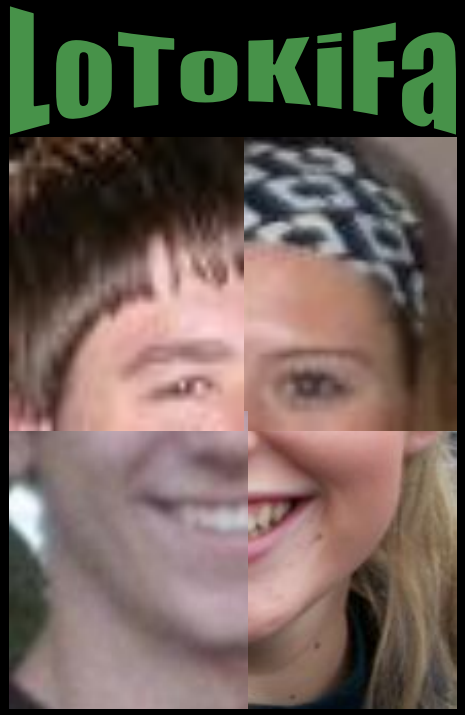
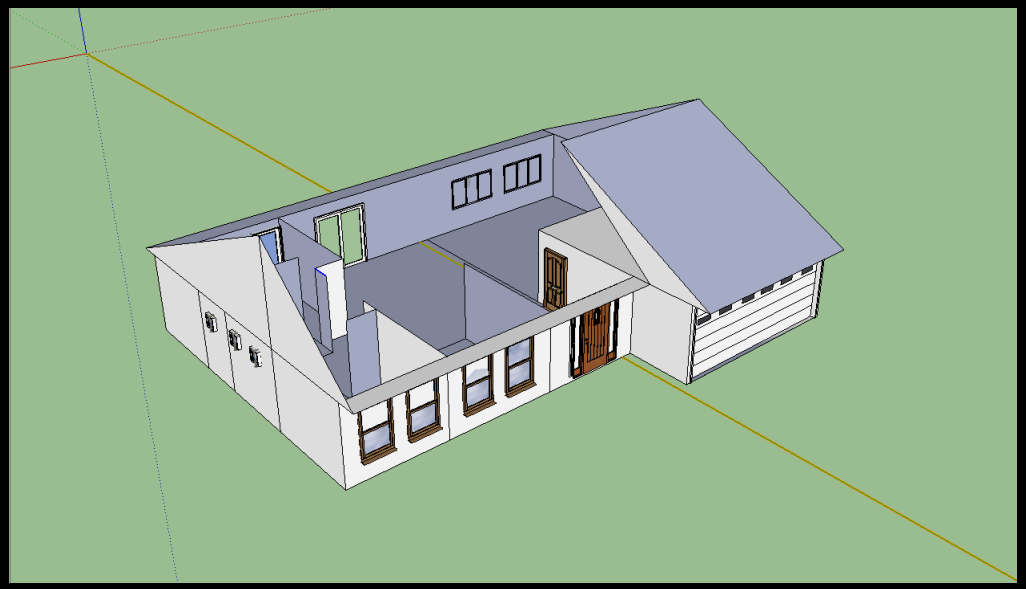
LoToKiFa





"Project Z"

Logan Sullivan
Tom Winkler
Kiley Dugan
Fawn Romanko

23 March 2010

Project Overview

- Goal: To create an innovative design that incorporates both a realistic living environment and energy-saving techniques that can withstand Pennsylvania's climate and atmosphere
- Most important features of design include:
  - Solar paneling
  - Adequate insulation
  - Efficient HVAC system

Project Overview cont'd

Location (city, state)	State College, PA
House size (floor area in square feet)	1,300 sq. feet
Number of floors	1
Number of occupants	Single family
Number of bedrooms	3
Type of heating system (forced air, hydronic, radiant floor, heat pump, etc.	Air source heat pump
Solar water heater (yes or no)	yes
R-value of wall insulation	3.7
R-value of ceiling insulation	4.0

Research Summary

Lessons Learned

- Small floor plan
- South-facing windows
- Solar panels on the South-facing side of roof

