THE "BABY STEPS" OF DISTRICT GEO LOOPS IN MASSACHUSETTS

(Pilot projects to replace gas with geo heat pump infrastructure)

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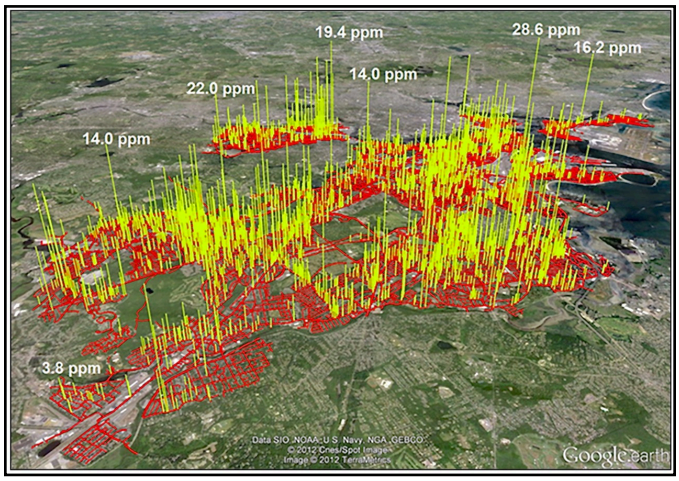
It started with citizen concern-

A community-minded group centered near Boston called **HEET** had worked for some time to **weatherize** housing in the area to lower energy costs for consumers. Lower bills and carbon reduction were also on their mind. Many residents benefitted from greater comfort, too. When local methane leakage from 100-year old gas mains became known, **HEET** wanted to work with utilities to quantify them and help to eliminate leakage.



Stopping methane leaks with new pipe-

There is a bit of public utility math that includes a phrase common in business and investor-owned assets by public utilities. It is called *"stranded assets,"* and has been used for years as a defense to obtain full, planned life operation of former investments (like water, gas, or long distance pipelines). The payback period is commonly 40-to-50 years for such assets. After that, the only expense is maintenance of infrastructure and billing systems. Massive investment gets retired by long-term revenue payments.

If the public utility serving Boston has significant methane leakage, the pipes obviously need replacing. They are approximately 100 years old. This is not only a financial math consideration, it's an environmental one, since leaking, unburned methane has 80 times more global warming potential than the carbon dioxide produced if it had been burned, instead. Electrification of heating, cooling, water heating, and cooking can stop what is currently a serious methane leakage problem. This is understood as "fuel switching." In contrast, the supply line for electricity is already at the doorstep of every occupied building.

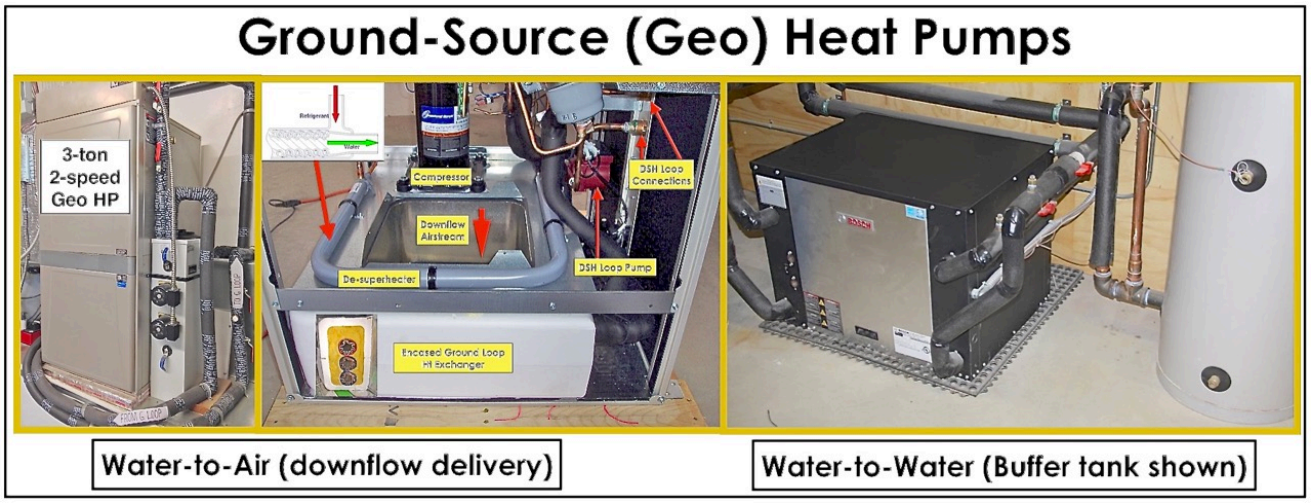
Table 4. Efficiencies of cooktops and ovens

	Cooktop Efficiency	Oven Efficiency	Combined Efficiency
Gas	27.2%	22.4%	25.5%
Electricity (resistance cooktop)	67.0%	29.0%	47.5%
Electricity (induction cooktop)	85.0%	29.0%	53.0%

Source: U.S. Department of Energy. 2016. Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Commercial and Industrial Equipment: Residential Conventional Cooking Products; Frontier Energy. 2019. Residential Cooktop Performance and Energy Comparison.

