2/4/21 Driscoll geothermal question responses

Q1: Is the geothermal line item ($2.7M on cost/benefit analysis currently shown as outside the budget target and therefore possibly not able to be included) independent of the $14.1MEP line item above?
A1: Yes. The complete systems with and without geothermal were designed, drawn, priced, and will be competitively bid. The $2.7M figure is the total additional construction cost for the Ground Source Add Alternate.

Q2: If the system is not a water source heat pump but rather an air source, is the equipment required for that the same cost?
A2: No, the MEP equipment has a different cost as noted in Q1. The base system is water source heat pump with fluid cooler

Q3: Are the utility rates also the same? If not, what are the two current rates expected for new Driscoll?
A3: The rates vary depending on the demand and whether they are 100% renewably sourced.

Standard Elec Rates:

- Base "Rate B7" school rate = $0.2101/kwh
- Geothermal Alt = $0.1810/kwh

100% Renewable Elec Rates

- Base = $0.25465/kwh
- Geothermal Alt = $0.2255/kwh

Q4: Was the electricity rate assumed as a Green rate or regular?
A4: Both were separately analyzed. Please see Q3 and Q6

Q5: Were Charlie Simmon's figures on maintenance and capital cost replacement escalated the same way as the BLCC v5.-38 note indicates was applied to the rates?
A5: Yes. Both analyses factored in DOE methodology for operating, maintenance and capital need replacement costs.

Q6:. As one example, in the last slide (Payback) you will note that the use of Green Energy improves the payback of geothermal but comes at an annual cost increase of $40K. In other words, it seems that the improved First Cost calculation may ignore the Operating Cost impact to the Town.
A6: Two analyses were completed, one using updated Utility company Electric rates (based on Ridley School bills), and the other based on 100% renewable electric rates. The primary reason that the payback period of ground-source alternate is reduced by 1 year when using the renewable electric rates is that the Base Option renewable green electric rate is higher than the ground source alternate. Operating costs have been factored into both analyses.

Q7:. As far as the rest of the payback calculation, I was looking for confirmation that the referenced DOE methodology included each of the components identified in their columns. I understand some of these values may have been generated by Charlie Simmons.
A7: Confirmed. Please see Q5

Q8: Do we understand the Useful Life of the Geothermal vs. Base systems? It appears their presentation assumes an equal life without stating that (although I could not find the actual number of years - 25? 40?). This is normally a lookup in an ASHRAE handbook.
A8: Lifecycle cost analyses (LCCA) study period is 30 years. LCCA factored in the major Capital need equipment replacement differences between the Base and Alternate systems. For the Base system, these costs include replacement of Adiabatic Dry Cooler (ADC) every 10 years, ADC pad every 3 years, and additional pump set motor change every 15 years. Major equipment components that require replacement within the study period (i.e. motors, compressors) for both Base and Alternate systems included a Capital equipment needs replacement cost at year 15. For presentation purposes these costs were combined and averaged over the 30 years study period. The actual analysis factored in DOE methodology. Both the Base and Alternate HVAC systems distribution system (i.e. air handling units/ductwork/piping/terminal equipment within the building) are the same, and are expected to have similar service life of 30 years or more.

Q9: In the Budget presentation, the Cost associated with the Geothermal was taken in and out without a change to the MEP line above. That means they included everything for the Base MEP and just added the Geothermal elements of permits, drilling/piping, pumps and exchange coils. This is reflected in their keeping the electric boilers in both schemes, even as they acknowledge their presence in the geothermal system is only for emergency backup. That is an added First Cost we need to understand, as it seems to come at a premium in the Geothermal payback.
A9: Please see Q1. The Electric boiler is only for backup heating in the Ground source alternate, and the electric boiler quantity and size is lower in this design option. The resultant lower cost of the Electric boiler has been factored into the additional cost of the Alternate Ground Source system.

Q10: How deep are the geothermal wells? Could we lower the price by going deeper and having less?
A10: The wells are 900' deep. This is the most cost efficient depth.