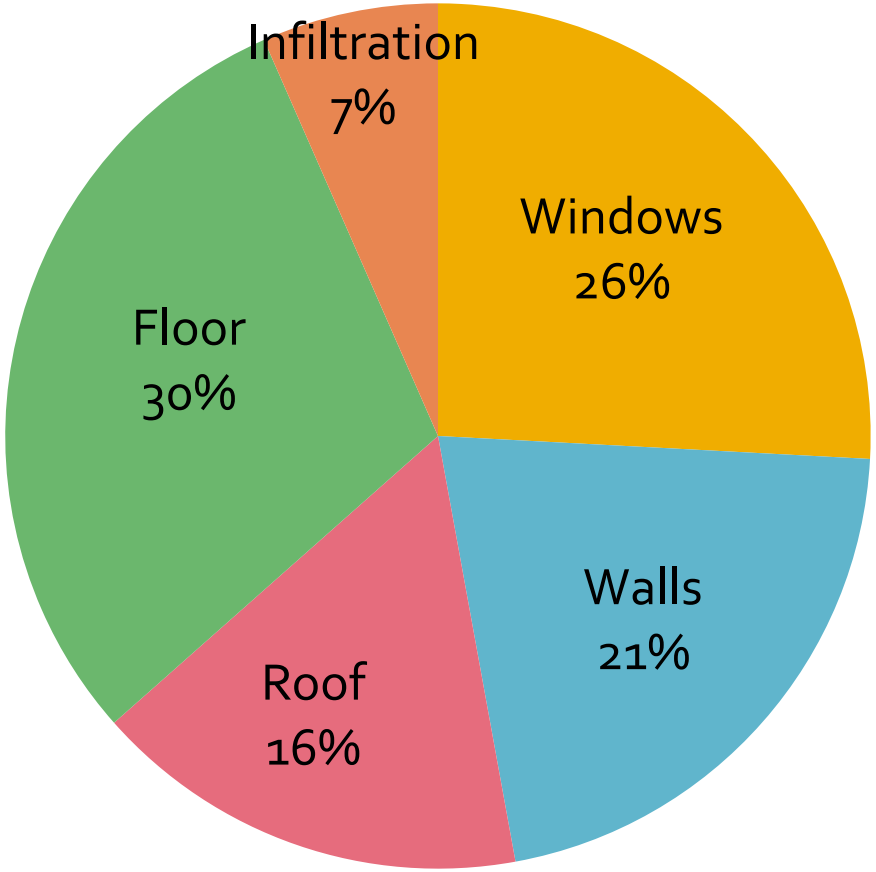
Location -- South Allison Hill, PA
Size -- 1675 sq. feet
Occupancy – 4 people

Location -- Wheat Ridge, Colorado
Size – 1280 sq. feet
Occupancy – 3 people

Envelope Design

- Use of fiberglass insulation (R-value of 3.7)
- Triple-pane low-e windows (R-value of 4.0) (more on this later)
- Door: Metal with foam core (R-value of 4.0)
- Construction with emphasis on tightness, ACH of 0.30/hr

Envelope Heat Transmission



- Calculated using Penn State Center for Sustainability's calculator.

Appliances

Dishwasher

Kenmore 1332

2.7 gal/cycle

0.477 kW/day

Appliances (cont'd)

Television

Philips 42PFL5603D

LCD

42 inch screen

0.736 kwh/day

92 watts/hr when power is on

Appliances (cont'd)

Refrigerator

Kenmore 69376

22.1 cubic feet

1.16 kwh/day

Appliances (cont'd)

Clothes Washer

Whirlpool WFW9400S

4.0 cubic feet capacity

0.510 kwh/day

HVAC

- Use of energy efficient HVAC system

- System will have a SEER rating of 14 or above (the minimum level for energy efficiency rating)

Solar Power

- Use of solar panels on the roof of our house.
- Decreases need for power from other sources, thereby reducing electric bill.
- Savings of over 30% if installed now, due to federal tax credits.
- Monthly electric bill could potentially be reduced to zero dollars (a very nice bill)

Solar, cont'd.

- Before laying our roof, we plan on placing flashable mounting brackets in order to greatly reduce the chance of leakage.

