

These Factors Can Help You Write Your Geothermal Heat Pump Success Story

New York State is helping business owners reach their clean energy goals by helping them to choose the renewable energy systems that best fit the unique needs of their employees, their facilities, and their day-to-day business operations. NYSERDA, in partnership with the New York Power Authority (NYPA), launched the Geothermal Clean Energy Challenge (the “Challenge”) as a way to help building owners assess the economic and technical potential of installing a geothermal heat pump, also referred to as ground-source heat pumps (GSHPs), in large commercial and institutional buildings in New York State.

Over two stages of participation, the Challenge collected qualitative and quantitative data from over 90 project sites, including colleges and universities, K-12 schools, state and local government campuses and healthcare facilities. Evaluation of the data revealed considerations that can contribute to the most valuable and sustaining GSHP projects.

While many facilities can benefit in a variety of ways from GSHPs, the "success factors" below result in greater system viability and greater overall benefits to an organization.

So, what factors can help *you* estimate the feasibility and value of installing geothermal technology at your facility? We’ve bucketed the primary factors, as highlighted throughout the Geothermal Clean Energy Challenge, into three overarching groups: economical, environmental, and organizational. After reading, you may be pleasantly surprised to find that many of the variables needed for a successful geothermal project already exist within your own building or facility.

Economic factors: deriving the most significant cost savings from GSHP systems

GSHP systems can generate energy bill savings in two ways: by more efficiently converting inputs (fuels) into outputs (space conditioning) and/or by opting for a less expensive fuel over a more expensive fuel.

Of the 91 participating project sites, the sites that switched from propane, fuel oil, or steam heat to GSHPs saw the greatest utility cost savings, although sites using natural gas for heating even achieved material energy bill savings in several instances. Sites with low-cost electricity contracts in place also saw notably higher bill savings.

Estimated average annual energy bill savings from geothermal systems = \$0.412 per sq. ft.

Project sites with high operations and maintenance costs, or those that were able to retire cooling towers during the time of the Challenge, were estimated to have greater annual operations and maintenance (O&M) savings potential.

Avg. annual O&M savings with geothermal = \$0.367 per sq. ft.

At the time of the Geothermal Clean Energy Challenge, incentives were available under NYSERDA’s GSHP Rebate program. Those incentives, on average, offset just over 10 percent of geothermal installation costs. Moving forward, facilities considering geothermal installation could apply to receive incentives through utilities participating in the NYS Clean Heat Program. It is worth noting that incentives under this program vary by utility.

Additionally, for all 91 participating sites, the implementing a GSHP system would create improvements in HVAC energy use intensity (EUI) of at least 25 percent, due in large part to the significantly greater efficiency of GSHPs when compared to traditional HVAC systems. This improved EUI could lead to additional energy savings

Environmental factors: lowering your facilities impact on the environment

In addition to these economic factors, the Geothermal Clean Energy Challenge also highlighted environmental factors related to GSHP project success.

The Challenge highlighted the significant greenhouse gas (GHG) emissions reduction potential resulting from GSHPs. Of the 91 project sites, those with larger GSHP systems saw greater GHG emissions reductions, as a result of the displacement of the largest amount of conventional energy consumption. Sites switching from fuel oil, which produces an especially high carbon content when burned, also saw an increase in the amount of GHG emissions reduction. The chart below shows the substantial GHG emissions reductions possible with GSHP systems measured as part of the Challenge.

Annual GHG Emissions Reductions from GSHP Systems (metric tons of CO₂ equivalent)

	All Sites (n=91)	Stage 2 Sites (n=30)
Mean	790	774
High	9,800	9,800
80th Percentile	1,003	971
Median	324	233
Low	48	48

Organizational factors that help make the business case for your GSHP

Both the economic and environmental factors discussed play important roles in assessing the potential value and success of a GSHP installation.

However, Challenge participants that were expected to achieve the greatest success were able to demonstrate deep organizational commitments to meaningful carbon reduction, prior success implementing clean energy technologies in other capacities throughout their facilities

and a dedication internal champion within the organization, who's commitment allowed for high-quality project leadership. This last factor is critical to help successfully guide a GSHP project through the various analytic, procurement, contracting, construction, and operational steps necessary for a GSHP system on its way to implementation.

While all the above factors are certainly favorable for organizations considering GSHPs, it is not necessary for all of them to be present in order for an organization achieve attractive investment results. There are many potential and varying paths to viability with GSHP technology. For more information on GSHPs, visit [NYSERDA's website](#).