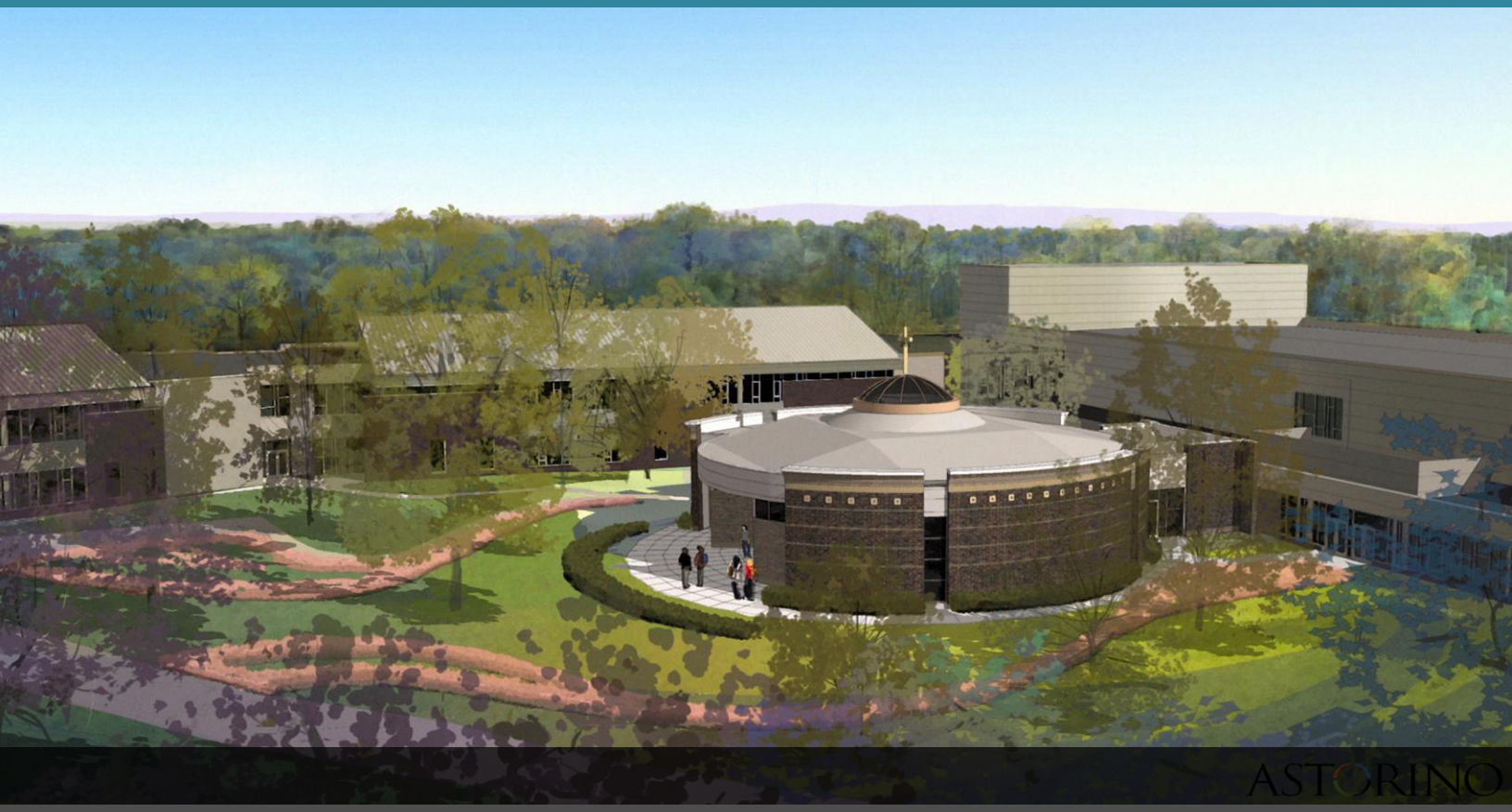

TECH III – Problem Identification

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Cranberry Township, PA

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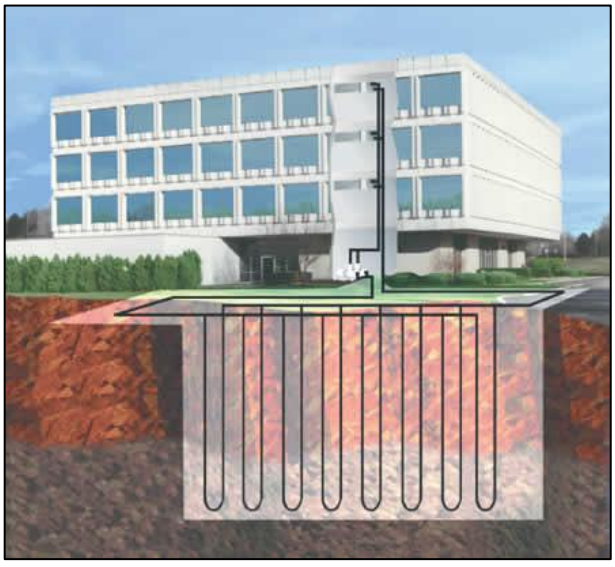
Problem Identification & Technical Analysis Options

1. Hybrid Geothermal System

The total project cost of Cardinal Wuerl North Catholic High School came to about $72.5 million and has a cost per square foot value of $13.91/SF. When separating the building costs from the entire site the cost is $43 million with a cost per square foot value of $242.92/SF. While the building cost/SF is relatively high, the difference between the two $/SF values can be explained by the expansive 71-acre site that was attained at the highest point in Cranberry Township. Much of this is to allow for on-campus sports fields/stadiums as well as parking lots and space for future development. Regardless, a geothermal heat pump seems to be ideal for this situation. An area could be determined as a designated well field not to be touched by any other usage, or the wells could be placed underneath the large parking lots or athletic fields. While these two areas may create a risk, geothermal systems rarely require digging to repair or maintain the wells, if ever.

