



WPI

Cleaning WPI's Heating

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About Solar

Solar energy will be used to heat the water of the building up to 180°F. Water would only need to be heated to 120°F at most.

Rebates

Up to 50% off solar water heating systems and 27.5% off geothermal

Indirect Active Solar Water System

Antifreeze liquid heated by the sun then the heat is converted into the water inside the building. Maintains heat for few days without sun

Goal:

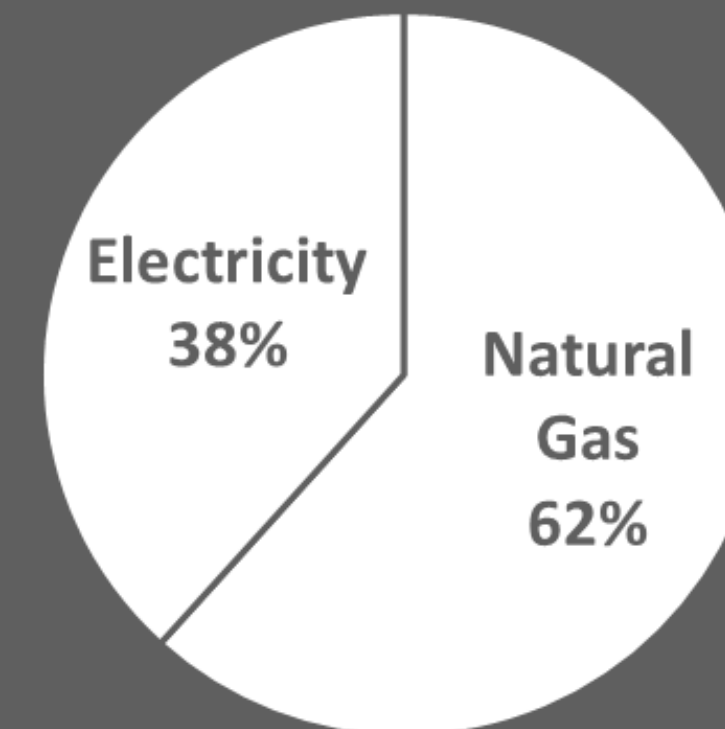
Reduce CO₂ Emissions on Campus

Residential Pricing

The installation cost for solar water heating is ~\$4,000-8,000. Annual operating costs are about half of a conventional water heater.

WPI's Campus uses Natural Gas For heating after switching in 2006 from fuel oil, WPI used 1,579,790.60 Therms of Natural Gas in 2018, while electricity wise WPI used 28,719,736 KWH = 980,192 Therms

ENERGY USE ON CAMPUS



According to the EIA, the electricity for Massachusetts comes from natural gas, nuclear, and renewable sources. It would be more difficult to switch the electricity source on campus since WPI is on the grid.

WPI Rec Center

Currently has 35 solar water heating for the pool. It keeps the water at 65 degrees.

School Image:

63% of applying students and parents care about a school's commitment to the environment. While WPI offers over 100 classes related to sustainability, none of campus is substantially heated

Solutions:

Install a geothermal heating and cooling system, and a solar water heating system for the new building.

Acknowledgements:

