Olivet Nazarene University
Student Life and Recreation Center Project
By Elara Engineering

CHAPTER/REGIONAL TECHNOLOGY AWARD - SHORT FORM

1. Category (Check one and indicate New or Existing, if applicable)

○ Commercial Buildings	○ New or	○ Existing
Institutional Buildings:		
● Educational Facilities	● New or	○ Existing
○ Other Institutional	○ New or	○ Existing
○ Health Care Facilities	○ New or	○ Existing
○ Industrial Facilities or Processes	○ New or	○ Existing
○ Public Assembly	○ New or	○ Existing
○ Residential (Single and Multi-Family)		

2. Name of building or project: ONU Student Life and Recreation Center

City/State: Bourbonnais, IL

3. Project Description: New Construction

Project Study/Design Period: 7/2010 (Begin date (mm/yyyy)) to 11/2011 (End date (mm/yyyy))

Percent Occupancy at time of submission: 100%

4. Entrant (ASHRAE member with significant role in project):

a. Name: Maze/Swanson/Malone (Last) Steve/Matthew/Brian (First) --/D/-- (Middle)

Membership Number: 5055868/8043936/8050506

Chapter: ILLINOIS

Region: VI

b. Address (including country): 30 N Wolf Rd 2nd Floor

Hillside (City) IL (State) 60162 (Zip) USA (Country)

c. Telephone: (O) 708-236-0300x158 d. Email: bagha@elaraeng.com

e. Member's Role in Project: SM:Principal in charge MDS:Senior Mechanical Eng. BM:Mechanical Eng.

f. Member's Signature: ______

5. Engineer of Record: Donald J McLauchlan

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the owner and have received permission from the owner to submit this project to the ASHRAE Technology Awards Competition.

Project Background

Olivet Nazarene University's new Student Life and Recreation Center (SLRC) is a true beacon for the campus' commitment to sustainability. The recently constructed, 143,500 sq.ft. student activity center is without question the most popular venue on the University's Bourbonnais Campus. The SLRC features a 56-foot climbing wall, a 4-story core area, a 72,000 sq.ft. multi-use field house and a 15,000 sq.ft. natatorium housing a 10-lane competition lap pool, a leisure pool with lazy river and a 10-seat whirlpool. The building's 4-story core also houses athletic support spaces which include locker rooms, a sports therapy suite, an exercise and weight lifting facility, athletic department offices and multipurpose rooms.

Project Statement

In 2010, Olivet Nazarene University called upon Elara Engineering to provide the Mechanical, Electrical, Plumbing, Fire Protection and Information Technology (MEPFPIT) systems for the new SLRC building. Elara's design approach takes advantage of the contrasting space functions by addressing them in four distinct mechanical systems. An outdoor air based dehumidification system provides enhanced energy efficiency and improved indoor air quality for the natatorium. The multi-use field house is conditioned using an air-based solution incorporating demand controlled ventilation (DCV). A dedicated outdoor air system (DOAS) with variable refrigerant flow (VRF) for sensible heating and cooling serves the remaining 4-story core building spaces. A water source heat pump system provides conditioning of the climbing wall atrium while a water-to-water modular heat pump provides heating for the pool and domestic hot water throughout the building. Finally, the sole energy source serving each of these systems, along with the domestic hot water, is provided by an 80-well, 650 ft deep vertical geothermal grid located approximately 500 feet away from the building. Each of these systems is controlled via a state-of-the art building automation system with real-time monitoring, trending and other control features in order to achieve synchronized energy performance.

Barriers to Implementation

For this particular project, the design team faced an initial challenge of designing highly energy efficient systems for an otherwise energy intensive building. The SLRC combines long operating hours with natatorium, exercise facilities and offices topped off by a ground to roof south facing glass façade. Since the natatorium and lap, leisure and spa pools are kept at a significantly warmer temperature and the pool evaporates into the space, its design requires heating and moisture control throughout the year. The field house, on the other hand, being such a large and open space, is highly driven by the outdoor conditions. In contrast, the climbing wall area, as a result of the solar gains from the south facing glass façade, is highly cooling dominant. Finally, the 4-story core space has diverse heating and cooling needs due to its mixed use and high concentrations of students, faculty and staff. Elara ultimately capitalized on the highly contrasting space types with a design based on the transfer of energy among and within these spaces. The geothermal design is optimized by this transfer of energy among these spaces

The design team was also constrained by the existing campus utility systems (steam, chilled water, electrical, etc.) which did not have the additional capacity to support a new building of this size/type. These existing conditions required the design of a completely independent heating, cooling and electrical systems which was ultimately addressed through the addition of the geothermal field. However, the closest feasible open area available for installation of the geothermal field was approximately 500 feet away from the new building. Elara was able to minimize the pumping impact on this by using a controlled primary-secondary pumping system. The geothermal field pumps are only used when the building loop temperature is above 70F or below 45F. Otherwise, water is circulated within the building only taking full advantage of the simultaneous heating and cooling requirements throughout the building.

