Technical Report Two

Building, Plant Energy and Emission Analysis Report

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New Castle Center for Delaware Hospice, Inc.

New Castle, DE

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Mechanical Option

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Executive Summary

The purpose of this report is to see if New Castle Center for Delaware Hospice is compliance with ASHREA Standard 62.1-2007 and Standard 90.1-2007. New Castle Center for Delaware Hospice is a two story building of 65,000 SF medical and administration. Image 1 (page 4) shows the location of the site for Google maps. Throughout the report New Castle Center for Delaware Hospice may show as DE Hospice to shorten the name. The DE Hospice is divided into two buildings connected by a Lobby area. Building A is a one story building with the main entrance and patient area facilities for the DE Hospice. The support services and administration are in the two story building B. Building A has patient rooms open to an outside patio and a courtyard for the inner patient rooms. DE Hospice has aluminum curtain wall systems with manufactured stone for the lower part of the exterior wall for the first floor and manufactured stone for some exterior walls. The manufactured stone is also used chimney on the East side of building B. The building is topped with asphalt shingles on the gable roof and cupolas. Windows are cladwood windows with louvers for shading.

The first part of this report is to model the design load estimation in an energy modeling program. In this report Trane Trace 700 was used. In the design load estimation and OA ventilation rates are based on data from design documents. In the second part of this report the model is use for annual energy consumption and operating costs.

Mechanical System Overview

The DE Hospice is a geothermal based mechanical cooling and heating system. The geothermal wells are under the east parking lot and in to the mechanical room in the basement. Then it is piped up to the attic where heat pump units and energy recovery units are. The water to water geothermal heat pump exchanges the energy from 20% glycol source to the R410A refrigerant. The refrigerant goes to heat pump units throughout the attic and the three ventilation heat pumps. The mechanical system does use two energy recover units that are located in the attic with the heat pumps. There are eight mechanical rooms in the attic. One mechanical room in the attic is not in line with an energy recovery unit or ventilation heat pump unit, it receives outside air directly to a regular heat pump. (see ASHREA Standard 62.1-2007 section 6 and appendix for more information on the mechanical ventilation)

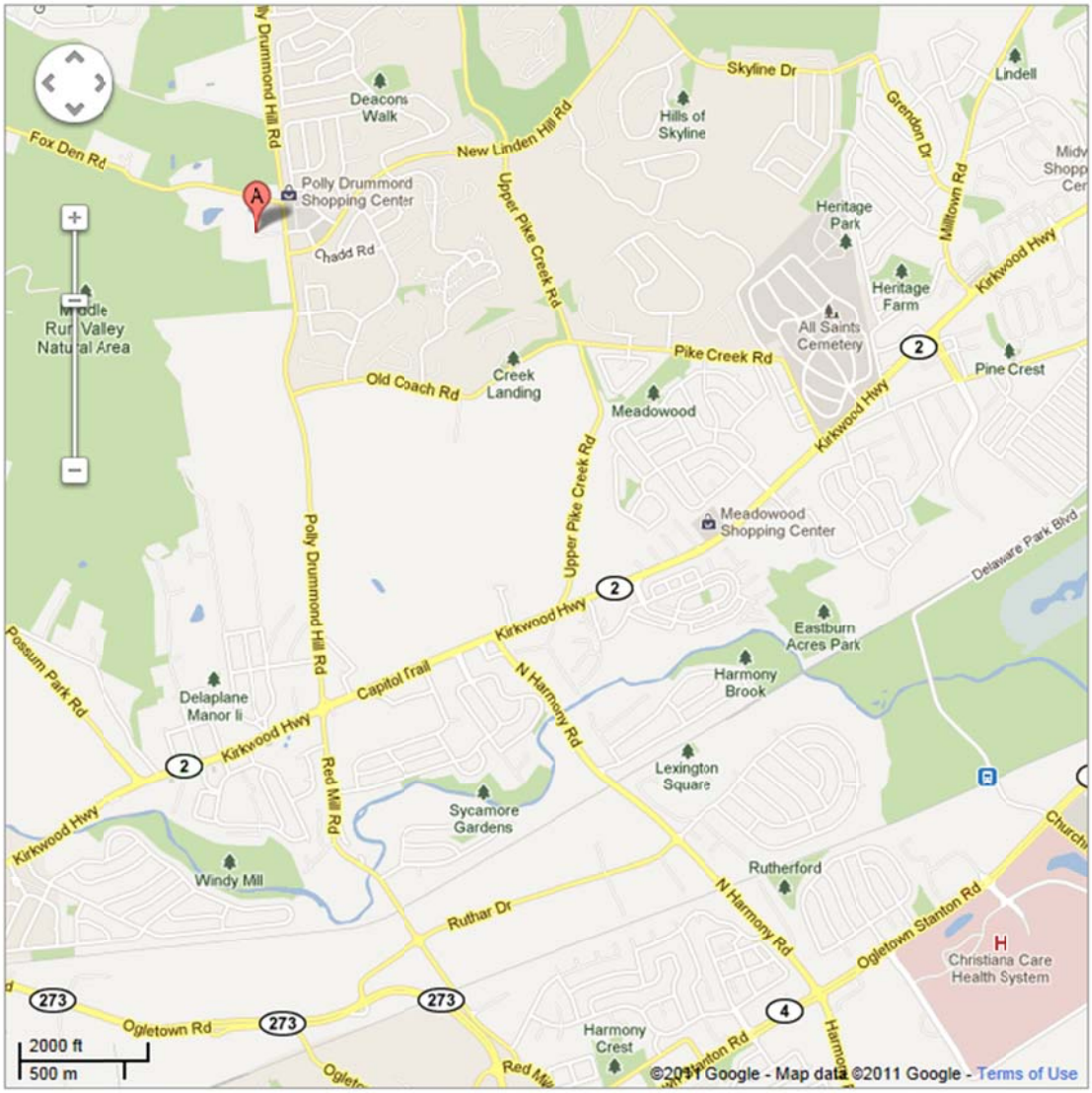


Image 1: A is the location of site, Image by maps.google.com

Design Load Estimation

Energy Modeling Program Selection

For technical report two of the DE Hospice building, I used Trance Trace for modeling of the building. I chose Trane Trace because I have used it in the past for modeling design loads.