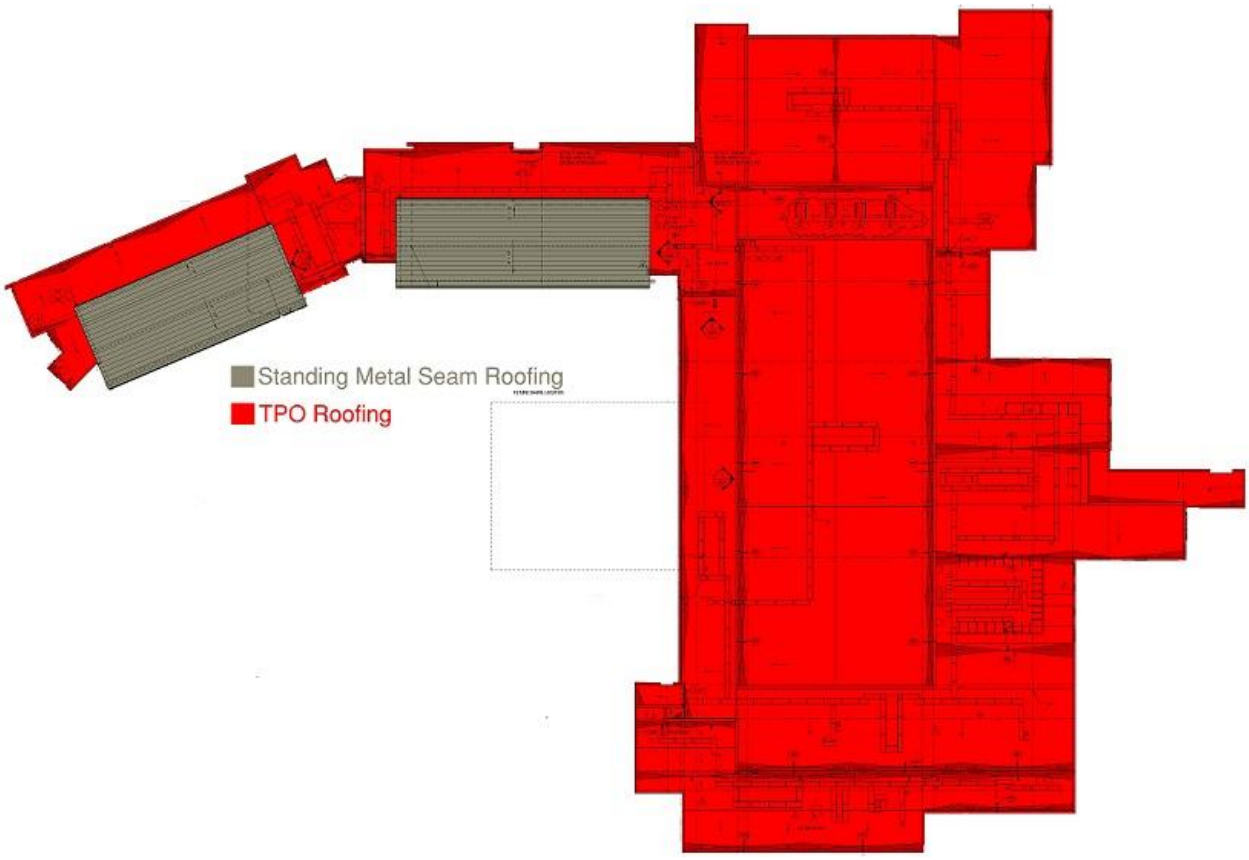
Most, if not all of the heating load could be deposited in or attained from the Earth for minimal costs compared to the three chilled water pumps and two chillers that are in place currently. I think an analysis to compare the initial investment and lifecycle cost of the chilled water system vs. the geothermal system would be beneficial based on the nature of site availability and eventual payoff. The geothermal system can also reduce the required mechanical space above ground as well as provide a higher LEED rating for CWNCHS. To save on initial costs, a 100% geothermal system will not be used. A hybrid with the current system will be developed to aid the current system and reduce energy costs. A constructability, feasibility, lifecycle payback period, and mechanical system compatability analysis can be completed. This also allows for the possibility of a mechanical breadth. An example of a geothermal system with vertical piping is shown below: (http://rays-hvac.com/images/photos/geothermal-commercial.jpg)



2. Hybrid Solar Energy Conversion System

CWNCHS sits atop the highest point in Cranberry Township, PA and its expansive roof makes it advantageous to add a photovoltaic system to the electrical building system. Both the thermoplastic polyolefin & standing seam metal roofing systems are compatible with a photovoltaic system and could greatly reduce the energy demand of the building depending on the magnitude of the system. The standing seam metal roofing would be the initial spot to place most of the photovoltaic panels since it will likely have minimal foot traffic compared to the TPO roofing. If panels are installed on the TPO roofing they will avoid the walking path to ensure that all life safety, warranty specifications, and maintenance requirements are fulfilled.

Technical analyses will be performed to determine a proper amount of photovoltaic panels to include based on their reduction of North Catholic's electrical load, the initial investment compared to available funds, and the payback period required for this system. I am confident that the large surface area of the roof leaves me with a myriad of options as far as payback periods and initial investment. This would leave the owner with a better idea of the desired scope for design and construction of a photovoltaic system. Considering that the fundraising for this project was a long process, this might be of high importance and consideration to the owner. I would determine an appropriately sized solar energy conversion system, conduct a payback period analysis to sell the idea to the owner, conduct a LEED analysis to determine if points have been gained and perform a constructability & feasibility analysis.



