

Barn House Holladay – Site Net Zero Energy

Prof. Jörg Rügemer

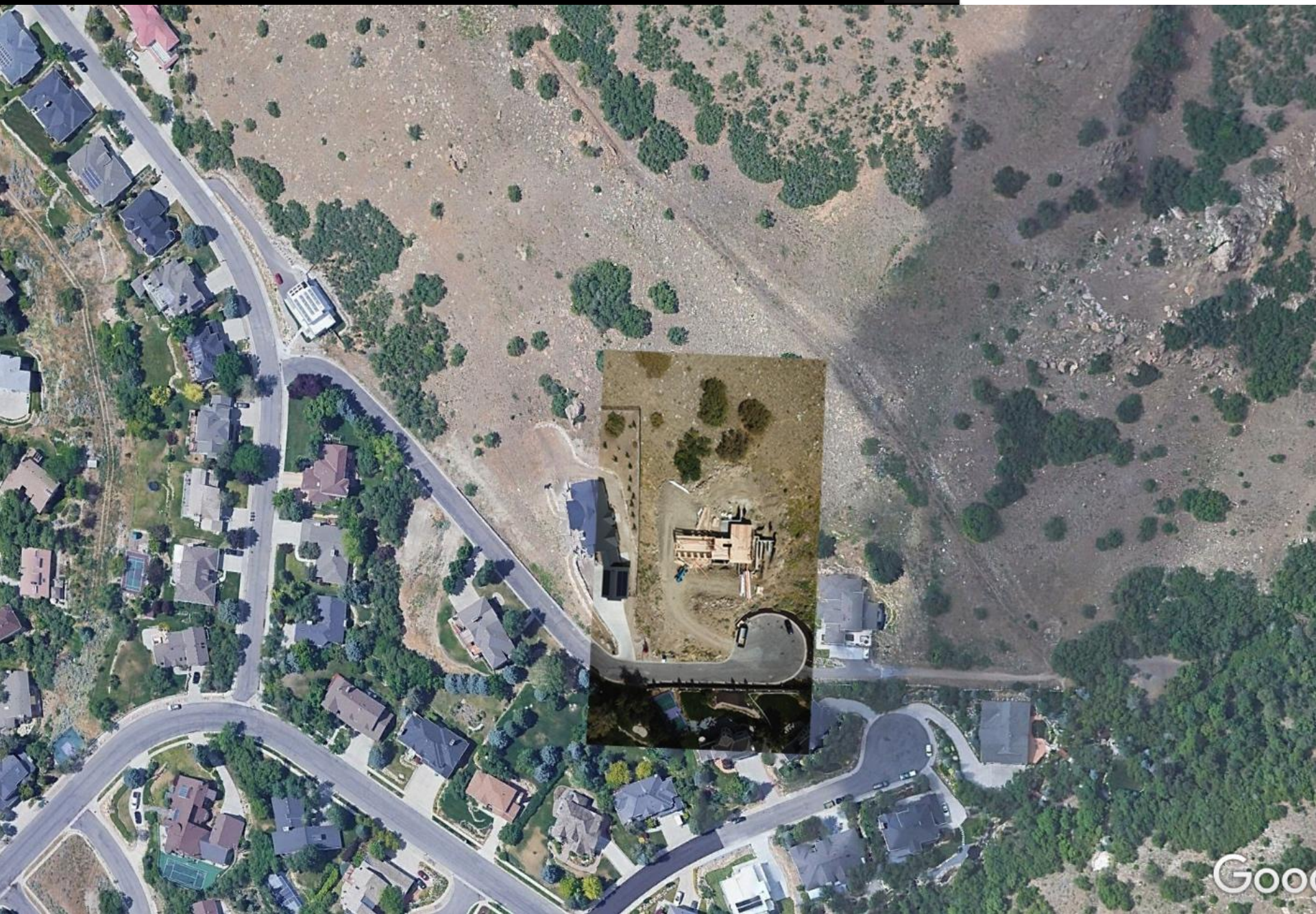