Assumptions

Building spaces and elements are simplified into block loads.

Design Conditions

The weather data for the DE Hospice building was selected for the Wilmington, Delaware, the closest city on the weather date list of cities. A template for ten typical rooms' types was made for trace 700 modeling (Table 1. Internal Load and Table 2 Construction elements). The tenth typical room template is storage, which there are little information to show on it. Table 2 was used for the all of the building's envelope. The rooms are zoned into eight zones (see Fig. 1-8) Zones 2,3, and 4 are mostly hospice areas and zones 1,5,6,7, and 8 are more offices.

Table 1. Internal Load

Internal Load					
Space Type	Density(ft^2/pp)	Sensible (Btu/h)	Latent (Btu/h)	Lighting (W/ft^2)	Ventilation (cfm/pp) or (cfm/ft^2)
Conference	20	245	155	1.3	20 pp
Corridor	0	250	250	1.4	.05 ft^2
Dinning	10	275	275	1.4	20 pp
Gen. Hospice Areas	100	250	200	1.0	15pp
Kitchen	75	250	250	1.4	7.5 pp
Lobby	17	250	250	1.4	15 pp
Office	143	250	200	1.1	20 pp
Patient Room	100	250	200	1	25 pp
Restroom	0	250	250	0.7	50 pp

Table 2. Construction elements

Construction	Description	90.1 Zone 4		Building		Complies
		U Max	R Min	U-Factor	R-Value	
Roof	Insulation Entirely above Deck	0.048	20	0.020	49	Yes
Walls	Mass	0.104	9.5	0.067	15	Yes
Floors	Mass	0.087	8.3	0.087	8.3	Yes
Fenestration		U Max	SHGC Max	U-Factor	SHGC	
Metal Framing	Windows	0.55	0.4	0.28	0.40	Yes
Metal Framing	Doors	0.85	0.4	0.28	0.40	Yes


