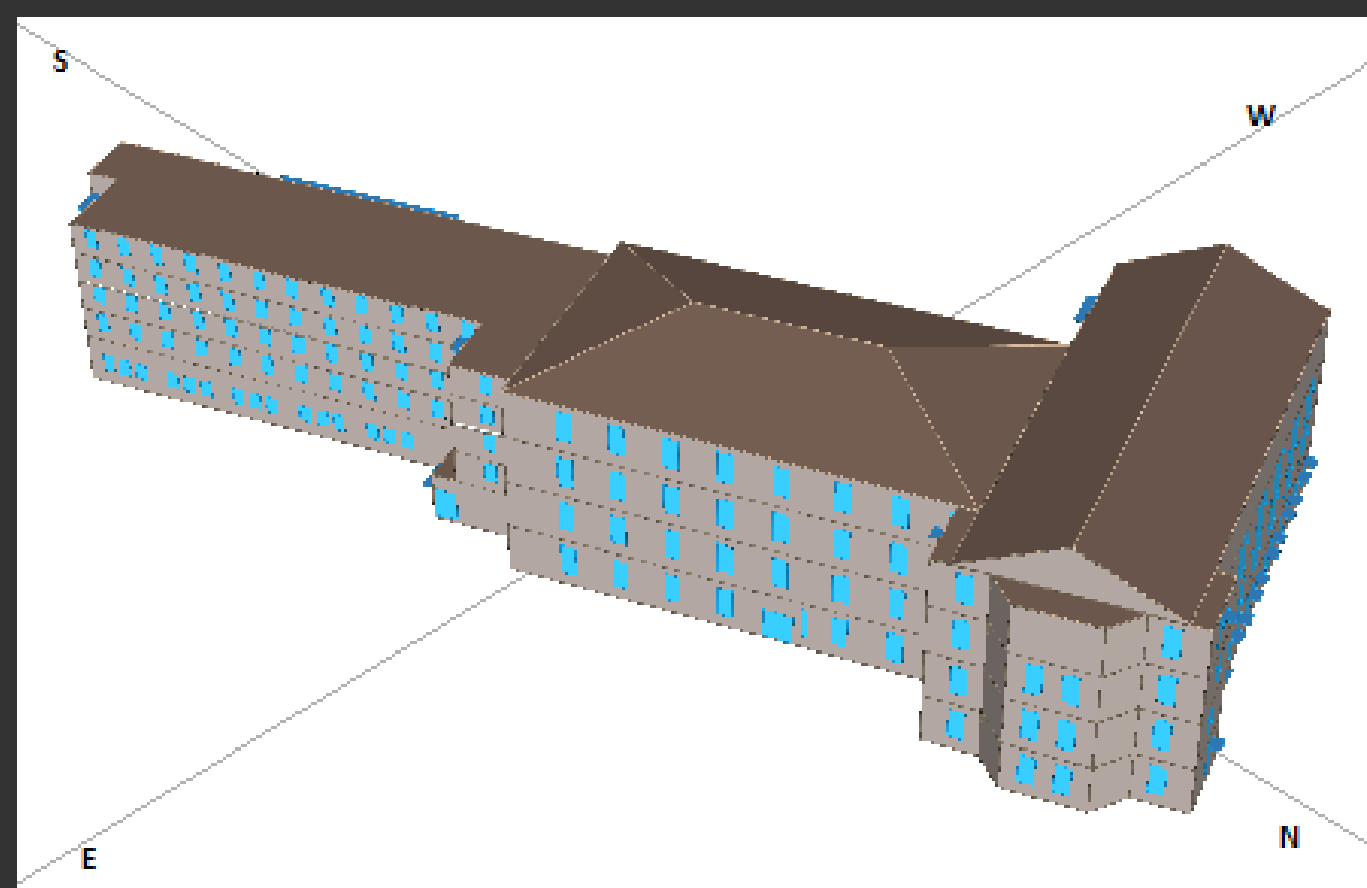


Cost-Benefit Analysis

Heating Load:

$$\dot{Q} = 594 \frac{\text{kbtu}}{\text{hr}}$$

eQUEST Building Model:



Results of Cost-Benefit Analysis:

	Coal	Geothermal	Biomass	Electric	Propane	#2 Fuel Oil
Fuel Cost (\$/MBTU)	13.52	8.37	18.67	35.17	34.81	37.72
Operation Cost (per year)	\$50,499	\$12,011	\$26,360	\$50,468	\$49,952	\$54,128
Maintenance Cost (per year)	\$24,501	\$1,000	\$24,500	\$0.00	\$2,000	\$2,000
Initial Cost (Including material and install costs)	\$0	\$277,000-\$700,000	\$53,375	\$36,600	\$52,975	\$64,350
Total Cost Over System Life Cycle (20 years)	\$1,500,000	\$537,220-\$960,220	\$1,070,575	\$1,045,960	\$1,092,015	\$1,186,910
Expected Life of Boiler/heat pump	n/a	20 years	20 years	20 years	25 years	22 years

Lowest Cost Option Over 20 years:
Geothermal Heat Pump

Payback Period: 16 years

Geothermal Heat Pump

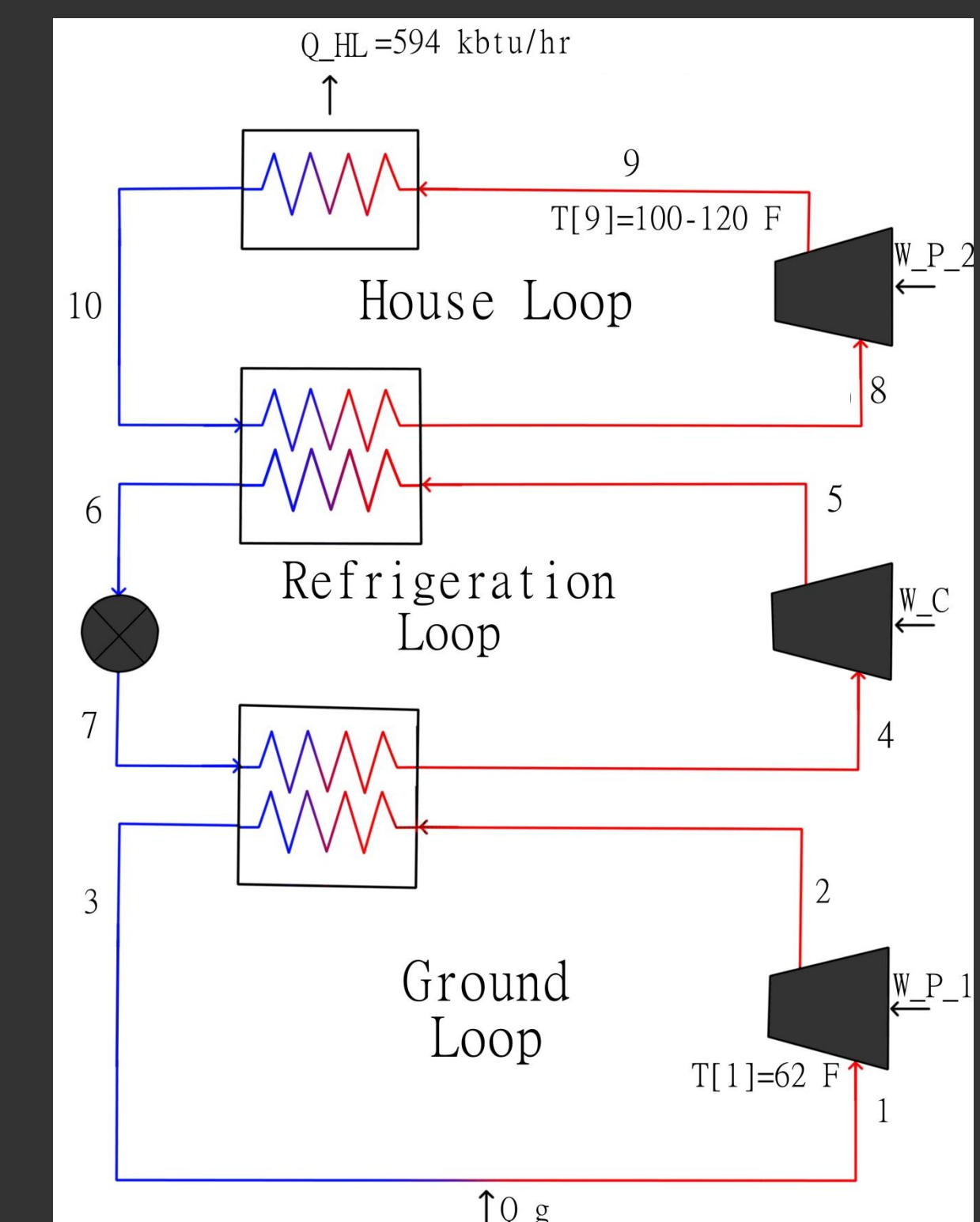
Problem Statement:

The Monastery of St. Gertrude is planning on replacing their coal boiler with a more effective heating system. A cost benefit analysis was required to determine the best alternative.