Standard solar flashable mounting bracket

Rain Water Collection

- Instead of having the gutters of our house drain to the sewer, we have created a sophisticated rain-water collection system.
- This system will help reduce both consumption of water from the public water system and the amount of waste placed into the sewer system.

Rainwater Collection, cont'd.

- All of our gutters will collect in one plastic (or other non-rusting) barrel, or combination of multiple barrels, dependent on capacity and cost-effectiveness.
- Rainwater can be used for rinsing and soaking clothes, doing the dishes, and for cleaning.

Walls

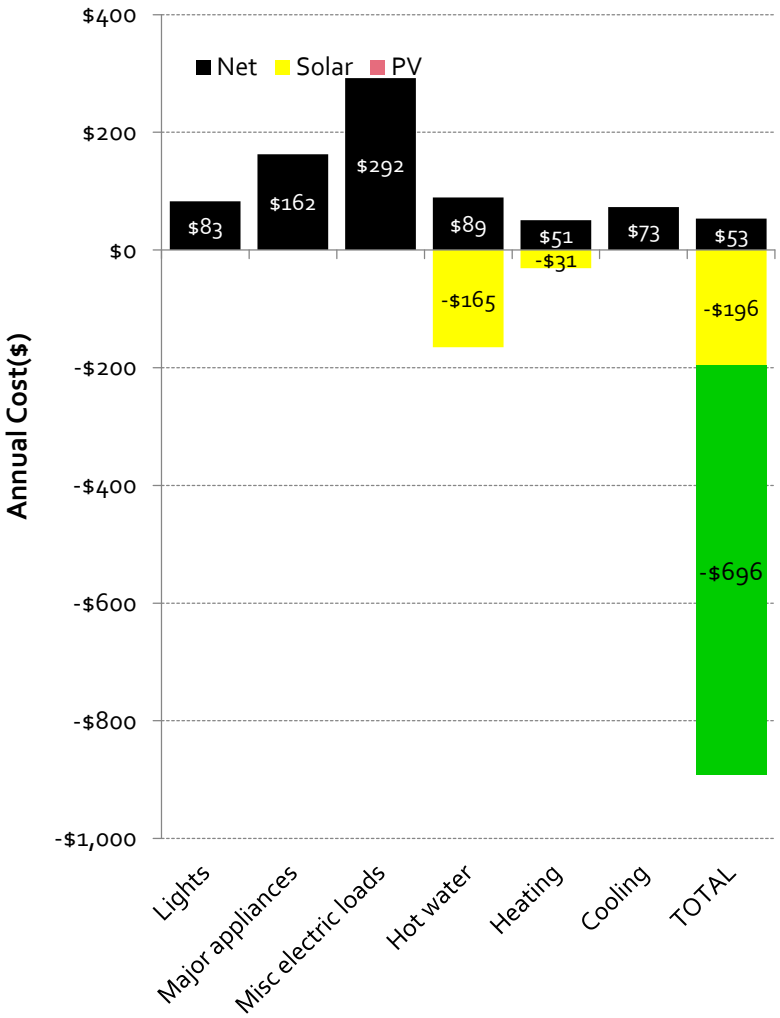
- Highly-insulated walls, including use of fiberglass (though not the most efficient product available, it is the most cost effective)
- Walls will prevent leakage from the house, therefore making it 'tighter' which will, in turn, lower heating and cooling bills, in their respective seasons.

