### Research Applications and Motivations

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<td>- Dynamic properties of unsaturated soils</td>
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<td>- Thermal behavior of geotechnical systems involving unsaturated soils</td>
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- Improve energy efficiency of heating/cooling systems and use spurious heat to improve geotechnical performance
- Efficient use of materials, sustainable/performance based designs
- Safe containment of waste using locally-available soils and ecological system

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### Concept of Energy Foundations

- Energy foundations provide support to a building and permit exchange of heat between the ground and a building
- Do not generate energy, but move it from one place to another with a heat pump
- Can function in any location
Energy Foundation Case Study: 1099 Osage St. Denver, Colorado

Centrifuge Modeling of Soil-Structure Interaction in Energy Foundations

Testing Phases:
1. Evaluate impact of temperature on foundation capacity
2. Evaluate impact of temperature on strain distribution and deformation
Student Research Involvement

**Centrifuge Testing**
- Melissa Stewart
- Josh Rosenberg
- Samiha Abdelrahman
- Ali Khosravi
- Rachel Sobke

**Field-Scale Testing**
- Conor Felleter
- Kyle Murphy
- Walter Zitz

**Temperature Effects on Soils**
- C.J. Coccia
- Alexander Vega
- Abdalla El Tawati

**Numerical Modeling**
- Navid Plaseied (T-z analysis)
- Wei Wang (Finite Elements)
- Christian Kaltreider (Heat Flow)

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