CONFERENCE CENTER
ENTRY HALL
LOBBY
COAT
PORCH
CANOPY
RECEPT.
CONF.
MEN
EXAM
PHYS. OFFICE
HALL
RESOURCE LIBRARY

Fig 1: Zone1

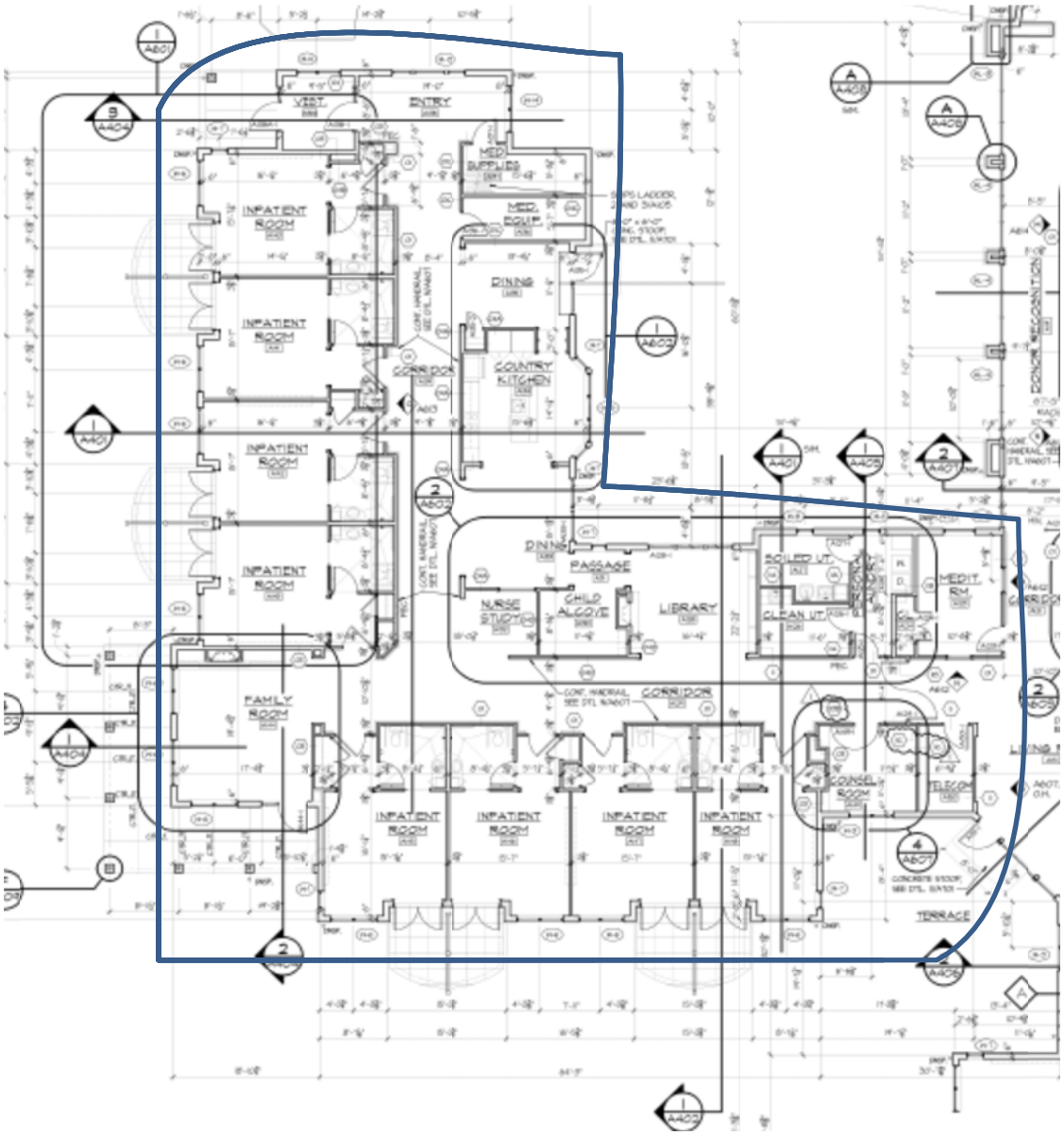

INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
FAMILY ROOM
DINING
COUNTRY KITCHEN
CORRIDOR
DINING
PASSAGE
NURSE STUDY
CHILD ALCOVE
LIBRARY
CLEAN UT.
SOILED UT.
MEDIT. RM
CORRIDOR
INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
CONSULT. ROOM
TELECOM
TERRACE

