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# Basis of Design (BOD)

BeOpt File: "Baseline & Optimized Models.BeOpt"
Climate Zone: 4A
Climate: Columbia Missouri

## 1. HVAC System

### 1.1 Narrative Description of System

A. Ground Source Heat Pump (EER 20.2, COP 4.2, High-k soil, Enh grout)

B. A ground source heat pump (GSHP) is an ideal HVAC system for energy-efficient homes due to its high performance, efficiency, and reliability. GSHPs leverage the consistent temperature of the ground for heating and cooling, ensuring stable operation in various weather conditions.

### 1.2 Reasons for System Selection

C. GSHP offer flexibility in installation, adapting to different property sizes, and have a lower environmental impact compared to traditional systems. While GSHPs may require higher upfront costs, their long-term energy savings make them a sustainable and cost-effective choice for homeowners, with suitability influenced by site-specific constraints such as available land and geological conditions.

## Indoor Lighting System

### 1.3 Narrative Description of System

A common residential LED lighting system often features recessed ceiling downlights with LED bulbs. LEDs are energy-efficient because they directly convert a higher percentage of electrical energy into light, minimizing heat loss and offering longer lifespan, making them a more eco-friendly and cost-effective lighting choice for homes.

*A. Fixture & Lamp type*

a. Recessed Can with 100% LED Bulbs

## 2. Water Heating System

### 2.1 Narrative Description of System

*A.* A solar water heating system typically consists of rooftop collectors, a circulation system, and a storage tank. The collectors, often south-facing with a tilt of 15 degrees, absorb sunlight and transfer heat to a fluid that circulates through the system, warming the water in the storage tank.

### 2.2 Reasons for System Selection

A. This system's orientation maximizes sun exposure, optimizing energy absorption. The system's energy efficiency stems from harnessing solar radiation directly, reducing

reliance on conventional energy sources for water heating and lowering overall utility costs.

## Insulation Values:

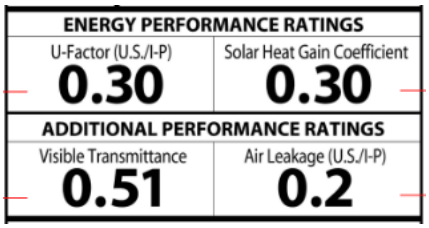
- *Wall:* 0.045 (U-Factor), 22.22 (R-Value)
    - “BASELINE: R-22, Batt, 2x4, 16 in o.c.”
    - Optimized: R-36 Closed Cell Spray Foam
- *Floor (Slab):* 10 (R-Value)
    - “BASELINE: 2ft R10 Perimeter, R10 Gap XPS”
- *Roof/Ceiling:* 0.026 (U-Factor), 38.46 (R-Value)
    - “BASELINE: R-38 Fiberglass Batt, 2x12”
    - Optimized: Metal Light

## Windows

*U-Value:* 0.30 *SHGC:* 0.30 *Infiltration:* 0.2 *VT:* 0.51

*Baseline:* Low-E, Double, insulated, Air, M-Grain

Optimized: Low-E, Triple, Insulated, Arg, L-Gain




*Window Areas:* “BASELINE: 5% Minimum Requirement”

## Doors

*U-value:* 0.30

## Appliances *(List all used in Energy Model Simulations):*

Refrigerator: Top Freezer, EF=21.9

Cooking Range: Propane, 80% Usage

Dishwasher: 290 Rated kWh, 80% usage

Clothes Washer: EnergyStar, 80%

Clothes Dryer: Propane, 120% usage

Hot Water Fixtures: 25 gal/day