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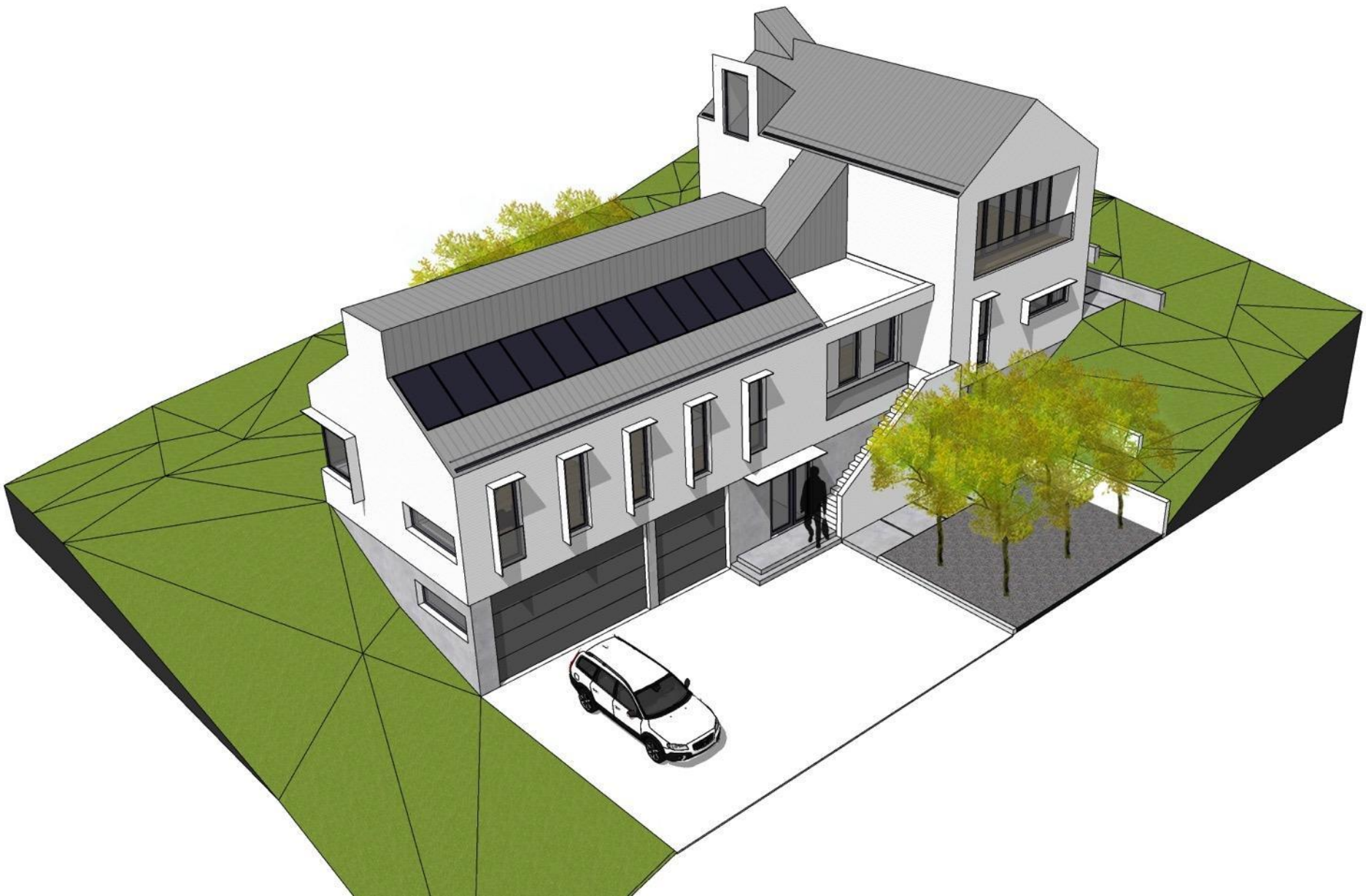




