To: Mr. Michael Tilford | Boston Properties

From: Samira Ahmadi | enviENERGY Studio

Date: May 11, 2021

Subject: 250 and 290 Binney Street
Updated Steam Utilization Feasibility Study

This memo outlines the results of a steam utilization analysis, using the 2015 Veolia Boston Cambridge DES Guidelines - updated guidelines were not available at the time of this analysis. While this preliminary analysis indicates a reduction in the annual energy consumption, the estimated Greenhouse Gas (GHG) emissions for a building connected to the district steam is higher than a stand-alone building since steam is generated via a non-renewable fuel source. Further, the Project would be able to capture only the stationary source GHG reductions for electricity that corresponds to the amount of steam purchased; it cannot be assumed that all electricity used on-site is generated by Vicinity locally, especially in the summer when local demand for steam is greatly reduced.

The potential connection to the local Vicinity plant in Kendall Square was investigated based on the site path energy modeling, assuming that steam will be used for space heating only and the results were compared with the "Low-Carbon" stand-alone design scenario. The detailed calculations that support the following findings are attached.

District Energy System (Utilizing Steam for Space Heating)

This analysis shows that if steam is used to offset the natural gas used for space heating, the site energy associated with the proposed buildings would be reduced by more than 50 percent; however, the estimated GHG emissions increase by approximately 10%, which is due to the higher GHG emissions associated with the natural gas used to generate steam. As the electric grid becomes greener and the new technologies are implemented to electrify the building, the carbon footprint of the building is expected to decrease significantly but since Vicinity's current and future emissions data are not readily available, the project cannot present a pathway to carbon neutrality utilizing the Vicinity steam.

Challenges with Connecting to District Steam

While utilizing district steam may result in reduced site energy, significant hurdles exist, including routing, capacity, condensate disposal, and long-term pricing. The several challenges to using the central plant steam approach include:

1. Locating the steam supply piping underground in relation to the buildings and finding a connection route that avoids existing obstacles (e.g. other utilities, Eversource substation, etc.)
2. Ensuring adequate capacity in the utility steam system to support buildings' needs and potential future modifications.
3. Utility steam condensate is dumped into the sanitary waste system in Kendall Square. Therefore, the condensate must be quenched with potable water to be less than 140° F before being dumped into the drain. There may be an opportunity to capture quenched condensate and use it as

reclaimed water for toilet flushing or irrigation. But this, also adds more equipment and infrastructure to the buildings.

4. Long-term steam pricing is negotiated through a contract; it is not a regulated utility, like gas and electricity. Therefore, long-term pricing is an inherent risk.
5. Supplier's long-term commitment to carbon neutrality is unknown which is in contrast with the future carbon neutrality goals.
6. The steam supplier is a private entity and is subject to being sold to other companies, with the inherent policy and procedure change, which is also considered a risk.

If there are any questions, please feel free to contact us.

Samira Ahmadi, BEMP, LEED AP BD+C ID+C Homes, CPHC
Founding Principal
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250 Binney Street

Proposed Design with On-site Condensing Boilers (BOD)

		Annual GHG (MTCO2e)
Annual Electricity Consumption (kWh)	14,012,662	4,610
Annual Gas Consumption (Therm)	220,897	1,292
Annual Energy Use (MMBTU)	69,915	
Annual Energy Cost ($)		
Annual GHG Emissions (kg CO2e)		5,902

Proposed Design with Vicinity Steam for Space Heating

Annual Space Heating Energy		Annual GHG (MTCO2e)
Steam (MMBTU) - from model	18,202	1,805
Convert to Gas at DES (MMBTU) = a*5.33	97,017	

		Annual GHG (MTCO2e)
Space Heating Annual Gas (therms)	970,167	
Annual Electricity Consumption (kWh)	13,938,840	4,586
Other Annual Gas Consumption (Therm)	9,843	58
Total		4,643

Electricity Generated at DES (kWh) = a*530	-9,647,060

Annual Energy Use (MMBTU)	**33,834**	
Annual Energy Cost ($)		
Annual GHG Emissions (MTCO2e)		**6,448**

Estimated Energy Use Savings compared to BOD:	***51.6%***
Estimated Energy Cost Savings compared to BOD:	***-9.3%***

Notes:

Utility Rates

Electricity	0.189 $/kwh
Gas	1.168 $/MMBTU
DES Electricity Rate (Assumption)	0.1 $/kWh

Greenhouse Gas Emission Factors (CO2e)

Gas	117 (Lbs/MBTU)
Electricity	658 (Lbs/MWh)
Vicinity Steam (calculated)	238 (lbs/Mlb)

From Veolia Boston 2015 LEED Document

For every 1 BTU of steam required, the plant uses 5.33 BTUs of Natural Gas
For every 1 MMBTU of steam required, the building received 530 kWh of free electricity

290 Binney Street

Proposed Design with On-site Condensing Boilers (BOD)

		Annual GHG (MTCO2e)
Annual Electricity Consumption (kWh)	10,951,119	3,603
Annual Gas Consumption (Therm)	175,991	1,030
Annual Energy Use (MMBTU)	54,975	
Annual Energy Cost ($)		
Annual GHG Emissions (kg CO2e)		4,632

Proposed Design with Vicinity Steam for Space Heating

Annual Space Heating Energy		Annual GHG (MTCO2e)
Steam (MMBTU) - from model	15,896	1,576
Convert to Gas at DES (MMBTU) = a*5.33	84,726	

		Annual GHG (MTCO2e)
Space Heating Annual Gas (therms)	847,257	
Annual Electricity Consumption (kWh)	10,894,442	3,584
Other Annual Gas Consumption (Therm)	9,843	58
Total		3,642

Electricity Generated at DES (kWh) = a*530	-8,424,880

Annual Energy Use (MMBTU)	**25,309**	
Annual Energy Cost ($)		
Annual GHG Emissions (MTCO2e)		**5,218**

Estimated Energy Use Savings compared to BOD:	***54.0%***
Estimated Energy Cost Savings compared to BOD:	***-12.6%***

Notes:

Utility Rates

Electricity	0.189 $/kwh
Gas	1.168 $/MMBTU
DES Electricity Rate (Assumption)	0.1 $/kWh

Greenhouse Gas Emission Factors (CO2e)

Gas	117 (Lbs/MBTU)
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