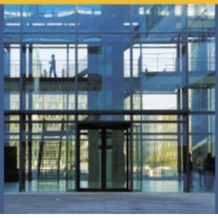


ENE Systems, Inc./Energy Efficient Investments, Inc.
Preliminary Investment Grade Audit

FOR:

Cheshire County New Hampshire

Prepared by:

Michael Davey, CEM

EEI ENERGY EFFICIENT INVESTMENTS INC.

ENE SYSTEMS REDUCING THE OPERATING AND ENERGY COSTS OF YOUR FACILITY

Date: Feb 16, 2021

Executive Summary

EEI is located in Merrimack, NH, and has a proven track record of designing and implementing energy improvements to mechanical systems, building controls systems, insulation, and renewable systems. EEI is also an approved energy management contractor with Better Buildings, Pay for Performance, Eversource, Liberty Utilities, and other utilities in New Hampshire.

The energy savings in this project will include a guarantee on annual energy savings over the financing period.

EEI has developed a plan which could reduce annual energy expenditures in the district by more than $124,000 in energy and a minimum of $12,000 in operation savings. It is important note that this is not a pure energy project where return on investment was the driving focus. EEI met with County Staff and had meetings with the commissioners and staff on these topics. The direction EEI received from the Commissioners was threefold.

1. Focus on long term solutions as all of the buildings likely be used by county for generations to come
2. Focus on reduction of fossil Fuel as primary heating source
3. Incorporate where possible a uniformity

Accomplishing this goal was a challenge, for various reasons, which include that the buildings range for nearly 164 years old to construction in last 12 years. The condition of the mechanical systems at County Hall and the Admin Building across the street are at end of life. When EEI first started working on this project it was assumed that corrections would focus on two items 1) LED lighting and other electrical efficiencies. However, our audit revealed, that the geo-thermal well field at Cheshire County Corrections is underutilized. Essentially the well is being only used during the cooling season the heat pump loop is not connected to primary heating load or the domestic water load.
This is creating a condition where the well field becoming over heated. This heat can be drawn off in the winter by 1. Connecting the VAV heat loop to the well field and the domestic water load. Further efficiencies can be added with a fluid cooling tower.

As noted, several of the buildings are facing end of life issues.

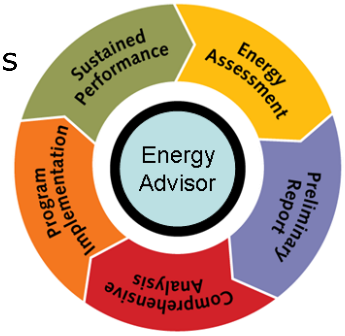
Building	Installation	ASHRAE Projected Useful Life	ASHRAE Recommended Replacement year
County Hall			
HVAC Controls	1978	15	1993
County Hall Ventilation and VAV boxes	1978	20	1998
Air Handler (VAV0	1978	20	1998
Boiler	1975	35	2010
Admin Building			
HVAC Controls	1980	15	1995
Air Handler units	1986	20	2006
Boiler	1981	35	2016
Maplewood Assisted Living			
VAV Air Handler Units	1998	20	2018
Cheshire Corrections			
Water To Water Heat Pumps	2008	19	2027
Units are experiencing early failure due to high operating temperartures			

EEI in its role as Energy Service Company (ESCO) has agreed to develop an energy project targeting energy savings at the locations identified below:

Building	Location
Maplewood Nursing Home (Alf Wing)	**201 River Road Westmoreland, NH**
Cheshire County Corrections	**825 Marlboro St. Keene, NH**
Cheshire County (County Hall)	**12 Court St. Keene, NH**
NH Circuit Court	**33 Winter St Keene, NH**
Admin Building (Registry of Deeds)	**33 West St Keene, NH**

The development of every energy project starts with the initial energy assessment which includes a site visit and the collection of utility and operational costs for each location. The next step entails defining measures, budgetary costs, and estimated savings values by measure for each building.

On the following page, the Energy Conservation Measures Matrix shows the proposed upgrades for Cheshire County. Once measures are selected from the Preliminary Investment Grade Audit a Final Investment



Grade Audit will be produced.

