Google's New Office Will Be Heated And Cooled By The Ground Underneath

By Adele Peters · Fast Company · 4 min

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The company's Bay View campus will have the largest ground-source heat pump system installation in North America, using the heat from the surrounding ground to power the building's climate control–and no fossil fuels.

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At a construction site on Google's new Bay View campus–a few miles from its headquarters in Mountain View, on NASA-owned land near the San Francisco Bay–cranes lift tubing high in the air and drop it into holes that descend 80 feet into the ground. It's a step that will allow three new office buildings to heat and cool themselves without fossil fuels, setting apart from nearly all existing offices, which use enormous amounts of energy to manage the temperature in their spaces.

The system uses geothermal heat pumps, relying on the steady 65-degree temperature of the ground to absorb and reject heat. Excess heat from the buildings can also be sent into the ground to be stored until it's needed.

"We have to be conscious about how we design our projects."

"In the wintertime, when we need to heat the buildings, we're actually absorbing that heat from the ground, and then in the summertime, when we are cooling the buildings, we're actually rejecting heat to the ground and warming the ground," says Eric Solrain, a principal Integral Group, an engineering firm working with Google on the design.

It's one piece of an overall design for the campus that aims for LEED Platinum certification, the highest level possible in the sustainability rating system for buildings. Outside, 20 acres of open space will be

planted with native species. Stormwater will be collected and treated for reuse in on-site ponds. (Materials will be vetted through Google's healthy materials requirements.) The windows–which fill the space with natural light–are treated with a pattern that helps birds avoid crashing into the glass. The windows can also automatically shade themselves and darken at night to reduce light pollution. Electricity use, as in other Google campuses, will be offset by renewable energy. By using heat pumps, the company will reduce its carbon footprint even further.

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Without the heat pumps, the buildings would have been heated with natural gas; the heat pumps eliminate the use of gas completely. (Though the ground temperature hovers around 65 degrees, the buildings can be warmer because the heat pumps concentrate the heat.) In the summer, a standard design would have used cooling towers that rely on piping in huge amounts of water to transfer heat. The heat pumps can provide 95% of the cooling necessary–cooling towers will still be used 5% of the time, on the hottest days of the year–and will save approximately 8 million gallons of potable water every year, critical in a region that's already prone to drought and likely to become more so as climate change progresses.

"The next challenge that we're all going to face is water," says Asim Tahir, a project executive with Google's Real Estate and Workplace Services who leads building systems design and energy strategy for Google's office facilities. "We have to be conscious about how we design our projects."

Google has been considering the use of heat pumps in its buildings for several years, and in 2010 it installed a small system on its main campus to provide hot water for a kitchen. But until now, the company hadn't found the right project for a large system. In some cases, heat pump systems use boreholes drilled into a separate field, but that

process is expensive. By using the deep piles, the foundational supports that are required for new buildings–for structural reasons, the buildings need 4,000 long piles, spread out over a large area–as a way to extend pipes deep into the ground, it was possible to make the system affordable.

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"Typically, in traditional design, problems are solved in silos, and you might come up with a good solution, but you might miss opportunities to look around and see what more can you achieve from that," says Tahir. "Here, one of the ideas we were encouraging the design team to consider was that everything has more than one job. If there's an element in the building that is only serving one function, that's missing out on potential opportunities. That's the sort of thinking that led us to combine the geothermal element into the piles."

In 2,500 of the buildings' 4,000 piles, a construction crew has been drilling holes, filling them with wet concrete, and dropping in the tubing to create "energy piles." (Only some of the piles are used because if they're too close together, the ground can get overheated or overcooled, making the system less efficient.)

The system also provides other benefits. Normal buildings recirculate air when it's hot or cold outside because it's too expensive to keep bringing in and treating fresh air. The heat pump system uses energy so efficiently that the new buildings can continuously use outside air, improving air quality.

Though some buildings in Europe use similar systems, Google's will be largest in North America, with tubing that stretches a cumulative total of 69 miles. The company plans to share what it learns with others who want to implement something similar, and to promote something that will be invisible when construction is completed.

"One of the beauties and the challenges of this is once this is constructed, nobody sees it," says Tahir. "So we can only talk about it through the data and the performance. Right now is very interesting because there's a hive of activity going on at the construction site, and now is the only time you can truly appreciate the scale of this. Once we pour the foundation it's invisible."