Project Goals:

- Development of a 3,800SF **resilient** and **sustainable** single-family residence
- **On-Site Net-Zero energy performance** through geothermal heating and cooling
- Coupled with a 7 kWh solar panel array
- Designed and build to Passive House standard:
- Walls R-45
- Roof R-60
- Slab R-42
- Windows **U 0.21**, SHG 0.5 – 0.25









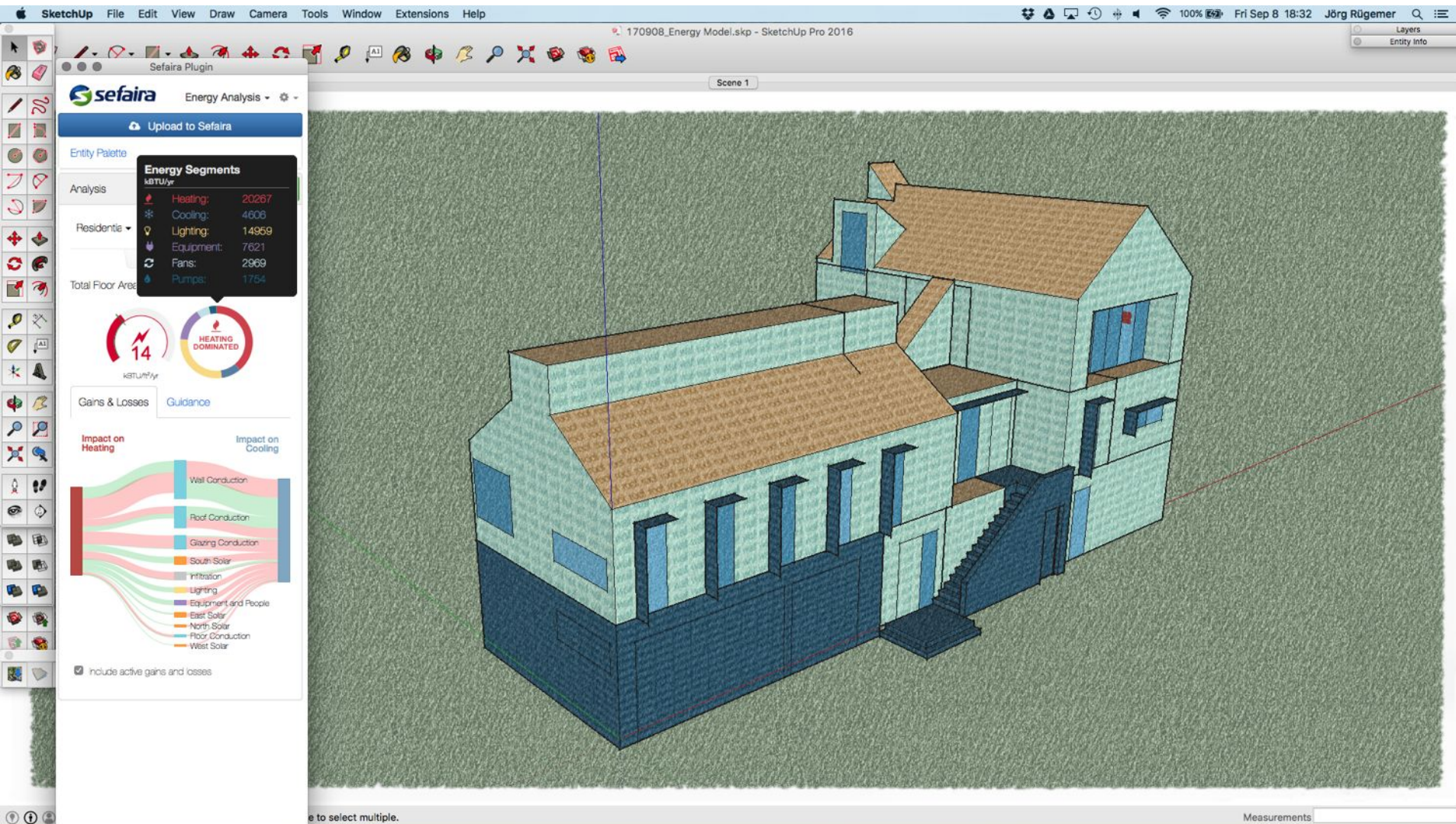












Component Performance Specification

The screenshot displays the SketchUp Pro 2016 software interface. The main window shows a 3D model of a two-story house with a brown roof and light blue walls, set against a green grassy background. The Sefaira Plugin window is open on the left, showing the following settings:

- Entity Palette
- Analysis: Update Analysis
- Residential in Salt Lake City, UT, U...
- Model Properties: Close
- HVAC type: Fan Coil Units and Central Plant
- Baseline: ASHRAE 90.1 - 2013
- ASHRAE Climate Zone: 5
- Wall Insulation: Well Insulated
- Floor Insulation: Well Insulated
- Roof Insulation: Well Insulated
- Glazing U-Factor: 3 Pane
- Visible Light Transmittance: 2 panes
- Solar Heat Gain Coefficient: Reflective
- Infiltration Rate: Best practice
- Ventilation Rate: Low Ventilation
- Equipment: Excellent