Q11: Could you please outline the assumptions about projected electricity costs for the next twenty years that were used to project the operational expenses and from what sources they were derived?"
A11: The projected electricity costs for the next 30 years are based on the DOE's projected escalation rates as follows:

Year	Escalation
2020	4.53%
2021	3.88%
2022	3.05%
2023	3.61%
2024	2.78%
2025	2.41%
2026	3.08%
2027	1.95%
2028	1.98%
2029	1.48%
2030	2.29%

2031	2.55%
2032	2.55%
2033	2.45%
2034	2.31%
2035	2.52%
2036	3.59%
2037	3.97%
2038	3.40%
2039	2.76%
2040	2.57%
2041	2.57%
2042	2.59%
2043	2.59%
2044	2.61%
Remaining	2.61%

Q12: Are all additional site work costs included in the payback analysis? What are those costs?
A12: Yes, all additional site work costs are included. The site costs for the geothermal add alt include the geothermal wells, trenching, and any site phasing for the temporary equipment required for the building to operate prior to the geothermal field is fully functional.

Q13: What is the expected life of each system (geothermal and water source)." For geothermal, the refrigerants are expected to degrade after 30 years and will likely need to be refreshed, but the heat would still be operable. The ground around the wells heats up so that's a factor too. The system is designed for 50 years, but I've been told we model for 30 years and include expect replacements after 20 years.
A13: The life cycle is based on a 30 year study period accounting for a 30 year building life. All replacements within the 30 year period have been indicated in Q8.

Q14: What is the maximum ACH/MERV under each scenario?
A14: Both scenarios will have identical ACH rates and MERV filter ratings. Each air handling unit will be provided with MERV-14 final filters and MERV-8 pre-filters. GGD has provided ACH information to Owner. Please refer to attached memo & charts.

Q15: How many wells will be needed, and where will they be?" What is the ability/cost to make the building geothermal "make-ready" for a future time? (if most of the air handling mechanicals within the school are identical for the 2 systems)
A15: 49 wells are required. Most are located under the new playfield, with the remainder under the new hardscape closer to the building. The base design system with the fluid cooler could be connected to geothermal wells at a future date though such an installation at a later date for the geothermal wells may not be feasible and would result in higher installation costs.

Q16: The analysis should be to compared the present value of the operating savings to the additional cost, factoring in things like inflation, r&m, etc. has that been done? can we see it?

A16: Please see Questions 5 and 7 above.

Q17: I was disappointed to hear from the OPM that geothermal wells are considered unaffordable since moving forward with them would require finding a savings of $2.7m elsewhere in the budget. Although I realize that the a FFF system will still be utilized, my understanding is that in this instance geo thermal represented an annual savings of $120k in operating expenses.
A17: Agreed. Given the unpredictability of the construction bid environment during the pandemic, the geothermal system was recommended as an add alternate to provide the Town with an acceptable "Plan B" which would not negatively affect teaching and learning, in case the bids came in higher than the reconciled estimates. The idea was reviewed and publicly approved by the Building Commission and the School Building Advisory Committee in August of 2020. Earthwork is typically the most complex and unpredictable item to price, so it was issued as an early package so that hard bids could be received early. Unfortunately, the sitework bids came in approximately $3M over the estimates of both professional cost estimators. The geothermal alt will still be competitively bid, and we will not know for certain that it is unaffordable until all bids are received, but it now appears unlikely that it can be built within the construction budget approved by the voters in 2019.

Q18: Same comment we heard this morning about the Florida Ruffin Ridley School energy performance
A18: The Ridley school EUI (Energy Use Index) was originally projected based on the anticipated use of the building. The building has been successful in having greater utilization of the HVAC system after hours than originally projected, to ensure more outside air is circulated through the building in an effort to help reduce the spread of the virus. Therefore, Ridley uses more energy, which had a negative impact on the EUI. The base bid (non-geothermal) option for Driscoll would still be more energy efficient than Ridley with similar use.

Q19: Under each scenario, what % of energy is expected to be provided from what sources (geothermal or water source, PV, purchased electricity, anything else)
A19: The new Driscoll will be all-electric, in conformance with the Brookline fossil fuel free ban on oil and gas piping in the building. It is anticipated that the Town will enter a Power Purchase Agreement for photovoltaic panels to be added to the roof, which would provide roughly 20% of the electricity from a renewable energy source for the new school.