Franklin Regional School District  Existing Facilities Assessments
Executive Summary:
Conceptual energy modeling is a tool that can be used to help make energy focused decisions early on in the design process. The energy model is essentially a virtual representation of the building that is built within a computer software program, in this instance Trane TRACE 700. The building is modeled to reflect the day to day activities of the building and its occupants. This includes things such as schedules for when occupants arrive and leave, what kinds of activities the occupants are doing, and when lights and miscellaneous equipment is being used (i.e. computers). From this information the program can determine the cooling and heating requirements for the individual spaces and the building as a whole.

With this information the user can then accurately model different HVAC plants and systems. The resulting outputs provide indicators of how the particular system will be sized and how it responds throughout the day. In addition, the user can see the energy use and resulting utility cost of any particular piece of equipment in the system or the energy use of the system as a whole. Coupled with a first cost estimate for each system, the program computes a simple life cycle cost that provides the user with another tool for selecting the most efficient system that suits the building’s needs while still staying within a predetermined budget.

The project options and subsequent HVAC systems within each option that have been modeled are as follows:

1. Full renovation of the High School with an addition (231,000 SF of renovation + 65,000 SF of addition)
   a. 4-pipe unit ventilator system (Hot water/Chilled water)
   b. Variable air volume (VAV)

2. Full renovation of Sloan Elementary with an addition (91,036 SF of renovation + 8,000 SF of addition)
   a. 4-pipe unit ventilator system (Hot water/Chilled water)
   b. Variable air volume (VAV)

3. New elementary school at the site of the current Sloan Elementary (125,000 SF of new building)
   a. 4-pipe unit ventilator system (Hot water/Chilled water)
   b. Variable air volume (VAV)

The following assumptions were made during the modeling process for the above options:

1. Utility costs
   a. Electric consumption charge = $0.0614/kWh
   b. Electric demand charge = $4.75/kW
   c. Gas consumption charge = $0.61/therm
2. Interior space temperature set points (thermostat settings)
   a. Cooling set point = 75°F
   b. Heating set point = 70°F

3. Construction information
   a. Wall R-value = 21
   b. Roof R-value = 25
   c. Window U-value = 0.55

4. Occupancy
   a. Renovation of High School = 1250 occupants
   b. Renovation of Sloan Elementary = 750 occupants
   c. New school at Sloan site = 800 occupants

The following figures show the results of the conceptual energy analysis: (Note, graphs are not provided for the electric and gas consumption of the new elementary on the Sloan site because there are not existing utility bills that can be used for a comparison. The electric and gas consumption would be similar but slightly higher than what is being shown in figure 2 and figure 4. This is because the overall square footage of the building is higher than the existing Sloan Elementary.)

![High School Electric Consumption](image)

**Figure 1:** The graph compares the electric consumption of the entire High School building. The line labeled ‘2015-2016’ is the actual electrical consumption from the utility bills for that period of time. The ‘Unit Ventilator’ and ‘VAV’ lines represent the predicted electric consumption calculated from the conceptual energy analysis.
Figure 2: The graph compares the electric consumption of the entire Sloan Elementary building. The line labeled ‘2015-2016’ is the actual electrical consumption from the utility bills for that period of time. The ‘Unit Ventilator’ and ‘VAV’ lines represent the predicted electric consumption calculated from the conceptual energy analysis.

Figure 3: The graph compares the gas consumption of the entire High School building. The line labeled ‘2015-2016’ is the actual gas consumption from the utility bills for that period of time. The ‘Unit Ventilator’ and ‘VAV’ lines represent the predicted gas consumption calculated from the conceptual energy analysis.
Figure 4: The graph compares the gas consumption of the entire Sloan Elementary building. The line labeled ‘2015-2016’ is the actual gas consumption from the utility bills for that period of time. The ‘Unit Ventilator’ and ‘VAV’ lines represent the predicted gas consumption calculated from the conceptual energy analysis.

<table>
<thead>
<tr>
<th>Project</th>
<th>HVAC Option</th>
<th>Annual Utility Costs</th>
<th>Estimated First Cost</th>
<th>Estimated Life Cycle Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High School Renovation</strong></td>
<td>Unit Ventilator</td>
<td>$181,490</td>
<td>$8,436,000</td>
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<td>Variable Air Volume</td>
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<td><strong>Sloan Elementary Renovation</strong></td>
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<td><strong>New Elementary School</strong></td>
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<td>Variable Air Volume</td>
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<td>$3,500,000</td>
<td>$4,181,637</td>
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</tbody>
</table>

Figure 5: The table shows a comparison of an estimated life cycle cost of the different projects and different HVAC options. The estimated life cycle cost is over a 20-year period.

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