 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-21st December
Pictures- 21\textsuperscript{st} September
Pictures-21st of June
Pictures-21\textsuperscript{st} 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
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

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

Annual Cost ($)
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.