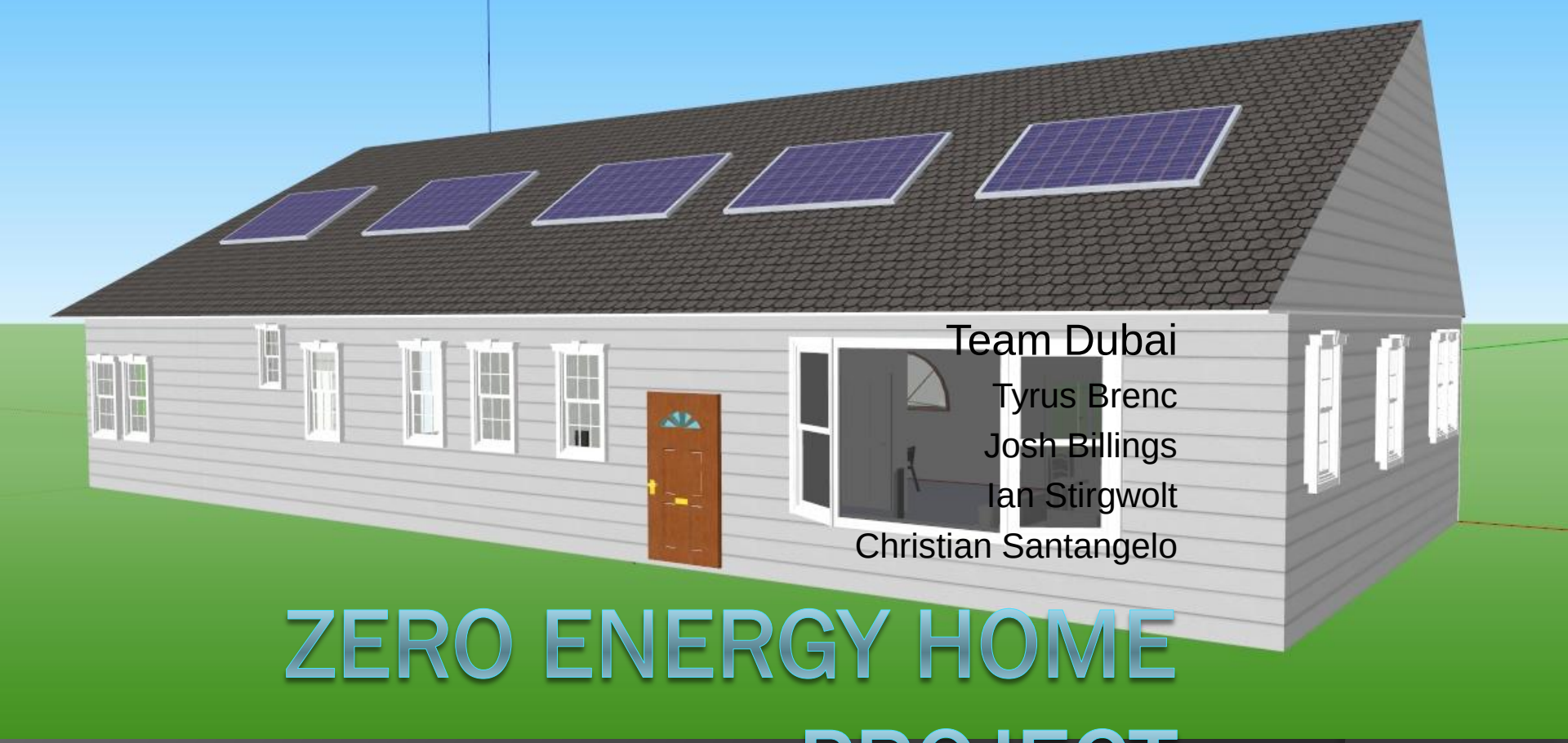


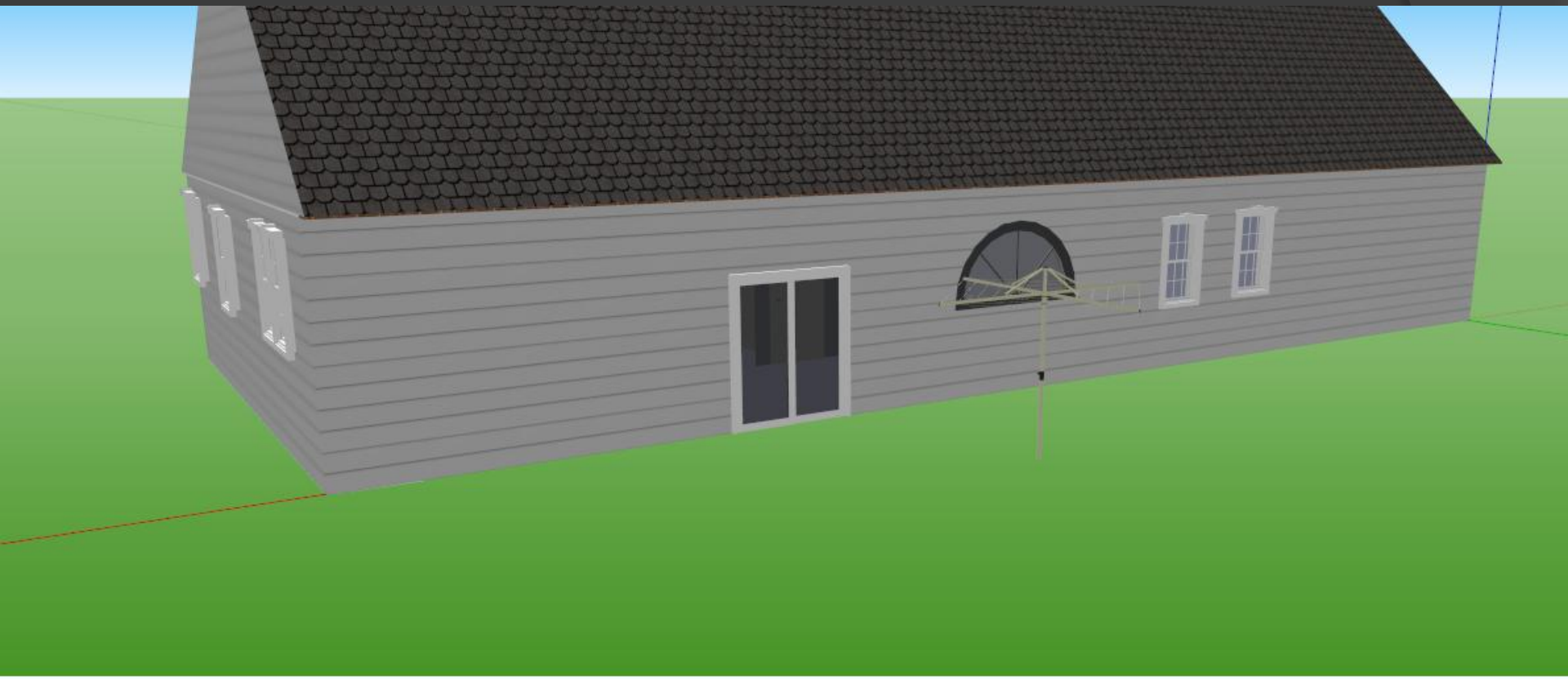
Team Dubai
Tyrus Brenc
Josh Billings
Ian Stirgwolt
Christian Santangelo

ZERO ENERGY HOME PROJECT

Project Overview

- Cheap
- Easy to manufacture
- Sacrifice
- Simplicity
- Mass Produce
- Basic Needs
- Location (city, state): Pottstown (General Area), PA
- House size (floor area in square feet): 2100 sqft
- Number of floors: 1 plus attic, no basement
- Number of occupants: 4
- Number of bedrooms: 3 bedrooms, 2 full baths
- Type of heating system: Geothermal, Dual System
- Main heating fuel: Geothermal, Electric Backup
- Solar water heater (yes or no): Yes
- Ventilation air heat recovery (yes or no): Yes