Fig. 2 Zone 2

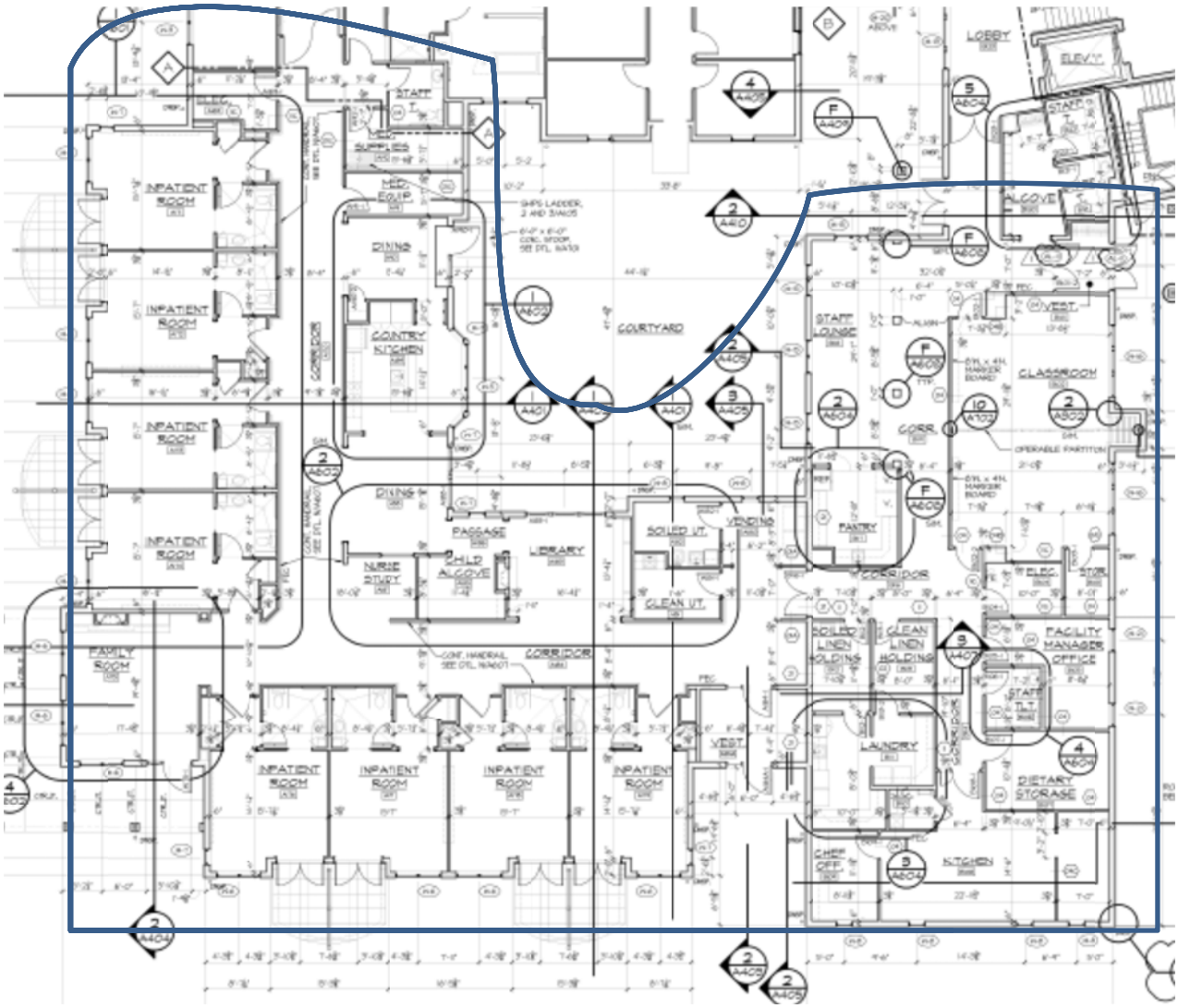

INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
FAMILY ROOM
COUNTRY KITCHEN
DINING
COURTYARD
CORRIDOR
PASSAGE
NURSE STN
CHILD ALCOVE
LIBRARY
SOILED UT.
CLEAN UT.
VENDING
CORRIDOR
INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
INPATIENT ROOM
VEST.
SOILED LINEN HOLDING
CLEAN LINEN HOLDING
FACILITY MANAGER OFFICE
LAUNDRY
DIETARY STORAGE
KITCHEN
STAFF LOUNGE
CLASSROOM
PANTRY
CORRIDOR
LOBBY
ELEV.
ALCOVE

Fig. 3. Zone 3

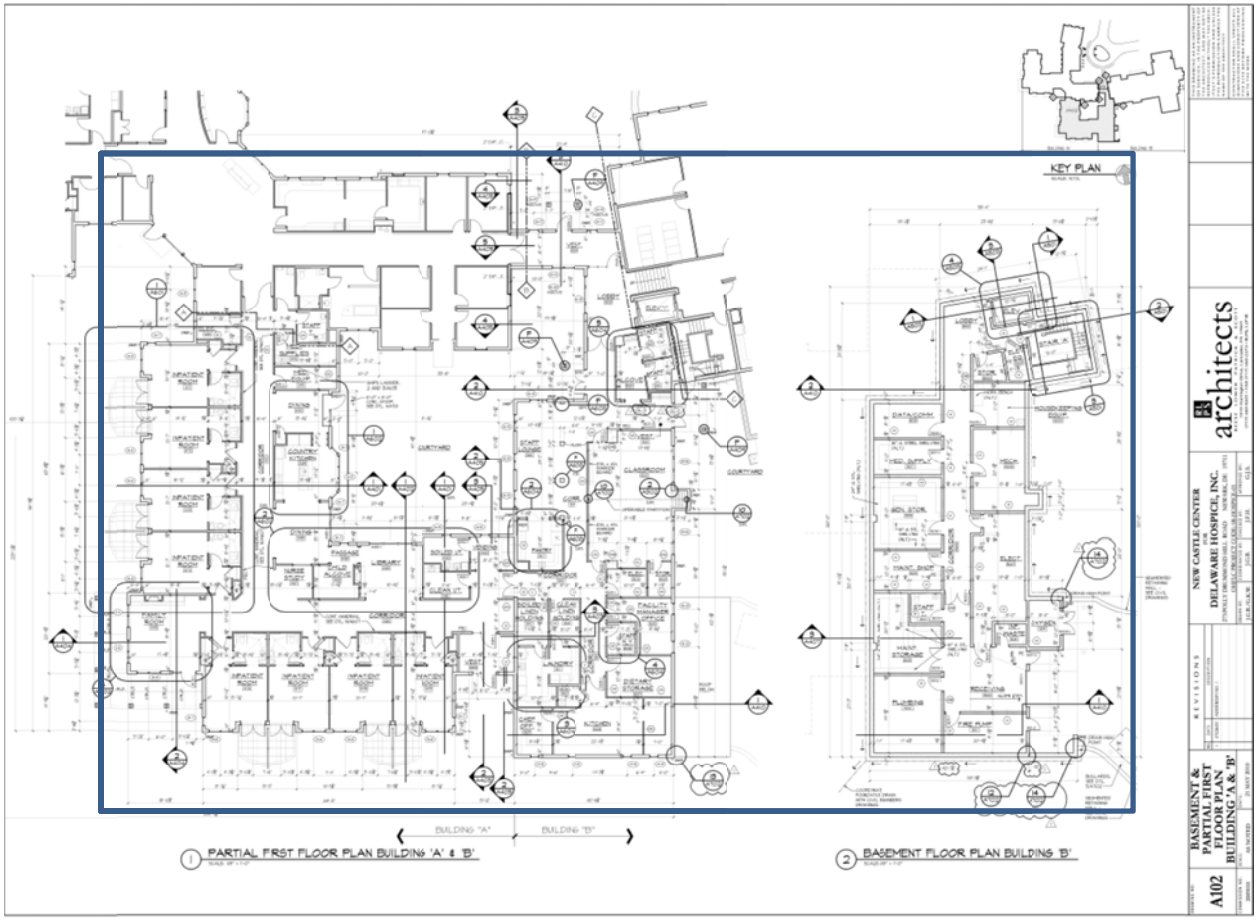

KEY PLAN
1 PARTIAL FIRST FLOOR PLAN BUILDING 'A' & 'B'
2 BASEMENT FLOOR PLAN BUILDING 'B'
BUILDING 'A'
BUILDING 'B'
NEW CASTLE CENTER
DELAWARE HOSPICE, INC.
BASEMENT & PARTIAL FIRST FLOOR PLAN BUILDING 'A' & 'B'
A102