Property of Astorino

The addition of a photovoltaic system has left me with a huge opportunity to conduct an Electrical Breadth on this topic. It must be determined how the system loads will tie together and how it will aid in the load reduction of the building, as well as any equipment sizing reductions. Shown below is a roof plan displaying the different roofing systems. The standing seam system is shown in gray and the TPO system is shown in red:

Also shown below displays a typical photovoltaic system on a TPO roofing system as well on a standing seam metal roofing system (property of Google Images):

3. Evaulation of Maintenance Costs Throughout CWNCHS Lifecycle

This idea was presented to me during the second session that I attended at the PACE Conference. During the process of Value Engineering, some professionals tend to choose the material with the most immediate cost savings and don't take into consideration the lifecycle maintenance costs. For example, at CWNCHS, the ceramic tile scope was greatly reduced by epoxy paint on the CMU walls of the locker rooms and by semi-gloss in the bathrooms. While this tile needs to be cleaned approximately every year, the costs of cleaning compared to repainting every 5-6 years throughout the lifecycle of a building may be worth analyzing. Another area of interest would be the installation of polished concrete in place of linoleum tile. Linoleum tile is often stripped and waxed once a year and can be a high cost maintenance item. It may also be worth analyzing these two finishes. If this topic is chosen to analyze, a list of finishes, materials and building systems that require maintenance under the current design will be compiled and examined compared to an alternative material and its lifecycle & installation costs. This will be a mostly VE analysis for cost purposes that may have some schedule implications.

4. Prefabrication of Façade Sections

Offsite prefabrication is becoming more and more popular in the construction industry. Considering the multiple levels of wall construction that were a cause of heavy coordination and schedule congestion at North Catholic, I believe it is worth evaluating the possibility of a prefabricated façade for the masonry sections. The Insulated Metal Panels were prefabricated and were often waiting on the completion of the masonry work to move forward. Not to mention, glass could not be installed until the brick was completed, which tied up interior finishes such as drywall installation, taping and finishing. A better coordinated process could mitigate these issues on the schedule and offsite prefabrication may also provide cost savings. Also, the spray-applied air barrier contractor was a spotty at best in the proper completion of their work and required an extraordinary amount of QA/QC management from the project team. This issue could have been averted under controlled conditions. Possible cost savings, schedule accelerations, contractual language for early finish benefits and logistical considerations can be evaluated by this concept. This topic provides a hefty amount of breadth opportunity. Structural implications occur since this prefabricated system will have to be tied into the structure somehow and architectural aspects must be considered for reasons of building envelope air/water tightness, R-value, connections to structure, and aesthetic implications.

5. Critical Industry Issue – Efficient & Effective Delivery of Facility Management Information

After attending the PACE conference, analyzing the CWNCHS BIM Execution plan, and speaking with the owner about his ambitions with developing a facility management model for the facility manager to utilize effective, I feel as though it is very beneficial to analyze the process of turning over from construction to occupancy and how to maintain the function and aesthetic of a building. The owner's great ambition to do this should involve an in depth study of how to go about this process in the planning stages, determining who needs to buy in to the process, how it can be managed, cost evaluations, possible schedule impacts, and determining when an appropriate time to hire and begin training a facility manager is. The PACE Roundtable provided a lot of information on this topic. I hope to determine the most efficient & effective method of facility management information transfer for this specific project and tailor it to the owner's needs. Unfortunately, there are not many breadth study options available for this topic.

6. Alternative Delivery Method – Design-Build

There are many reasons that a design-build project delivery method on this project may have benefitted more than design-bid-build. Bringing together all parties earlier in the design phases may have helped to mitigate a lot of the problems that the construction team encountered. While all issues that have been encountered thus far have been addressed in an effective & timely fashion, it is always preferable to plan as much as possible to reduce the amount of issues. For example, the roofing activities for the TPO section of roofing were only able to installed at a certain threshold temperature and delayed the schedule. Since the critical path in the middle of the project was on the TPO roofing activities in Areas A, B and D it created huge problems. If the roofing consultants were brought in to help develop the

schedule earlier in the process, necessary adjustments could have been made. Also, Mascaro Construction may have been able to provide their experience input with the site engineers to determine the necessity of deep foundations due to red bed soils earlier on. The biggest scheduling issue occurred with permitting through the township. This may have been mitigated by utilizing a different delivery method. Contractual language and set up as well as organization charts will be developed and analyzed under this new structure. Communication with the current team members who have design-build capabilities and experience may help to determine how this process can aid in the above mentioned issues. Unfortunately, there aren't many options to develop a breadth analysis on this topic.