Finally, the local code requirements applicable to the 4-story core originally classified it as an atrium space requiring full smoke evacuation capabilities, which represented a seven figure additional investment. Together with the architect, Elara devised a solution to enclose the top two floors of the 4-story core with 2-hour rated glass to circumvent the atrium classification for the climbing wall. This architectural modification is ultimately the most striking feature of the building. Additionally, given the height of the 56 ft climbing wall itself, proper air distribution could not be achieved through traditional ceiling or floor air distribution systems and a system routed along the south facing façade would not be aesthetic. As a result, again working with the architect, Elara designed supply plena within the enclosures around the structural columns extending the full height of the climbing wall space for optimized air distribution.

Justification for Claim of Excellence

Energy Efficiency: Although the SLRC design applies several apparent energy savings strategies such as a heat recovery VRF system, ventilation heat recovery, demand controlled ventilation, a geothermal heat pump system and high-efficiency lighting, the building's diverse usage profile allows for an energy balance within the building and a highly efficient use and first cost of the vertical geothermal field. Additionally, this energy transfer concept is further exemplified within the VRF system that was designed to serve the building's 4-story core. The VRF is able to take advantage of the simultaneous heating and cooling loads present in a setting where workout areas and classrooms are combined with office spaces. Together, the building's energy efficient systems were modeled to achieve an estimated annual energy savings of 2,770,000 kWh over a conventional all electric system.

Indoor Air Quality: The dehumidification method for the natatorium takes advantage of favorable outdoor air conditions and exceeds the code required ventilation airflows by more than 30% on average. Additionally, the incorporation of DOAS with DCV directly linked to the building automation system (BAS) allows for real-time monitoring and efficient outdoor air delivery to ensure occupants and space conditions are of high quality. Finally, the building air handling units employ MERV 13 filters for improved air quality.

Innovation: As previously mentioned, the making use of the energy transfer among spaces of varying uses represents an innovative approach to achieving energy efficiency in an otherwise energy intensive building. Additionally, this system is optimized further by using a geothermal system that fully supports the building without any auxiliary heating or cooling. Elara's solution to the atrium classification of the climbing wall as well as air distribution within the space demonstrate additional creativity in addressing initial challenges without sacrificing visual connection or space aesthetics. Innovation is further shown with the use of fusiolen piping for all the HVAC system piping within the building. As a lower installed cost alternative to typical piping, fusiolen piping is installed using fusion joining methods.

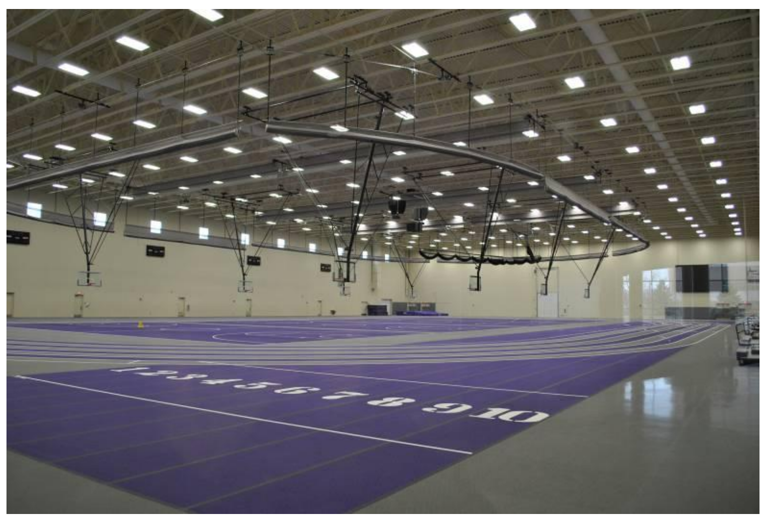
Operation & Maintenance: The installation of equipment with intelligent controls and proper service clearances improves overall operation, maintenance and reliability. Additionally, the new geothermal field was designed to incorporate future loads for (2) new dormitory buildings thereby offsetting additional operation and maintenance requirements for these future buildings. The entire building can be controlled remotely through a web-based BAS with BACnet communication complete with an energy dashboard for real time monitoring and trending.