Fig. 4 Zone 4

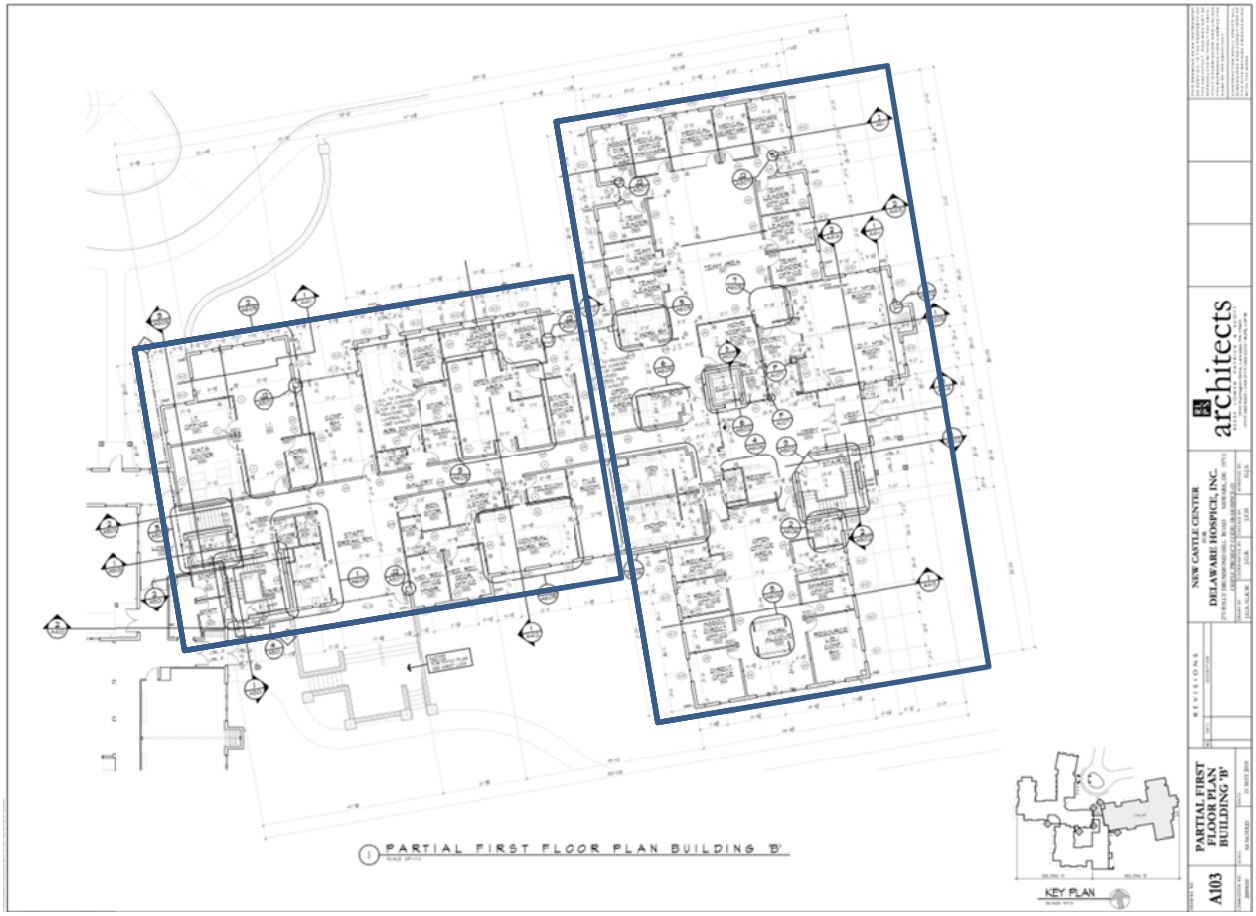


Fig. 5 from left to right Zone 5, Zone 6

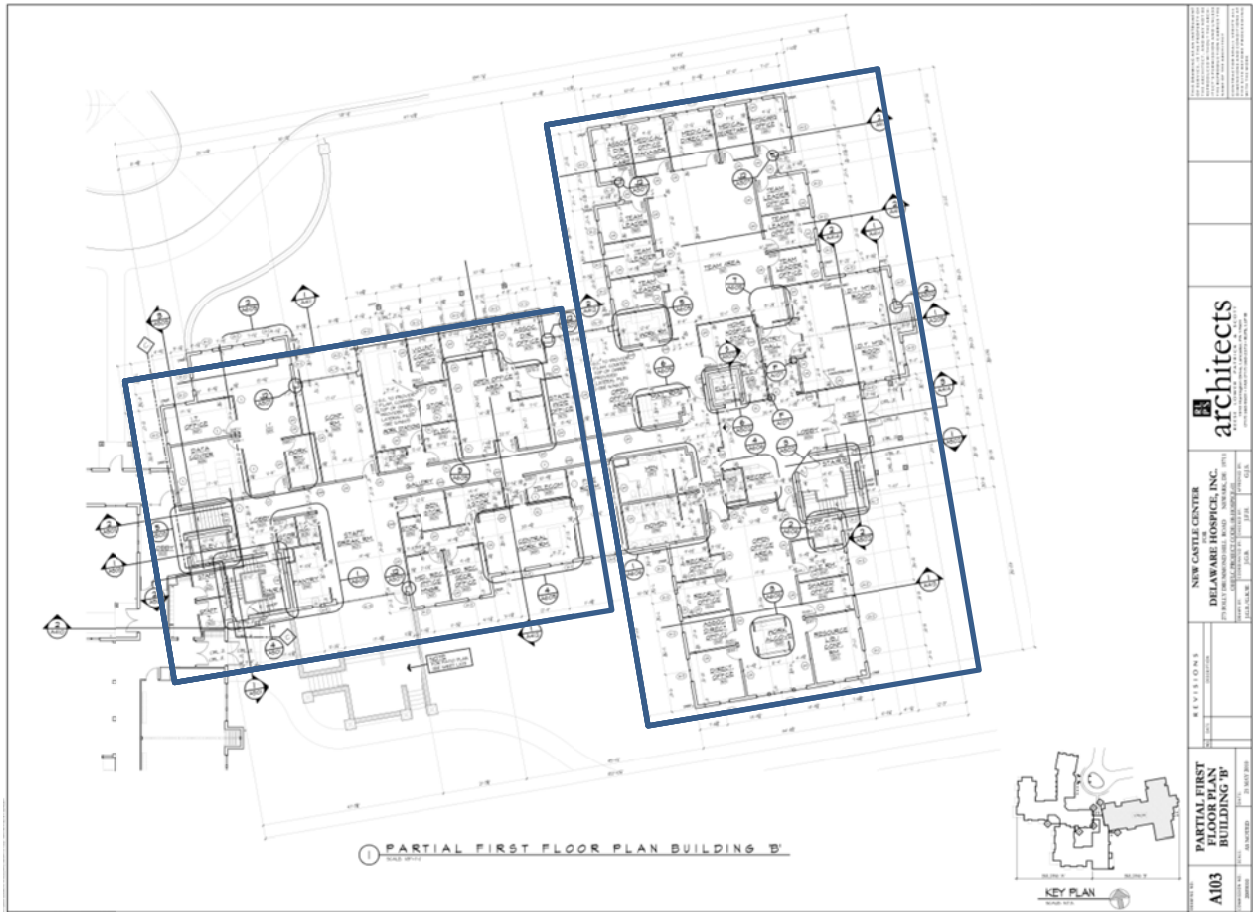


Fig. 6 from left to right Zone 5, Zone 6

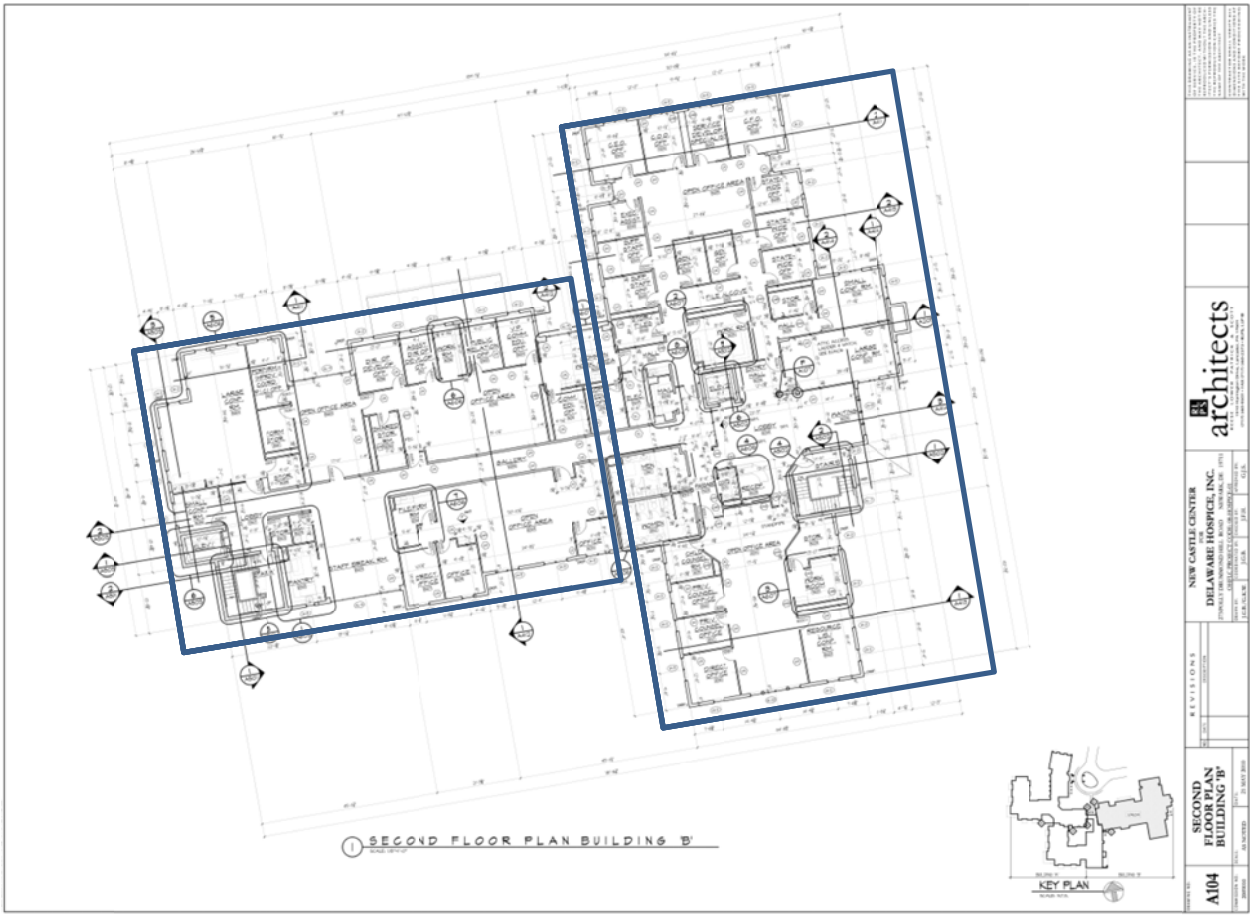


Fig. 7 from left to right Zone 7, Zone 8

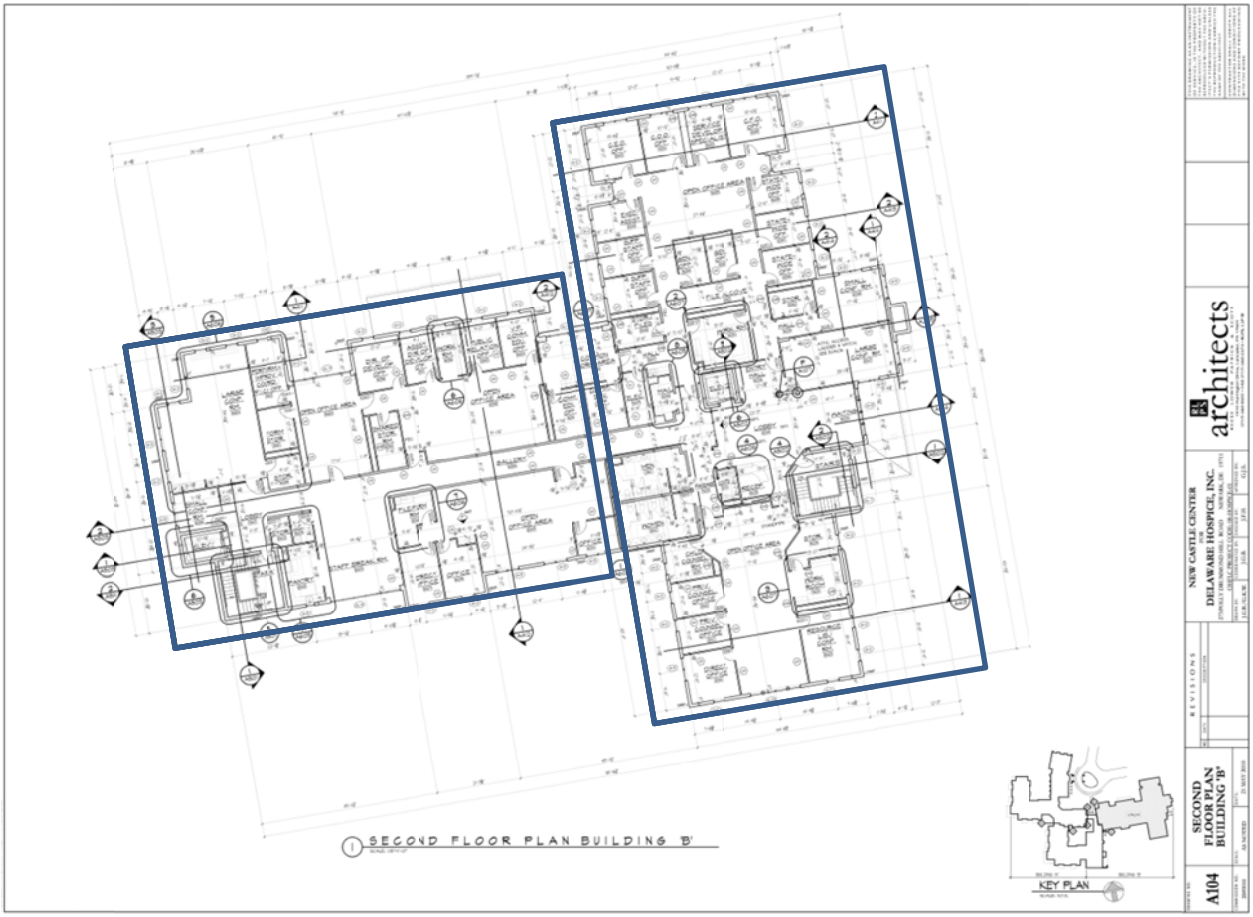


Fig. 8 from left to right Zone 7, Zone 8

Load Sources and Scheduling

The building being a hospice and offices, I used a hospital typical scheduling for building A and an office typical scheduling for building B. Building A is zones 2-4 and Building B is zone 1, 5-8.

Annual Energy Consumption and Operating Costs

The annual energy consumption was calculated with Trane Trace 700, the same for the load calculations.

Annual Energy Consumption

In Table 4 (Annual Energy Consumption) , the energy for the building for the year is separated into load types, energy usage, and percentage of total energy. Table 4 shows that the highest percentages of total energy used in a year are the supply fans and the lighting. The ground source heat pump of the building has appeared to lower the typical high heating load on a typical building. The building being driven by the schedule of the hospice has increase the lighting load. A place for improvement will be replace some of the supply fan where the load is not driven by OA with chilled beams.