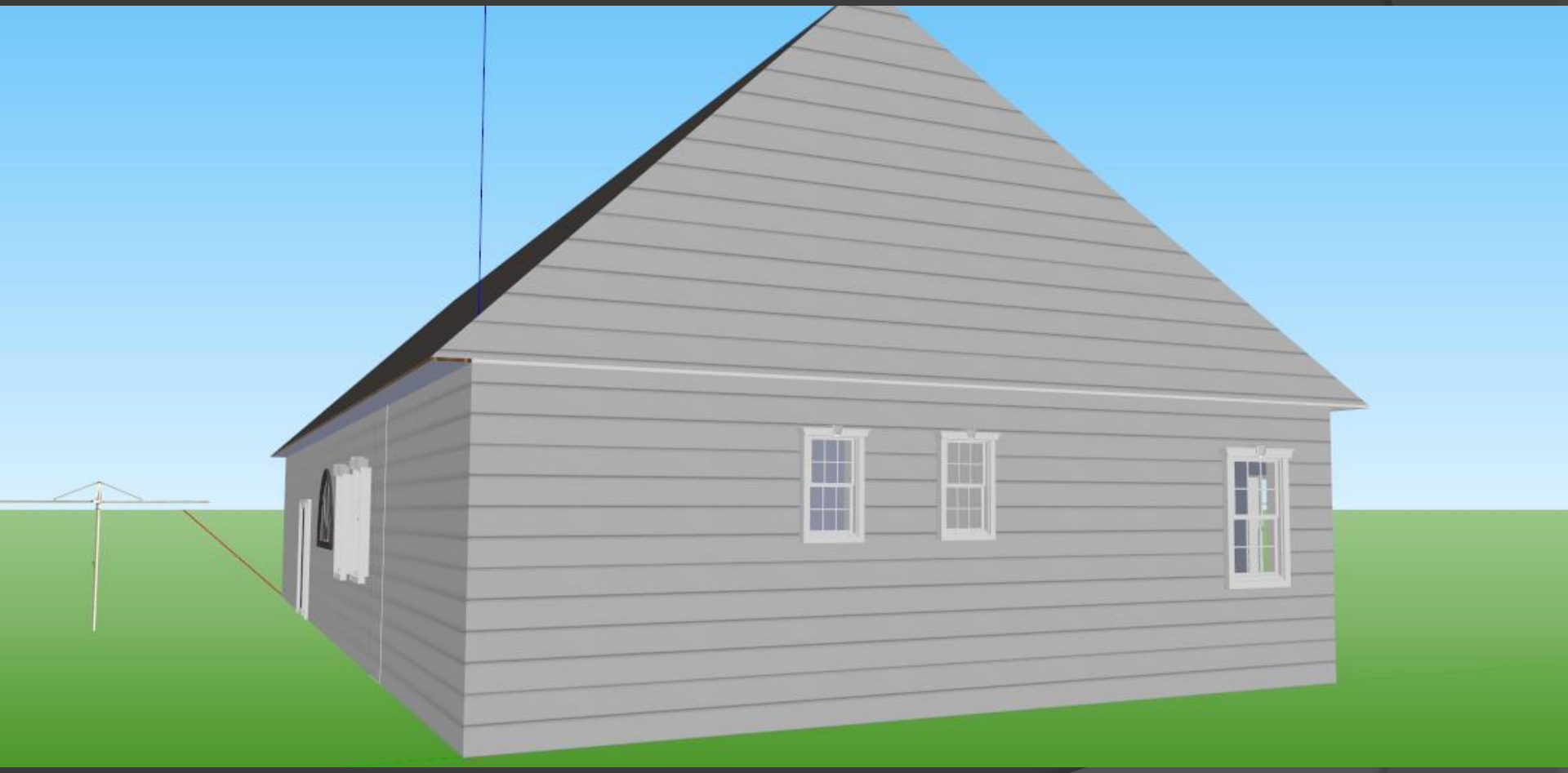
Pictures-North Face



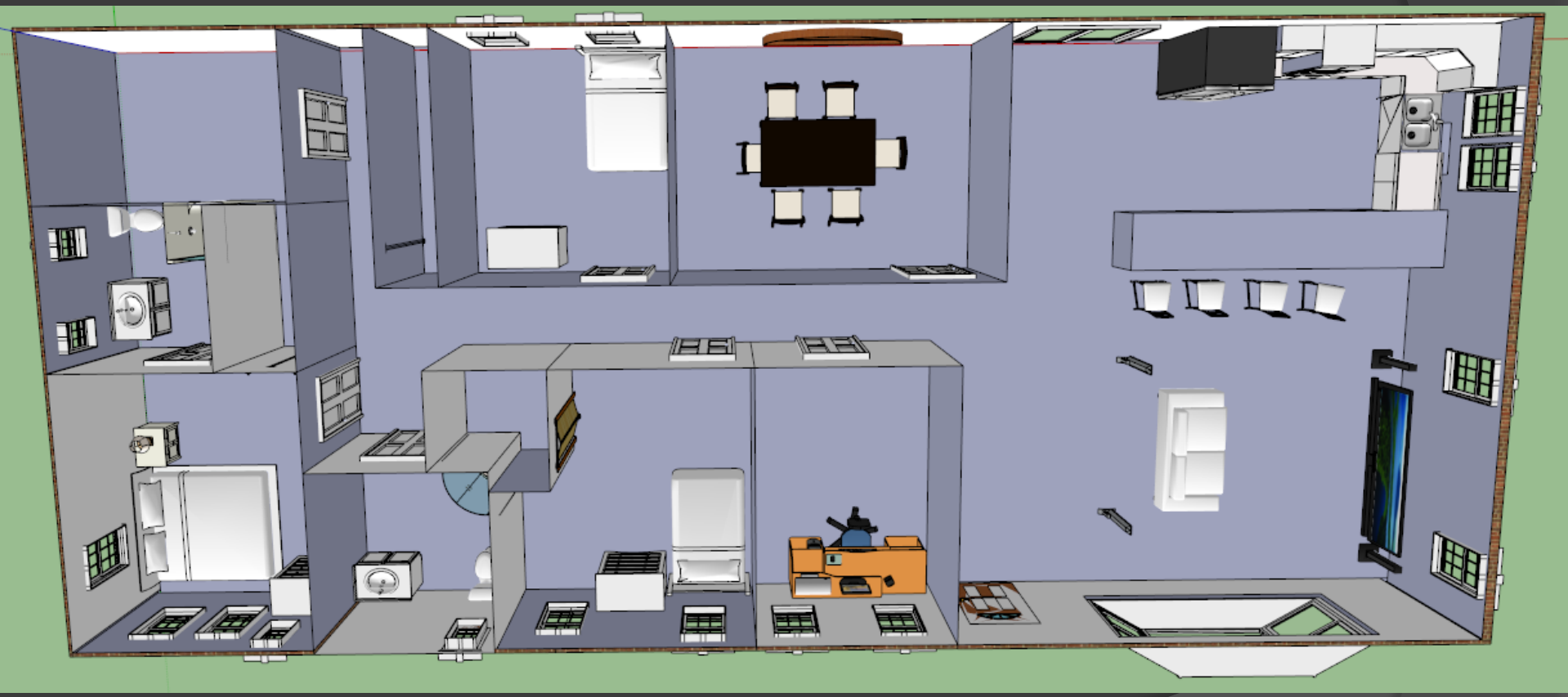
Pictures-South Face

Pictures- East Face

Pictures- West Face



Pictures- Inside Top View



Pictures-21st December

Pictures- 21st September

Pictures-21st of June

Pictures-21st of September

Research Summary

- Design-our house
- Create- a simplistic design and models
- Combine-various systems to work together
- Simplify- do not bring complex components into the plan
- Study- ZEH research, looking at other models
- Collaborate- work as a team

