

THE DECARBONIZATION OF KISIK TOWERS: A CONCEPTUAL CASE STUDY

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Project Background

- A 45% reduction in emissions (compared to 2010 levels) is a goal of the Paris Climate Accords. **This reduction is required to keep global warming below a 1.5 °C increase**
- This study will focus on using electrification as a method of decarbonization
- **Electrification** is known as the replacement of equipment or processes that use fossil fuels (i.e. natural gas) with electrically powered alternatives



Goals and Objectives

- Compare the current heating and cooling system with heat pump alternatives
- Evaluate different types of heat pumps and their limitations on Kisik Towers
- Make recommendations based on carbon reduction and an economic analysis

Methodology

- Model the existing radiant slab system and building in the **Trace 3D Plus software**
 - Verify and validate the model
- Integrate a heat pump into the validated Trace 3D Plus model
- Compare the performance of the heat pump system

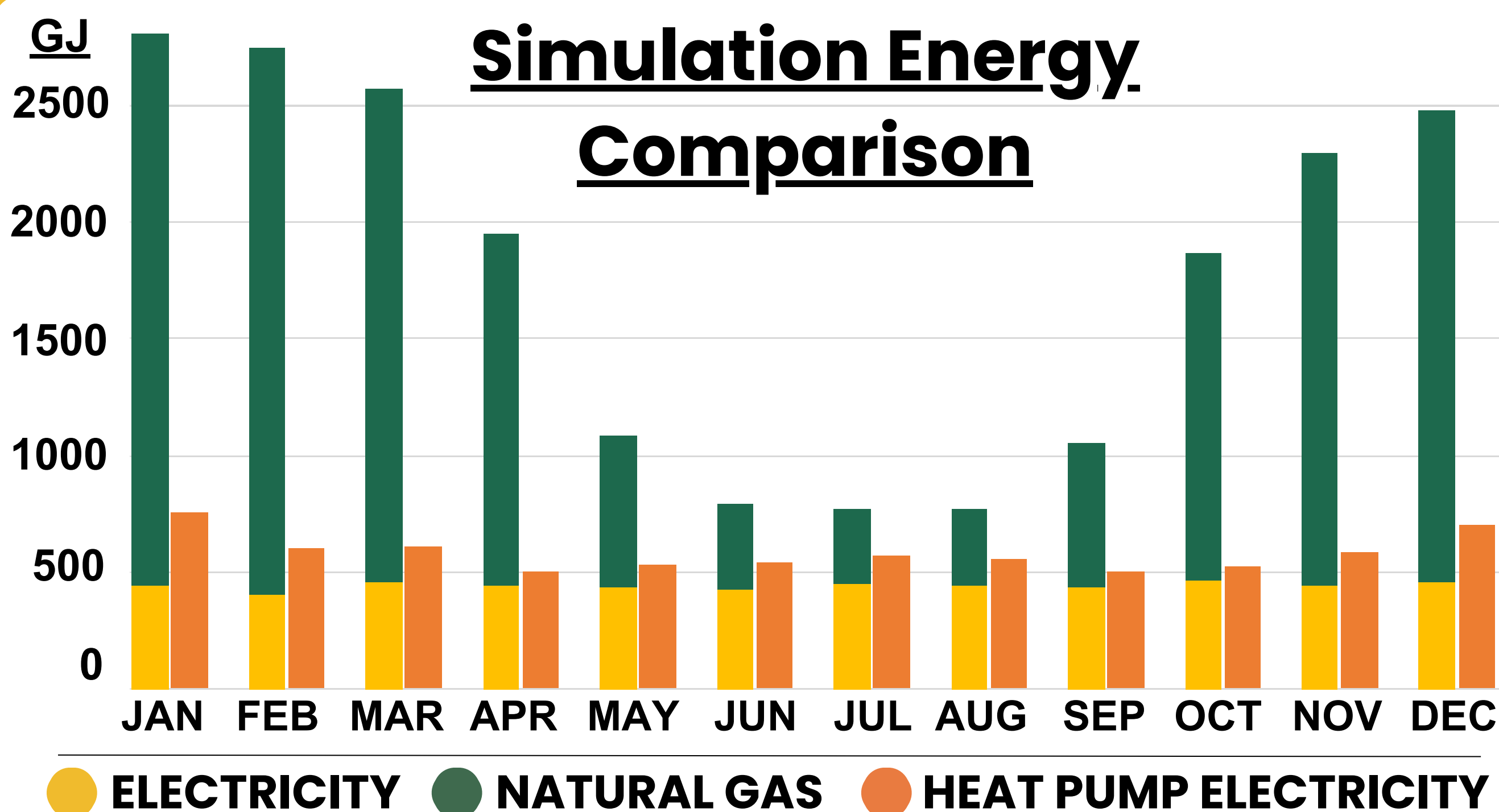


Heat Pump Simulation and Selection

- A water source heat pump will be connected to the campus' Central Plant

Selected two, York YVWH-200 Heat Pumps

- Combined: 8.1 MMBTU heating 400 tons cooling
- **Installation cost: ~\$1.5 Million**



Conclusions

- The project is feasible and cost effective due to the high pricing of the carbon tax on natural gas systems
 - **Saves ~\$95,000 annually** (almost entirely due to the carbon tax)
 - **Simple payback is under 15.4 years**
- From a carbon reduction standpoint, the heat pump **reduces CO₂e by 34%**
 - Requires additional solutions (such as solar) to meet the Paris Climate Goal

ASHRAE Standards

- 55: Thermal Environmental Conditions
- 62.1 Ventilation and Acceptable Indoor Air Quality
- 90.1 Energy Standard for Buildings
- ASHRAE Guideline 14: Measurement of Energy and Demand Savings
- ASHRAE Handbook Fundamentals



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