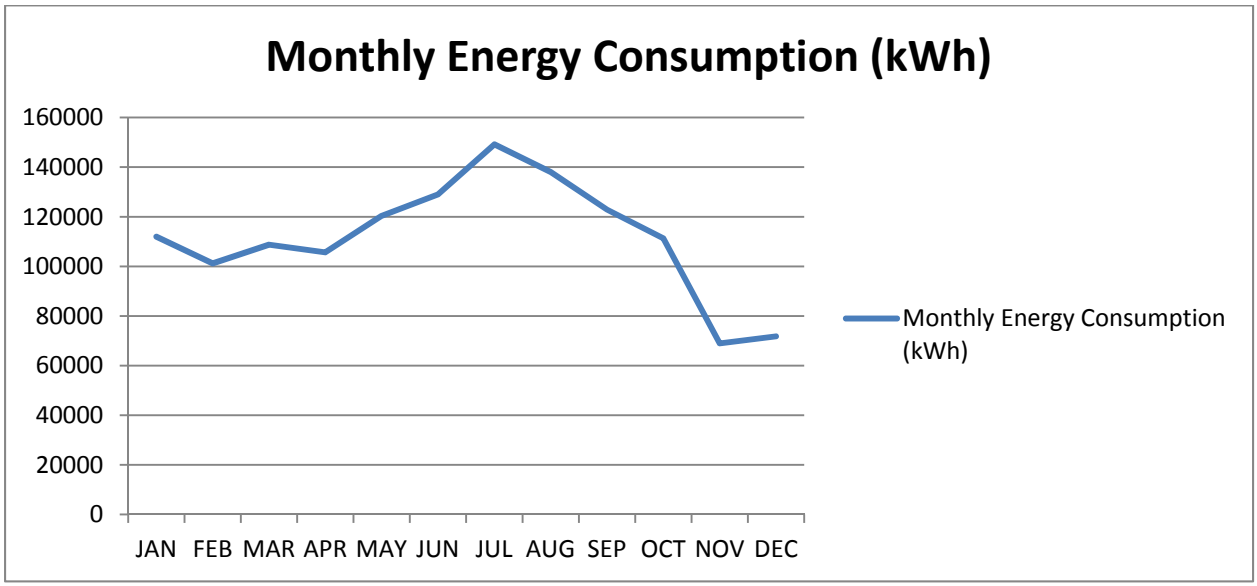
Table 4. Annual Energy Consumption

Annual Energy Consumption			
Load	Electricity (kWh)	Natural Gas (kWh)	Percent of Total Energy (%)
Heating		21,765	1.5%
Cooling	158,997		11.2%
Supply Fans	448,844		31.7%
Pumps	257,923		18.2%
Lighting	438,502		31%
Receptacle	88,126		6.2%

Total: 1,414,156 kWh

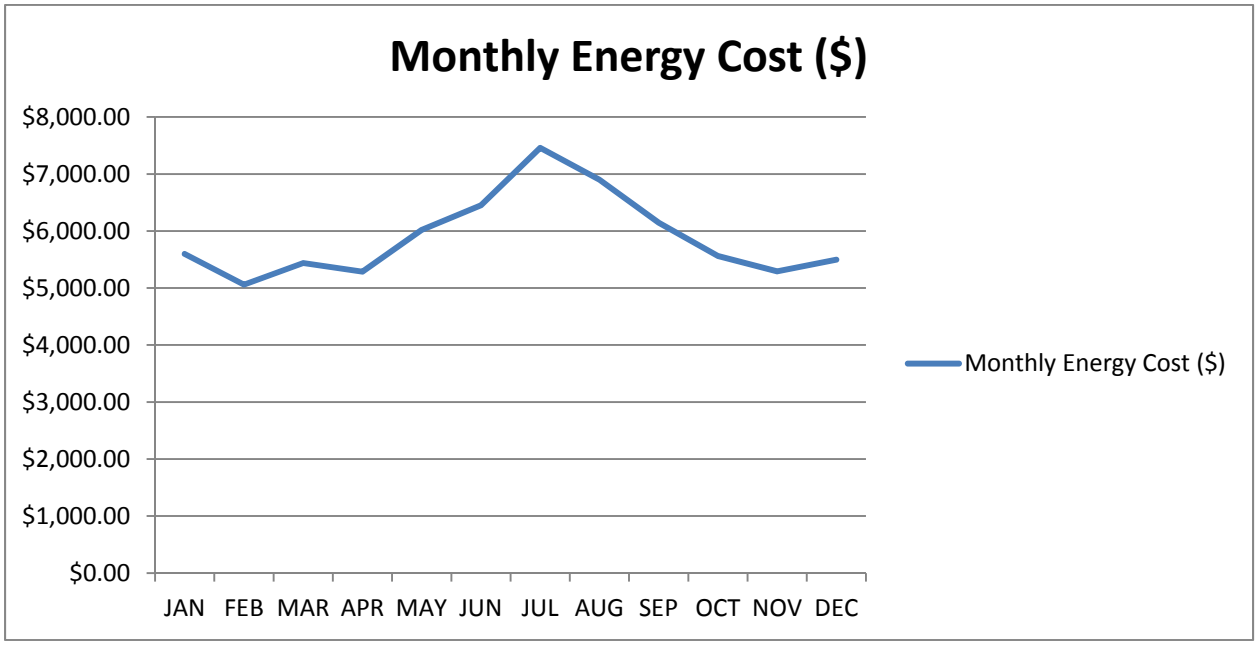
In Graph 1 and 2 below, it shows that the summer is the peak of cost for the building. With the heating load being 1.5% compare to cooling load this is expected.

Graph 1. Monthly Energy Consumption



Energy Costs

Graph 2. Monthly Energy Cost



Annual Emissions Footprint

Table 5 (Environment Impact Analysis) was calculated using Trane Trace 700.

Table 5 Environment Impact Analysis

Environmental Impact Analysis	
CO2	2,550,780 lbm/year
SO2	13,935 gm/year
NOX	4,274 gm/year

Conclusion

The building types are split into hospice and low-rise office buildings. After review of report this report and results of Trane Trace 700 modeling program, the data since to be skew to a cooling load profile and less of a heating load profile, which is typical in North America. My setting in Trane Trace 700 is off, farther view and reading is need to find the mistake in the trace modeling programs setting.