Analysis of Key Decisions

- Basic Design- Rectangle, seventy feet by thirty feet- designed house first, then rooms inside
- Three bedrooms, two bathrooms
- Open floor plan for aeration when wind permits
- Laundry room combined with Utility room
- Kitchen, dining room, office, bar
- Total Square Footage= 2100 sq. ft.

Appliances

- Selection Process for each appliance:
  - James Washing Machine
    - Zero energy
    - minimal water usage
  - Kenmore Refrigerator
  - Vizio LCD TV
  - Whirlpool Dishwasher

Team Name	Refrigerator			Dishwasher			Clothes Washer				Television				
	Size	Mfg & Model	Energy Use	Mfg & Model	Water Use	Energy Use	Capacity	Mfg & Model	Water Use	Energy Use	Size	Type	Mfg & Model	Energy Use	Power When On
	(ft^3)		(kwh/day)		(gal/cycle)	(kwh/day)	(ft^3)		(gal/cycle)	(kwh/day)	(in)	(Plasma, LCD, LED)		(kwh/day)	(Watts)
Dubai	21.9	Kenmore 76252	1.3	Whirlpool DU1055TX	4.08gal/cy	0.88	3.5	James Washer	5 gal/cylce	0	17 gal	LCD	Vizio VO32LF	0.276	69

Envelope and Behaviors

- Five Surfaces to consider
- Opted to have no basement, there was really no need for one
- Thus, four walls, one ceiling
- Designed to be very tight, with minimal amount of spaces that could leak air.

- Minimal water usage:
  - Low flow shower heads
  - Hands free faucets
  - Laminar Flow Faucet Aerator
- Save on energy costs:
  - Clothes line
  - Manual Clothes Washer
  - Power Strips

ZEH Spreadsheet

Penn State Center for Sustainability

General Info

Location	Philadelphia
Electricity cost ($/kwh)	0.1
Conditioned floor area (sq.ft.)	1152
Number of bedrooms	3

Envelope Details

Wall construction	Double 2x4 with 10" foam
Ceiling Insulation	R60
Window type	Triple low-e
Upper floor ceiling area (sq.ft.)	2100
North wall area (gross) (sq.ft.)	630
East wall area (sq.ft.)	270
South wall area (sq.ft.)	630
West wall area (sq.ft.)	270
North window area (sq.ft.)	90
East window area (sq.ft.)	60
South window area (sq.ft.)	155
West window area (sq.ft.)	60
Air tightness	Tight with heat recovery

Major Appliances

Refrigerator	Best
Clothes Washer	Best
Dishwasher	Best

Zero Energy Home Calculator

Heating & Cooling

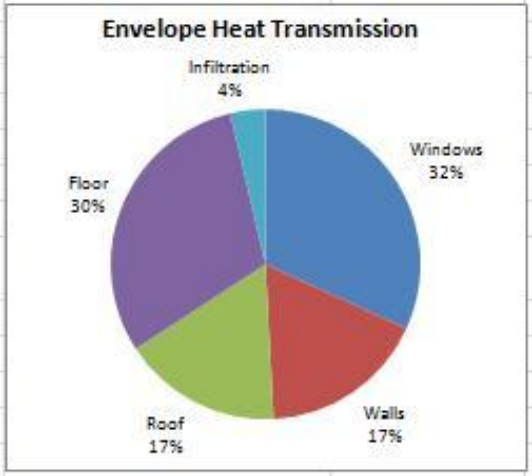
Type of heating & cooling system	Electric heat pump

