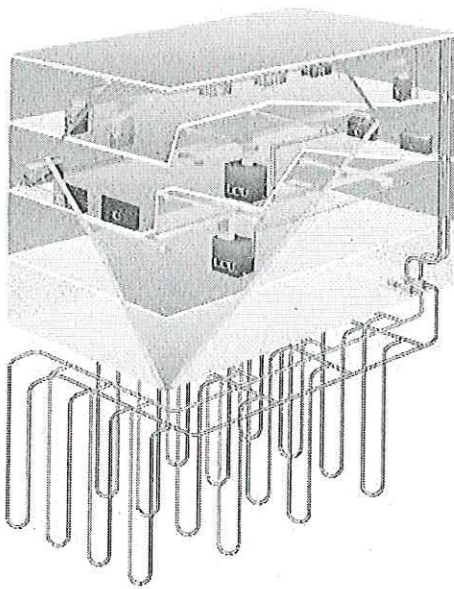


## West Chester University of Pennsylvania North Campus Geothermal Initiative

In the Summer of 2006, a program was launched to replace the eight north campus residence halls (~700,000 sqft) built in the 60's with new, updated designs that would include geothermal HVAC systems. Since the old residence halls represented more than 35% of the load on the university's 50+ year old coal/oil-fired steam heating plant, a study was commissioned to consider cost effective alternatives for the other buildings using this system. In parallel with this initiative the university had already launched a major energy savings program through a **Guaranteed Energy Savings Agreement (GESA)** which aimed at overall campus wide energy savings of more than 20%. Therefore, any alternatives to the steam heating system would have to generate savings that are in addition to those expected from the GESA.



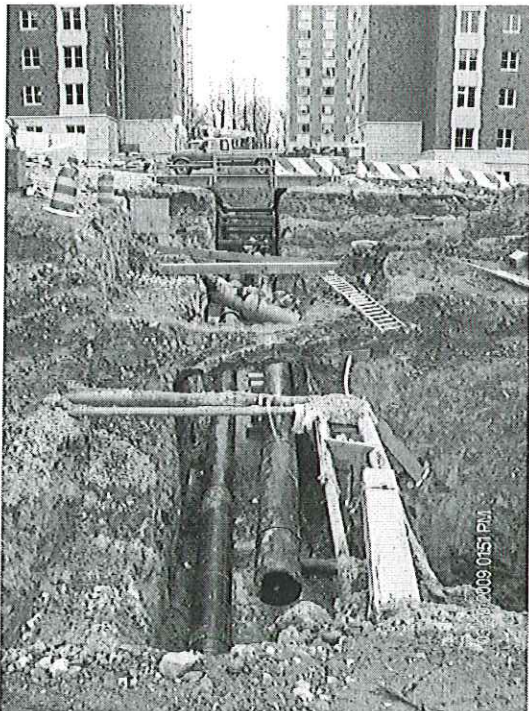
The initial study indicated that it was both feasible and, based on anticipated operational savings exceeding \$1M per year, cost effective to convert the other university buildings from steam heating with electric chillers for air conditioning to a geothermal-based HVAC system. Because many of the buildings being considered have HVAC systems that are 25 or more years old, this approach would also provide a path for upgrading obsolete heating systems. A more detailed study by a consultant who specializes in geothermal system design was commissioned to develop a conceptual plan addressing each building, as well as to define the size and examine possible locations for the required geothermal well fields to support this approach. By the Spring of **2007 a conceptual plan** had been produced that answered these questions and showed a clearly beneficial return on the investment required, with expected savings of ~40% for heating and ~20% for cooling. A program to convert 25+ North Campus buildings over a period of 10-13 years was tentatively launched. Among the long term benefits of this program will be the shutdown of the central heating plant, eliminating all coal (7000 tons per year) and most fuel oil (200,000 gallons per year) burned on campus, and reducing our emissions by 85 tons of SOx, 54 tons of NOx, and 44 tons of particulate matter that were being emitted from the our heating plant every year.

In the spring of 2007 the planned renovation of a 53,000 square foot academic building at 25 University Avenue (former Swope Hall) was altered to include converting its HVAC to geothermal and, with this energy initiative as its basis, a \$242K Pennsylvania Energy Harvest Grant was obtained and applied to offset most of the cost to install the 35 geothermal wells needed to support this system. The ongoing GESA was modified to apply the funds planned for HVAC improvements to the 140,000 square foot FH Green Library to converting its HVAC system to geothermal (water source heat pumps) which would be supplied from a well field



to be installed later (temporary provisions are included to compensate for the lack of the geothermal wells until they are available). Planned GESA HVAC improvements in Ruby Jones Hall (21,000 sqft) were also changed to convert the building to geothermal HVAC, but the completed design for this conversion is being held until construction funds are available in the future.

By the Summer of 2008, as 25 University was being placed back in service with its new geothermal HVAC system, the first two new residence halls (379,000 sqft) were under construction and a university project was initiated to install the 170 geothermal wells required and ~7,000 feet of distribution piping to support them. By this point in the program the continuing development of the overall geothermal concept had evolved to a district geothermal system, using a shared well field to supply multiple buildings. This approach solved a number of problems being: the congestion of underground utilities in center campus, drilling noise in mid-campus, and restricting the ground containing wells for future development. On the positive, sharing wells between buildings of varied use reduces the demand on the well field, thereby reducing the number of wells needed by 30%. The shared well field can be located under parking lots on the edges of campus. Although this increases the length of the geothermal supply and return piping, this cost is offset by the reduced number of wells needed.



The second phase of WCU's transition is in progress and this work will take until 2012 to complete. This phase includes drilling ~250 more wells, building a central Pump House, installing ~6,000 feet of distribution piping and connecting that piping to six buildings (Francis Harvey Green Library I & II, Anderson Hall, Recitation Hall, Ruby Jones and the Student Recreation Center). Additionally, Anderson and Ruby Jones Halls will have their HVAC systems changed to geothermal compatible systems. This phase is funded from a number of different sources: Pennsylvania DGS funds (\$6M) which were originally allocated for replacing old underground steam and condensate lines, a 2009 Pennsylvania Energy Harvest Grant worth \$252K, a \$300,000 Congressionally directed grant via Congressman Sestak, a \$558K DOE ARRA grant, a \$4.142M DOE FY10 appropriations grant and \$1.5M from West Chester University funds.

A third expansion of the geothermal system is happening using PA DGS funds (\$15.1M) which were awarded to WCU in 2012. This third phase will add 300 to 400 more wells, extend the geothermal distribution piping, connecting to the renovated Mitchell Hall, the new Business and Public Affairs building, Commonwealth Hall, Recitation and Hollinger Field House. These last two buildings will also have their HVAC systems replaced with geothermal compatible HVAC systems. The well field at 25 University will be incorporated into the North Campus Loop at this time. And the following buildings will get standalone natural gas boilers so the Central Heating Plant can be de-commissioned. Schmucker Science Center, Main Hall, Merion, Old Library, Lawrence, Ehinger, Speakman, Peoples, Philips, Sykes, Goshen, Schmidt, Wayne and Killinger Halls. By the end of the third phase of the North Campus Geothermal Initiative, in 2015, three

new residence halls plus a new student recreation center (a total of 600 K sqft), and eleven academic buildings (~500 k sqft), will be part of the North Campus Geothermal Loop, served by over 800 wells. This represents approximately 55% of the ultimate goal for this initiative.

