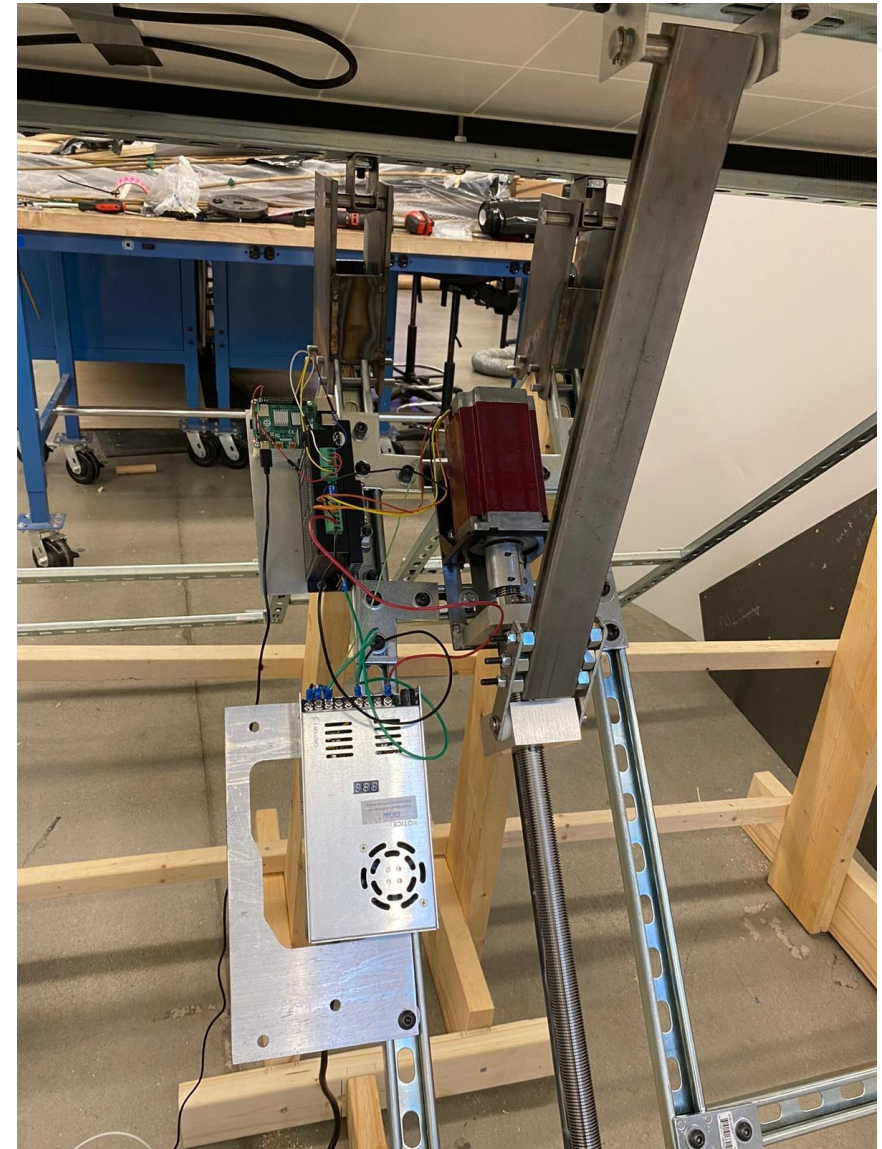


Max Von-Mises:
101.74 MPa

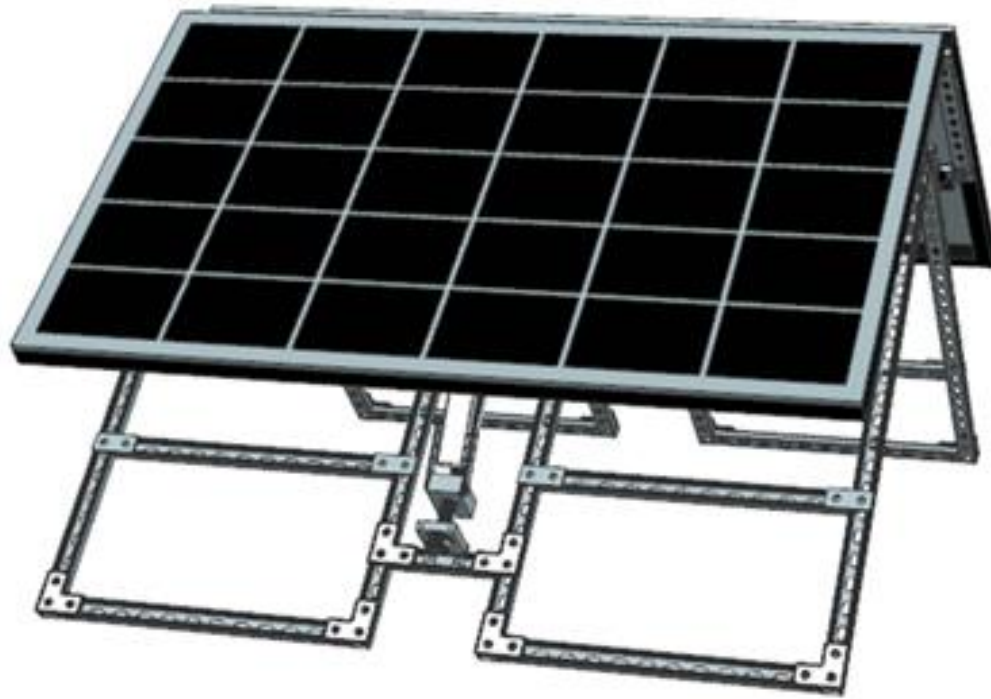


Motor Controller Code

- Can control motor motion, including speed and direction
- Single-axis tracking
- Algorithm options
 - Pre-determined movement, based on known solar movement patterns
 - Dynamic tracking, based on sensor feedback
- Tracking increases energy capture by an average of 22.5% in Atlanta
 - Higher in areas with more direct sunlight, and less diffuse sunlight



Completed Design



Final Assembly



Thank you for watching!