Objectives:

- Determine best alternative to existing coal fire boiler using a cost-benefit analysis
- Develop an EES program for generalized geothermal heat pump systems
- Design a system for optimized cost and efficiency

Geothermal Pump System Modeling and Coding



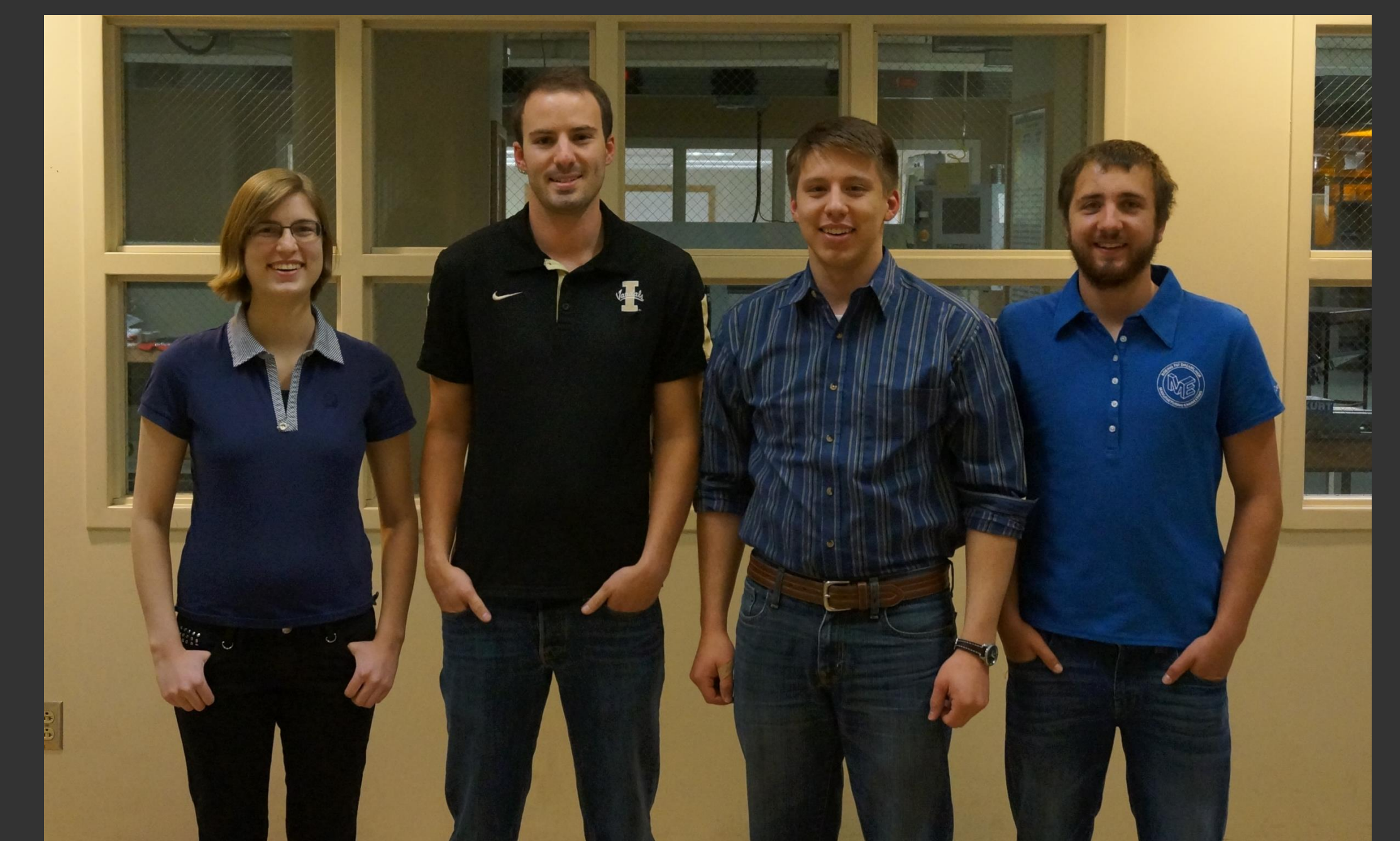
Base Design Parameters:

Working Fluids: Methanol for ground loop
R410a for refrigeration loop
Hot water for house loop

Building heating load

Ground Temperature: 64 °F

Min. Radiator Delivery Temperature: 120 °F



From Left: Desiree Reed, Colin Ryan, Samuel Qualls, Mitchel Gogert
Team Advisor: Dr. Tao Xing