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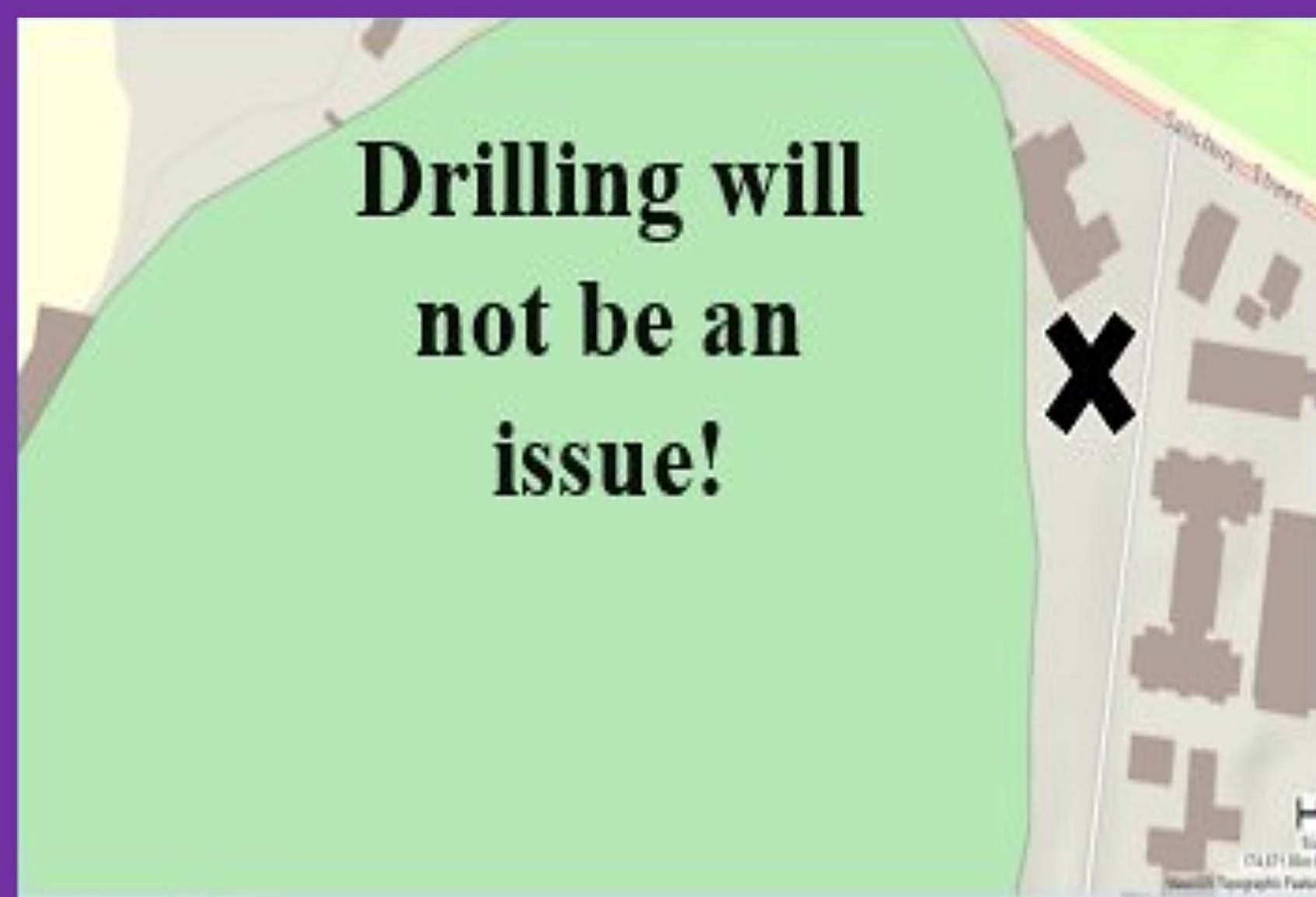
References:

- American Geosciences Institute. (2018, February 16). Interactive map of Massachusetts' geology and natural resources. Retrieved March 29, 2019, from <https://www.americangeosciences.org/critical-issues/maps/interactive-map-massachusetts-geology-and-natural-resources>
- Energy Saver. (n.d.). Estimating the Cost and Energy Efficiency of a Solar Water Heater. Retrieved April 16, 2019, from <http://www.energy.gov/energysaver/estimating-cost-and-energy-efficiency-solar-water-heater>
- How Much Does a Solar Water Heater Cost? (2018, March 19). Retrieved April 2, 2019, from <https://www.angleslist.com/articles/how-much-does-solar-water-heater-cost.htm>
- Onser, A. (2006, November 29). Ground-source heat pumps systems and applications. Retrieved March 22, 2019, from <https://www.sciencedirect.com/science/article/pii/S1364032106001249>
- Solar Thermal Hot Water and Heat. (2009, March). Retrieved April 7, 2019, from https://illinoisolar.org/resources/Documents/ISEA_solar_thermal_broch_2009.pdf
- U.S. Energy Information Administration - EIA - Independent Statistics and Analysis. (2019, January 25). Retrieved February 20, 2019, from https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a
- WPI Dedicates Its Sports and Recreation Center. (2019, April 21). Retrieved from <https://www.wpi.edu/news/recent/wpi-sustainability-report-2017-18>
- WPI - Sustainability Report 2017-18. Retrieved April 7, 2019, from <https://www.wpi.edu/sites/default/files/inline-images/Offices/Sustainability/2018%20Sustainability%20Report%203.21.19.pdf>

Vertical loop Geothermal System:
Bore holes are drilled ~20ft apart from each other and ~400ft deep

Great Investment
Lasts 20 years. Half the annual cost of running than conventional systems, no need for air condition as it can cool too

Residential Pricing:
\$20,000-\$25,000
Works as both a heating and cooling system.



Efficiency
48% more efficient than natural gas.