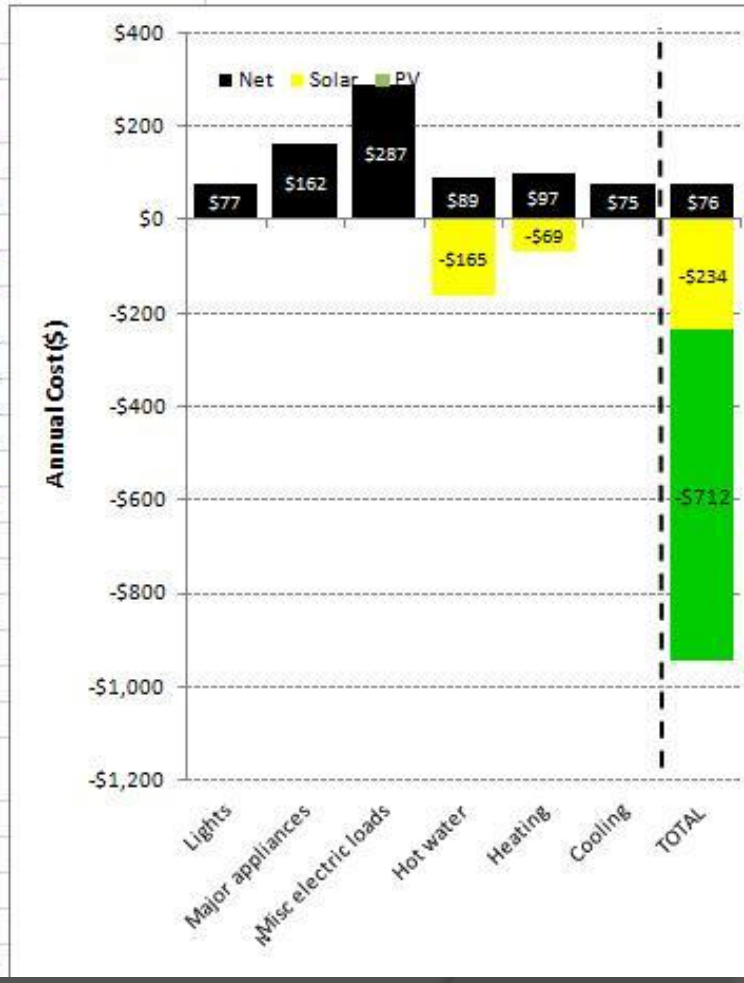
Solar Technologies

Size of PV system (kw)	5.3
Solar water heater	Yes

Behavior

Water conservation	A lot
Uses clothesline	A lot
Thermostat setback	A lot
Heat thermostat setting (F)	66
Cool thermostat setting (F)	78





HVAC

- No dedicated air conditioning system(built into geothermal)
- Mostly a Geothermal based heat pump system
  - System lasts for 25 to 50 years, thus very practical
  - Very high efficiencies(300-600%) achieved on very cold nights
  - Dual source heat pump provides even greater savings
  - Original cost returned through electrical savings in five to ten years.

Solar Technologies

- Photovoltaic Panels for Electricity Generation
- Solar Water heating panels
  - First hand account- Tyrus-Little to no maintenance, last a very long time
  - Very little maintenance, cost returned to you many times over.
  - Original cost returned in estimated four to ten years, has a much longer life span
  - If designed well, backup heater will only experience minimal usage

Summary of Design

- Simplicity
- Integrated Designs
- Greatest Challenges-Designing the physical model, coming up with a floorplan, working with rough materials when building physical models

Summary of Design

- Team Members favorite parts:
  - Ian-Designing and working on Physical model, lack of complex variables
  - Tyrus-floorplan
  - Christian- Sketchup model, Simplistic design
  - Josh-Open Floorplan design, working on physical model

Goals and Conclusions

- Main goal- simplistic house that combined various systems, including HVAC and Solar Energies, in an integrated design that was easily obtainable
- Obtained, as shown by previous slides, through collaboration, study of previous designs, and simplistic variables.