- Lighting: Good
- Total Floor Area: 3,770 sq ft

At the bottom left of the plugin window, there are two circular gauges: one showing a value of 14 kWh/m²/yr and another labeled 'HEATING DOMINATED'. The bottom of the interface shows a 'Measurements' field.

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ASHRAE 90.1 - 2013 / EnergyPlus

Comparison Code-Standard vs. as Proposed: **Preliminary Modeling**



In this preliminary modeling mode, Ogden Residence will use approximately 60% less energy compared to the ASHRAE 90.1 - 2013 Code Standard Building for Salt Lake City.

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ASHRAE 90.1 - 2013 / EnergyPlus

Specifications and Performance - Version 01: as Designed

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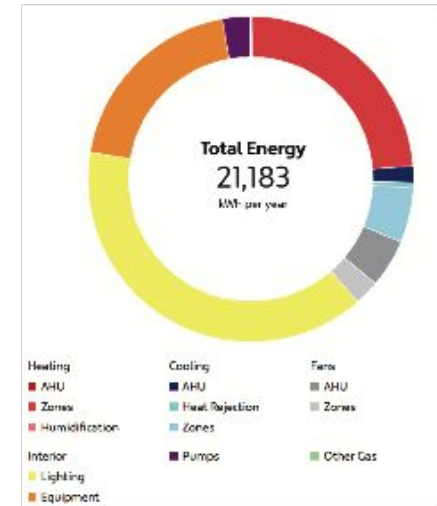
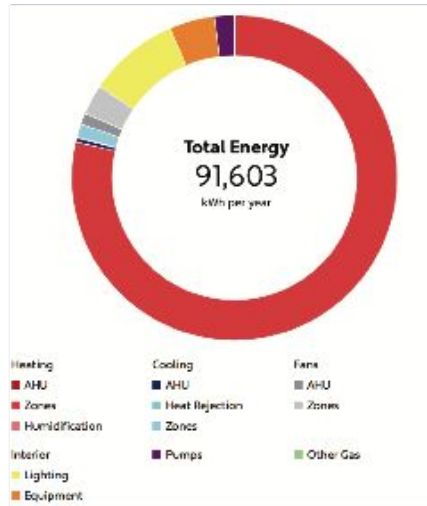
ASHRAE 90.1 - 2013 / EnergyPlus

Specifications and Performance - Version 02: Triple Pane Windows

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ASHRAE 90.1 - 2013 / EnergyPlus

Comparison Code-Standard vs. as Proposed: **Advanced Modeling**



Ogden Residence will use approximately 77% less energy compared to the ASHREA 90.1 - 2013 Code Standard Building for Salt Lake City.