Windows

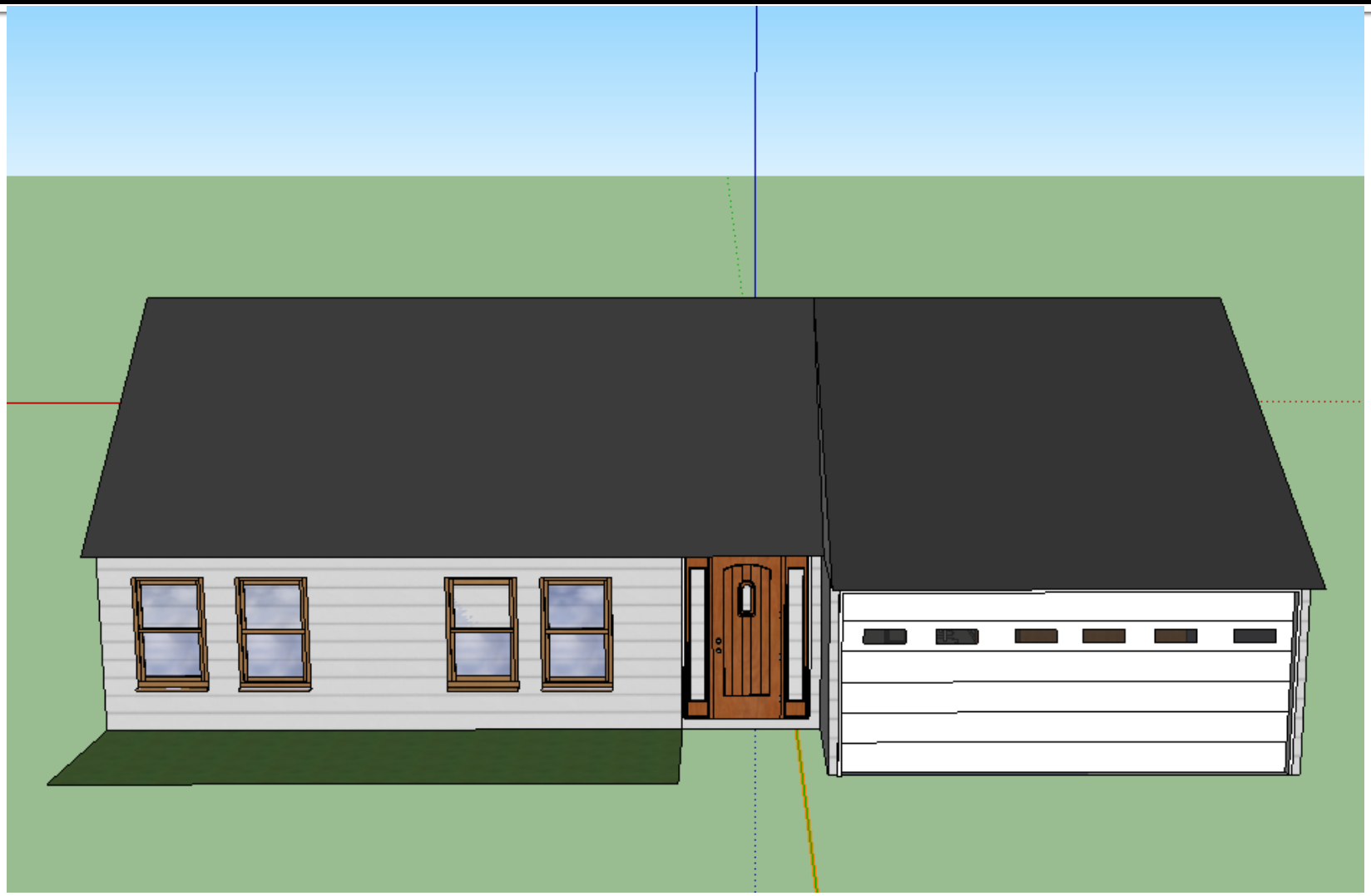
- Copious amount of windows, especially on the south-facing wall.
- Use of highly efficient windows that allow less air leakage than regular double-paned windows
- Allows for natural heating in winter and allows for natural ventilation in more temperate months