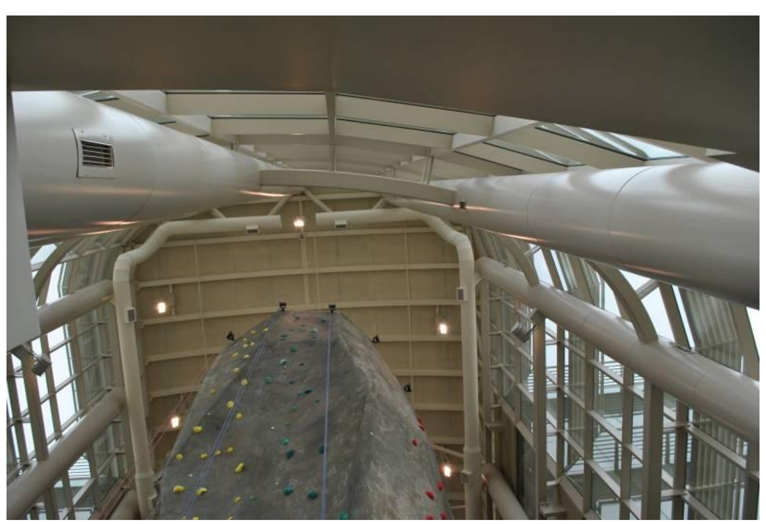
Cost Effectiveness: To date the project has received approximately $347,000 in grant and incentive funding through the efforts of Elara Engineering. A post-bid analysis of the actual MEPFPIT construction costs for the project showed that the energy efficient systems designed for the SLRC were comparable to that of a conventional system. The mechanical systems including the geothermal field were installed for approximately $37/sqft. Over the initial several months of occupied use, the building has been exceeding Elara's energy performance and comfort projections.

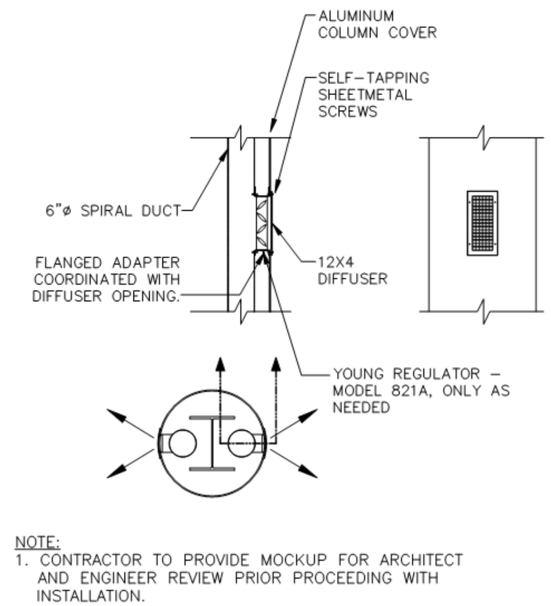
Environmental Impact: None of the designed systems for the SLRC utilize natural gas. Additionally, the use of harmful chemicals has been minimized by eliminating the need for an open cooling tower. The building utilizes less water than traditional buildings due to the geothermal system (modeling suggests a water savings of approximately 626,000 gallons annually). Finally, the energy efficient systems minimize the building's overall carbon footprint.

Results:

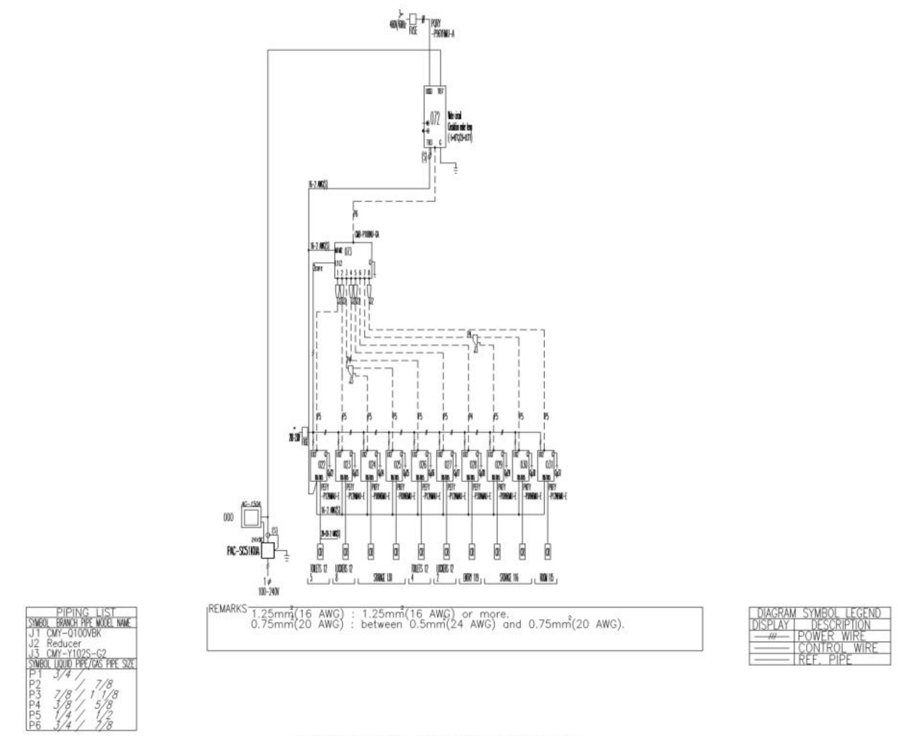
Olivet Nazarene University's SLRC building was successfully completed in the fall of 2012 with an official ribbon cutting ceremony on December 12, 2012 at 12:12 am. Approximately 1800 students awaited the ribbon cutting that night, some in their climbing gear and some in their swim suits, for a chance to be the first to climb the wall, or swim in the pools. As mentioned previously, the building has outperformed Elara's modeling projections by approximately 58,000 kWh over the first 6 months of tracked usage.



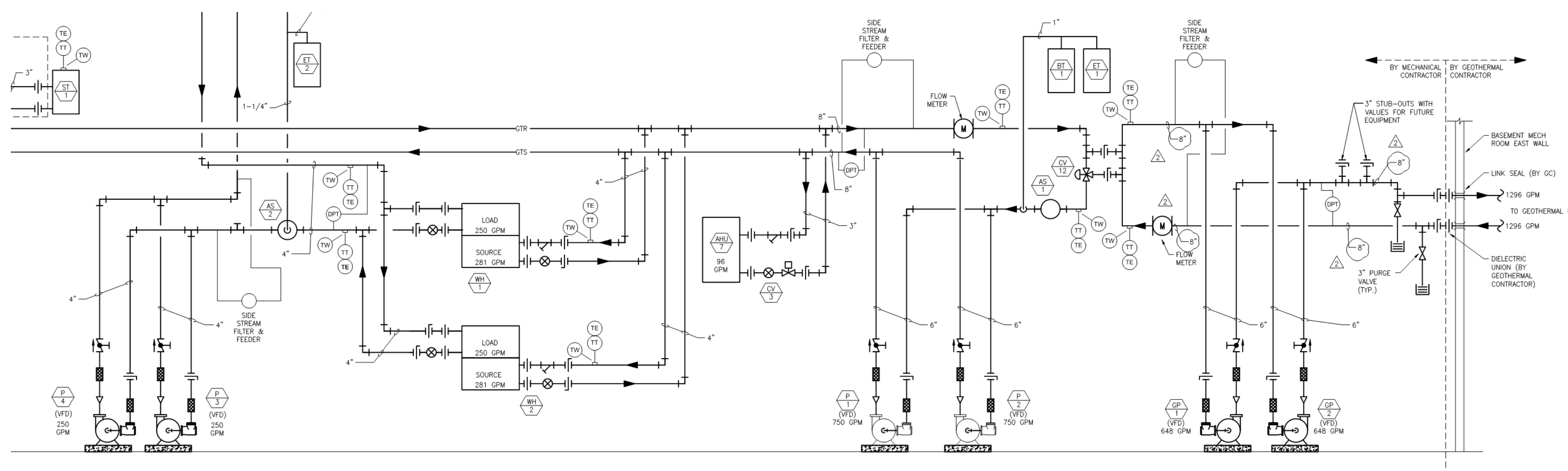




16 CLIMBING WALL CLADDING DIFFUSER DETAIL SCALE: NOT TO SCALE



2 NORTH GYM - VRF SYSTEM SCHEMATIC
SCALE: NTS



1 HYDRONIC PIPING SCHEMATIC
SCALE: NTS

ELARA