

Senior Thesis Final Report

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1.0 Executive Summary

Senior Thesis Final Report is intended to provide a thorough in-depth analysis of the New Indian Valley High School construction project. Areas of research include a broad investigation into client information, project delivery, key project team members, existing conditions and major building systems. In addition, this report also provides research into four different analysis topics encompassing several different disciplines of engineering and building construction.

The four analysis topics illustrated in this report include feasibility and design study of a photovoltaic energy system, the development of a short interval production schedule, re-orientation of current vertical closed-loop geothermal mechanical system and the possibility of building re-orientation/design excavation effects. The four analyses were developed to revolve around the critical industries issues of raising efficiencies and eliminating unnecessary spending.

Analysis #1: Feasibility and Design Study for Photovoltaic Energy System

The New Indian Valley High School design utilizes only a few sustainable design techniques. However, the implementation of a photovoltaic energy system could provide a substantial financial benefit to the new high school. This analysis will focus on the design and feasibility of a rooftop PV system. The analysis showed that incorporating a total of 20000SF of PV arrays, along with limited use of off-the-grid electricity that substantial savings could be rendered throughout the life of the building. Preliminary analysis and research into cases studies showed potential savings of \$25,000 a year could be achieved. Taking into consideration the rebate/incentive programs within the state of Pennsylvania and yearly savings on energy, the school district could see a full return of investment throughout the proposed lifetime and use of the school.

Analysis #2: Implementation/Development of Short Interval Production Schedule

Short Interval Production Scheduling (SIPS) is the focus for the second analysis. Two of the five phases of construction of the new school house a vast majority of the classrooms. The repetitive nature of these phases of the project provides a perfect opportunity to attempt to bring a high level of efficiency and

quality to the construction process, not only saving time but also money. The shortened duration has the potential to generate savings in rising general conditions costs and assure a more quality project due to the rapid repetitive nature of the schedule.

Analysis #3: Re-orientation of Vertical Closed Loop Geothermal Mechanical System

The New Indian Valley High School has been designed with a vertical closed loop geothermal mechanical system. This highly efficient mechanical system is one of the few sustainable features of the building. However, unforeseen rock conditions in proposed well field sites caused project delays. The re-orientation of a horizontal closed loop geothermal mechanical system would eliminate extra installation costs of the deep vertical wells coupled with the elimination of construction delays. The new school has efficient land area to incorporate the horizontal changes to part of the closed loop system.

Analysis #4: Building Orientation/Re-design Excavation Effects

Site properties open a door for potential building re-orientation/footprint design due to the amount of excavation work needed on this project. The ridge line north of the current high school serves as the new location of the new school. This ridge line consists of a moderate slope which requires extensive excavation, grading, earth reinforcement and the placement of retaining walls to prepare the site for use. The goal of this analysis was to show potential savings from excavation and site work without sacrificing owner wants/expectations.