Estimation of Costs

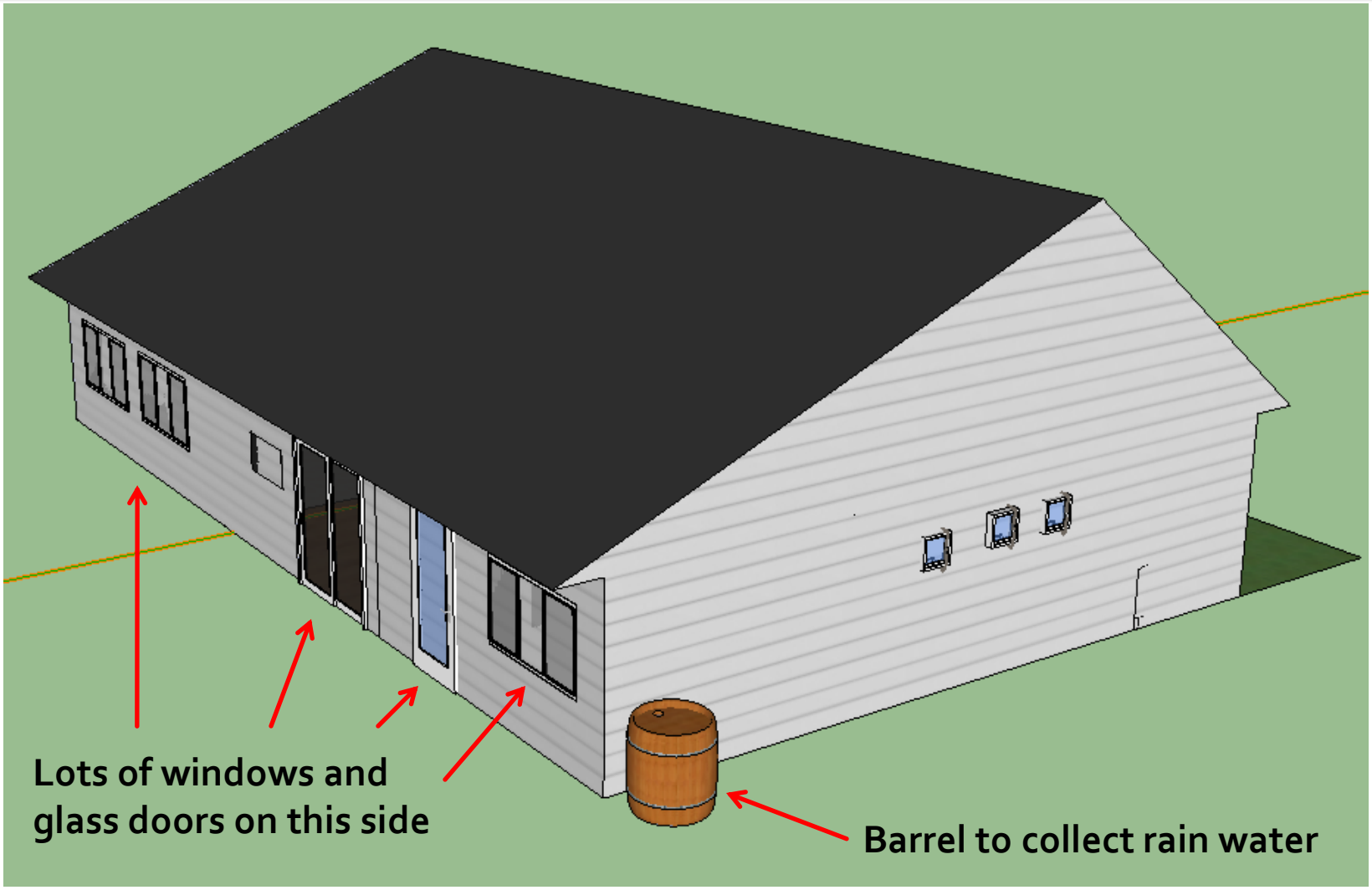
- Although State College was not an option on the ZEH Home Calculator, we decided to calculate using Harrisburg as our location, hoping to gain what insight we could.