For example, moving toward induction cooking is not only more efficient, but it stops CO2 production in kitchens. It stops methane leakage and also that of Benzene, a carcinogen with no acceptable range of safe exposure; it can leak even when gas stoves and ovens are off.

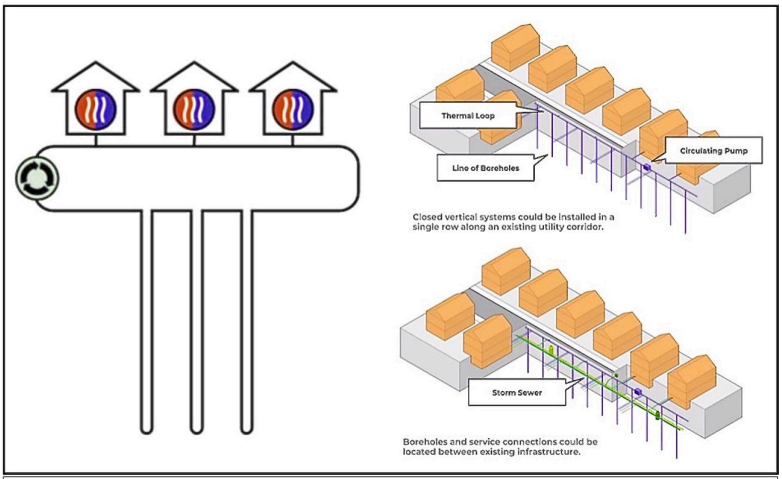
Heat pumps for the concentration and transfer of heat inbound or outbound are electric appliances that have gained popularity. They are in demand due (in part) to increasing heat waves affecting North America. Many households have not had air conditioning. The most efficient models of heat pumps are those called **geo** heat pumps, which **pull from** or **push back** to an underground mass with very little temperature variance. These units don't work as hard as air-source equipment, which face outdoor air temperature swings that are extreme.



Teamwork Begins-

HEET got involved in the measurement of methane leaks around Boston, cooperating with three gas utilities. When the data was analyzed, the estimate to replace gas mains in Boston and Cambridge Massachusetts would cost $9.3 Billion. An investment of this kind would need to be paid off over 40 years or more, while re-committing to carbon. If decarbonization policies by the state called for halts in methane use before that, there would be significant "stranded assets" requiring payment from somewhere, or the utility's financial survival might be at risk.

HEET engaged the engineering firm BuroHappold to explore the [feasibility of geothermal micro-districts to replace gas use.](#) If aging gas infrastructure was replaced with geo loops to serve the majority of buildings with geo heat pumps, a major (new) gas investment could be avoided.



HEET's District Loop Design Concept by BuroHappold Engineering

HEET, BuroHappold, Eversource, and various consultants finalized a pilot proposal to convert several “neighborhoods” within the gas system. Regulators were approached, and a pilot plan was approved. After underground thermal conductivity was tested in the fall of 2022, Eversource Gas broke ground on the geo micro-district in May, 2023. However, the unique nature of this work goes beyond the substitution of geo for gas.

Those citizens volunteering to connect to geo district loop infrastructure with a retrofitted geo heat pump household system will do so at no upfront cost. They’ll pay a thermal delivery fee to their former gas utility (Eversource) and the regulators have approved a small additional tariff on *all gas customers* to cover the cost of developing and maintaining the district geo loop. If that seems in any way unfair, consider this.

This was a three-way collaboration of a community group desiring improvements in quality of life, a utility willing to look beyond its historic business model, and regulators who noticed what might be possible. If the engineering, construction quality, customer participation, and financial strategy are successful, then, achievement of Massachusetts’ decarbonization goals might be assured.

Notably, HEET’s community citizens do not consider themselves a “pressure group,” but an advocacy organization that invites collaboration with other stakeholders. This pilot project would not have come to pass without such cooperation and collaboration. In a few years, we will know whether this pilot is successful, whether it can be tweaked for improvement, and whether it should be rolled out across other neighborhoods in and beyond Massachusetts.

The GeoExchange® technology to be employed here isn’t experimental. Neither are district geo loops. **The utility’s cooperation and support**, along with a special rate tariff are the newer elements revealed by this pilot. This level of unity is not consistent elsewhere, especially in **this example from Austin, Texas.**

The Future-

Boston is not the only fossil based pipe grid across the U.S. There are others, and HEET is already talking to some of them. There may yet be a way for cities to achieve their decarbonization goals while avoiding thermal heat islands, water consumption, and a larger electric load on the grid. This pilot may ease the transition to decarbonization for current gas utilities, who would be able to survive as liquid thermal providers. And the percentage of residences with cooling would increase, helping to avoid heat illness that now affects many. We can hope for more of these district loops, which connect to the cheapest battery available—the Earth.

—Bill Martin