This results in roughly 60% annual cost savings - ~\$2,320/year, or ~\$190/month BEFORE the application of photovoltaic cells.



At 4% interest, this monthly cash savings will finance (principal + interest combined):

- an additional ~\$26,000 over a 15-year mortgage*
- an additional ~\$40,000 over a 30-year mortgage*


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ASHRAE 90.1 - 2013 / EnergyPlus

12" Double Stud NORTH Wall: Component Humidity over Time

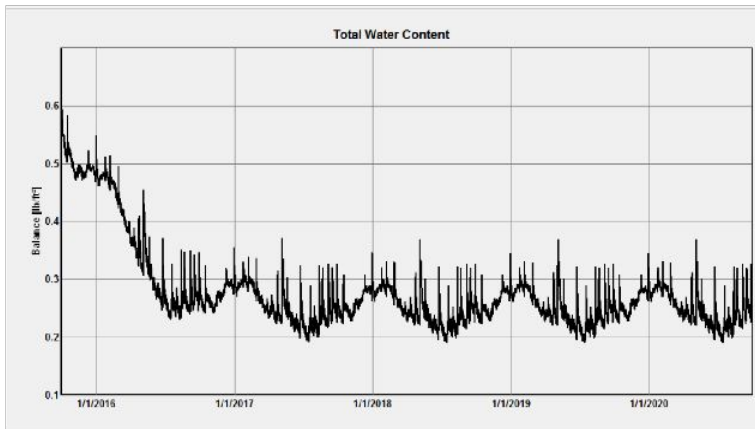
Orientation:  Inclination: 
Inclination [] [0] [°]

Building Height/Driving Rain Coefficients:
 Rain load calculation according to ASHRAE Standard 130

 RI [-] [0] [0]
R2 [s/m] [0.07] [0]

Note:
Rain Load =
Rain * (R1 + R2 * Wind Velocity)

Short Building, height up to 33 ft

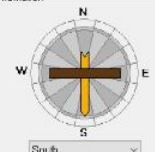



September 10, 2017


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ASHRAE 90.1 - 2013 / EnergyPlus

12" Double Stud SOUTH Wall: Component Humidity over Time

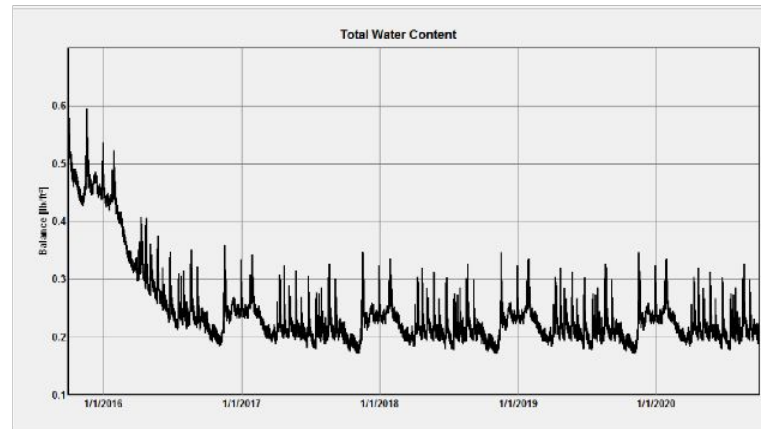
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Challenges anticipated:

- Client decided on contractor against architect's recommendation
- GC at times is overwhelmed by standard construction already
- GC at times is not able to build to plans, resulting in faulty concrete works in the basement walls and most retaining walls
- This results in a \$75,000 demolition of concrete works as we speak
- The embodied energy in the demolition equals at least 10-15 years of energy savings
- GC is completely inexperienced in Passive House concept, so time will tell once it comes to air infiltration etc.

? + !

Thank you very much!

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