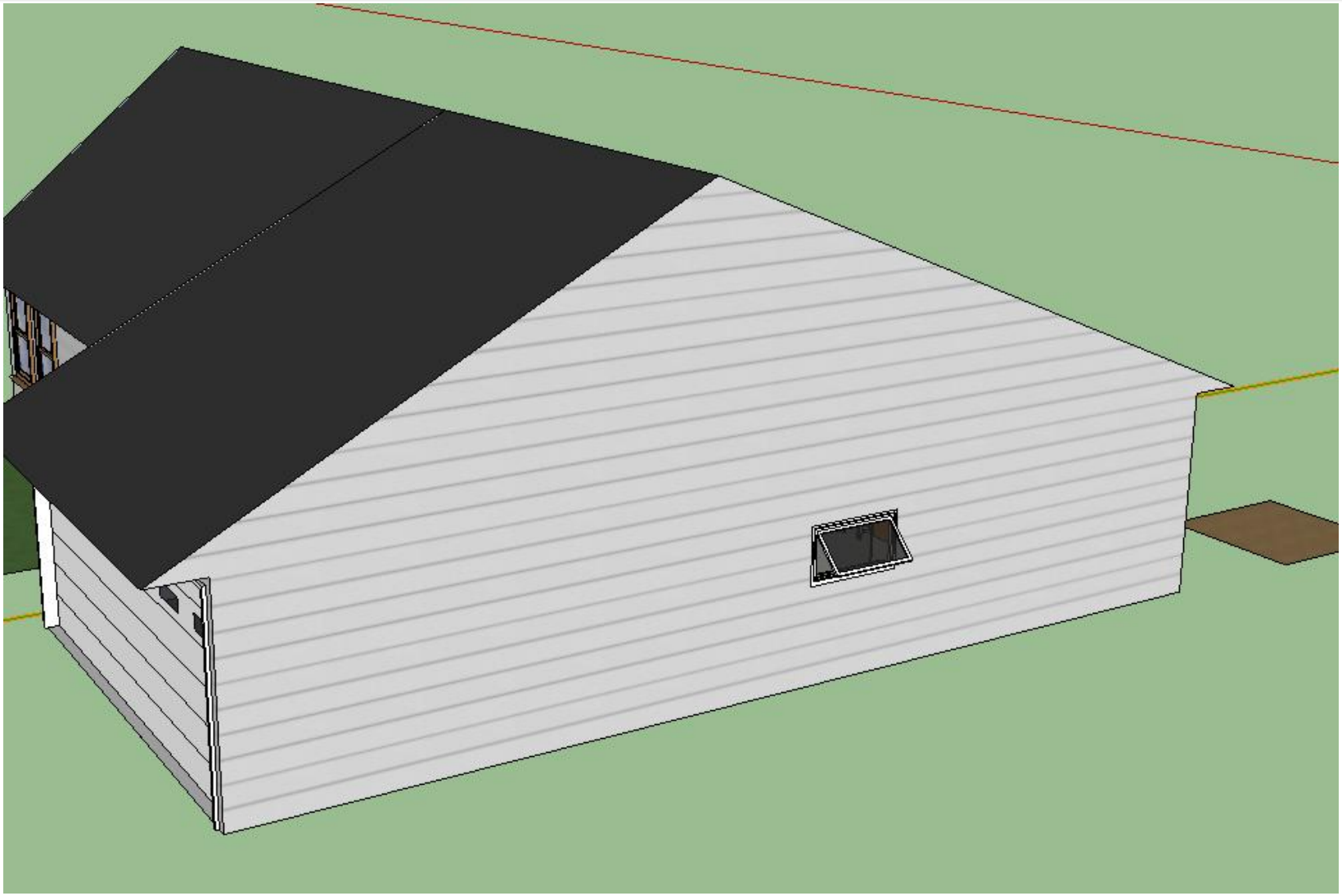
Front View (North-facing)



