Geothermal-Enabled Zero Energy Community
A techno-economic design study to address cold-climate challenges

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Introduction:
“Zero energy” construction is the practice of employing energy efficiency and renewable energy so that a site’s annual primary energy needs can be cost-effectively met with renewable energy technologies, usually on-site.

A zero energy building’s total cost of ownership is usually lower than minimum-code construction. But in colder climates, there are several significant challenges:

• Thermal loads are higher due to cold weather
• Solar photovoltaics performance is worse, due to lower incident sunlight, snow, etc.
• Solar generation is less aligned with energy demands throughout the year

Grid Impacts
• Geothermal power supply is a much better match to energy demands of a community, reducing impacts on power grid

Scenarios:

All-Electric Community
• At ZNE community sizes above 1,100 homes, geothermal is more cost-effective than rooftop PV
• With excellent reservoir conditions, geothermal power can be competitive at smaller delivered capacities

Electric+Direct-Use Community
• Geothermal power and direct use is not as economically competitive due to low price of natural gas
• Communities sizes above 2,200 still show benefit from using geothermal power and thermal generation, vs. rooftop PV
• Thermal energy storage is beneficial for reducing well sizes

Findings:

Electric+Direct Use Community
• Geothermal power and direct use is not as economically competitive due to low price of natural gas
• Community sizes above 2,200 still show benefit from using geothermal power and thermal generation, vs. rooftop PV
• Thermal energy storage is beneficial for reducing well sizes

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Journal paper under review, documenting electric and electric-direct use cases