Rear (South-facing) and Left View

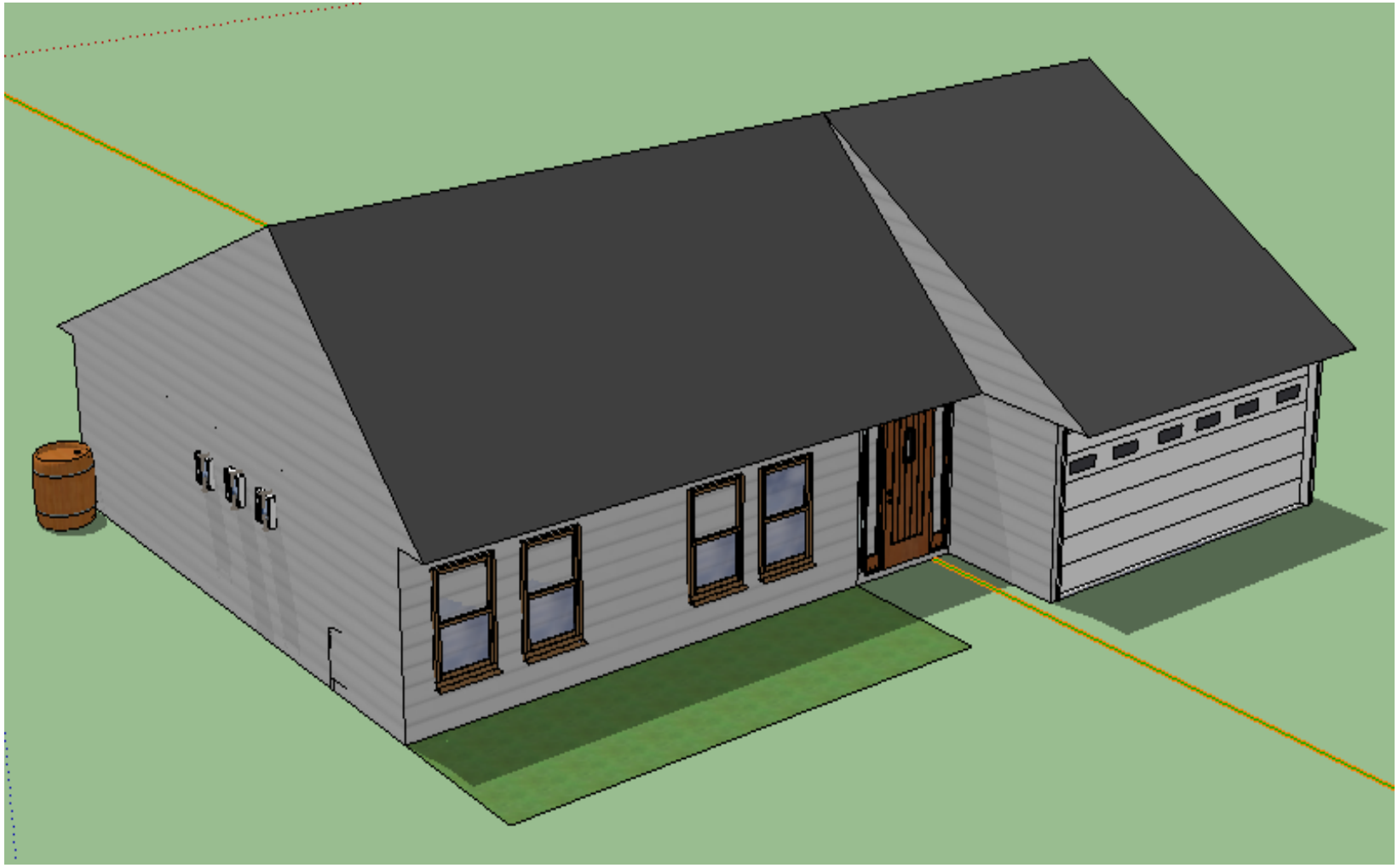


Right View

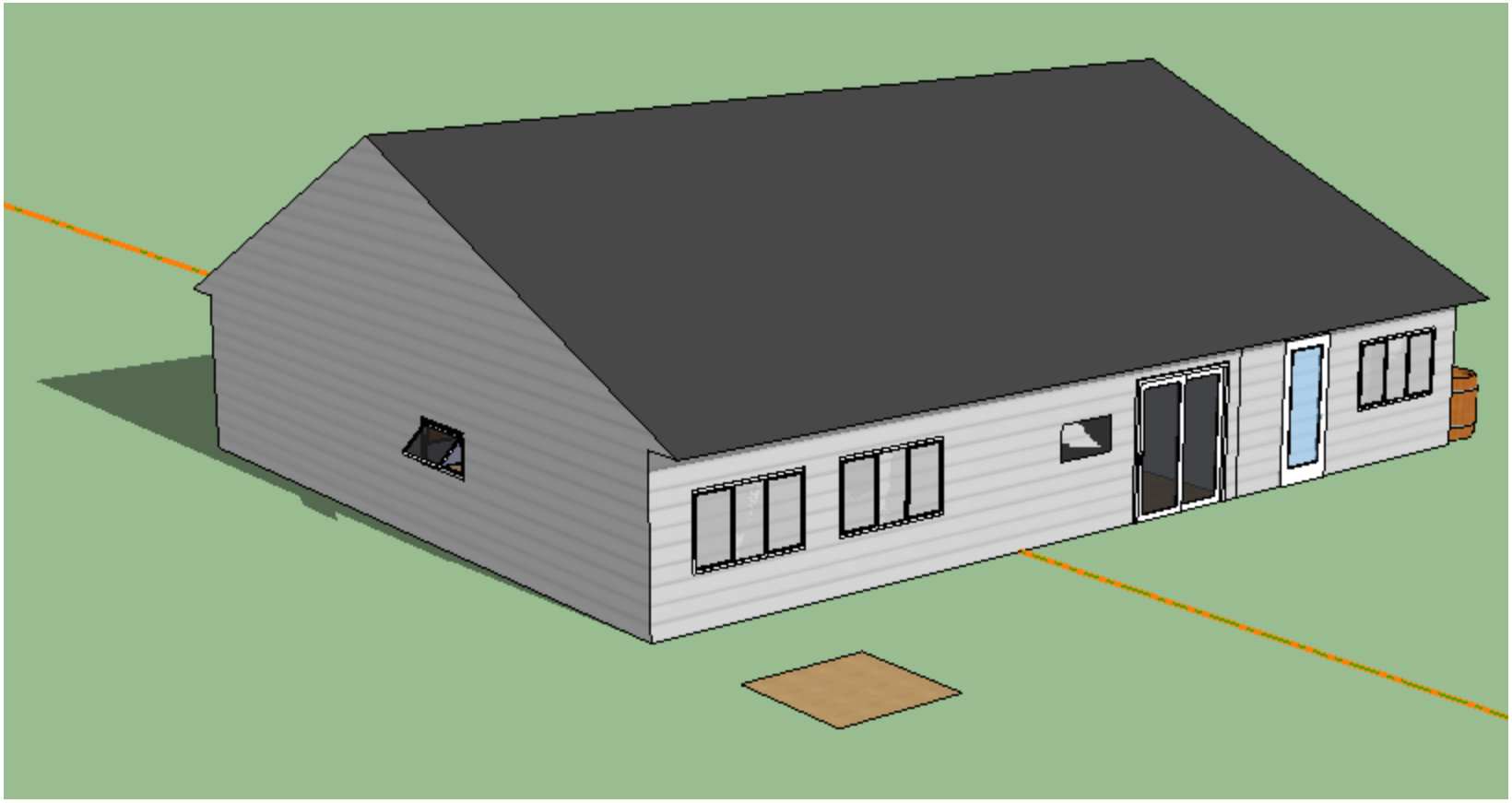


Interior View

Summer Solstice: June 21st



Winter Solstice: December 21st



Equinox: March 21st

Physical Model

Favorite Features

Logan – The Home Garden

- Home grown foods in the summer (Ex: potatoes, watermelon, basil, and much more)
- Very convenient and home grown foods instill a sense of pride

Fawn – The Rainwater Collector

- Uses gutters to collect and store rainwater in a convenient barrel
- Used to water the garden, wash clothes, and wash cars

Favorite Features (continued)

Tom – The Solar Panels

- Use energy from the sun and convert it into usable energy
- Angled at 30^0 to maximize effectiveness

Kiley – The Sliding Glass Doors

- Allow sunlight to enter to help heat and brighten the house
- Located on the south-facing wall to maximize effectiveness

Problems

- Had to build two roofs for the physical model
- We originally wanted our design to be for a warmer climate
- We had to change our original landscaping plans due to location
- We could not get the solar panel components to accurately connect to the roof of our Google Sketchup model.

Lessons Learned

- Creating a ZEH in PA is possible, though it can easily become expensive.
- In order to be a completely effective ZEH, not only must the construction of the house be green, but also the interior components of the house (appliances, for example) and the activities of those living in the ZEH (lowering the thermostat, taking short showers, etc)