County Hall Date 10/7/2020

Energy Conservation Measure Number	ECM Description	Cost for Installed Measure	Estimated Annual Energy Savings	Potential Rebate
CH1	Building Automation (DDC Controls)	$ 248,810	$ 3,250	$ 20,000
CH2	VAV Roof Top Unit	$ 310,192	$ 2,150	$ 15,000
CH3	Drychip Boiler with City Gas Backup	$ 413,800	$ 11,000	$ 233,000
CH4	LED Lighting	$ 149,000	$ 9,667	$ 34,226
CH5	Replace VAV Boxes	$ 186,875		
CH6	Ceiling Tiles Sprinkler Relocation and Electric	$ 116,500		
	Total	**$ 1,425,177**	**$ 26,067**	**$ 302,226**

Admin Building

Energy Conservation Measure Number	ECM Description	Cost for Installed Measure	Estimated Annual Energy Savings	Potential Rebate
1	LED Lighting	$ 43,000	$ 3,800	$ 11,300
2	VRF (Variable Refrigerant Flow) HVAC	$ 920,000	$ 4,912	$ 15,000
3	Building Automation (DDC Controls)	$ 65,000	$ 1,200	$ 5,000
	Total	**$ 1,028,000**	**$ 9,912**	**$ 31,300**

Maplewood Assisted Living Facility

Energy Conservation Measure Number	ECM Description	Cost for Installed Measure	Estimated Annual Energy Savings	Potential Rebate
1	ALF 6 HVAC Units	$364,285.71	$1,000.00	
2	Ceiling tiles and lights as required	$41,000.00		
	Total	$405,285.71	$1,000.00	

New Courthouse

Energy Conservation Measure Number	ECM Description	Cost for Installed Measure	Estimated Annual Energy Savings	Potential Rebate
1	LED Lighting	$85,000.00	$5,100.00	$15,000.00
2	Building Automation Integration (Controls)	$50,000.00	$3,200.00	
	Total	$ 135,000	$ 8,300	$ 15,000

Corrections

Energy Conservation Measure Number	ECM Description	Cost for Installed Measure	Estimated Annual Energy Savings	Potential Rebate
1a	Geothermal System Improvements (Domestic HW)	$ 182,210	$ 16,680	$ -
1b	Geothermal System Improvements (Additional Heating)	$ 986,860	$ 36,000	$ 15,000
2	Building Automation Integration	$ 47,596	$ 8,000	$ -
3	Led Lighting	$ 269,000	$ 12,000	$ 26,500
4	Walk In Cooler Controls	$ 13,000	$ 1,300	$ 5,000
6	Transformers	$ 111,720	$ 5,000	
	Total with Geo	**$ 1,610,386**	**$ 78,980**	**$ 46,500**

Total Cheshire County Option (Geothermal Corrections)	$ 4,603,849	$ 124,259	$ 395,026
Payment & Performance Bond	$ 46,038		
Cheshire County With Analytics	$ 46,038		
Owners Project Manager	$ 46,038		
Total Budget	**$ 4,741,964**		
Estimated 20 Year Lease Payment Amount at 3%INT	$ 284,170		
Estimated Budget Impact Geothermal Corrections and all other measures(Lease PMT-Energy Savings)	$ 159,911		

2. Energy Conservation Measures (ECM)

In this section of the document, we will define the Energy Conservation Measures we have evaluated for this project as shown in the table on page #5. Then we will define the measures on a building-by-building basis. Careful consideration was given to each measure and its interaction with the overall building performance.

<u>County Hall</u> *(General ECM Descriptions)*

<u>ECM 1 – DDC Controls</u>

The existing building has 1960's era pneumatic controls (Fig.1). Pneumatic system uses compressed air to activate the building controls. This type of controls system was invented in the 1880's and replaced the previous system of manually opening and closing dampers and valves to adjust for heating and ventilation.

The pneumatic controls were phased out in the commercial industry in the 1980's when a more efficient electrical/digital systems came to the market. The pneumatic systems use more energy, have parts that are hard to find, and there is a shrinking pool of professionals that work on them. Digital systems are energy efficient, easier to maintain, provide a higher degree of controllability, have remote access through the Web, and are an industry standard for high efficiency buildings.

Fig. 1: Pneumatic Control Panel

SCOPE OF WORK

Standardization of controls integration and removal of all pneumatic devices and systems. Furnish, install, integrate and commission a new DDC control system for all building HVAC systems.

Fig. 2: Digital field devices

The control system will be installed per mechanical drawings H-1, H-2, H-3, H-4, H-5, HN-1, HN-2, HN-3, HN-4, HN-5, dated May 1978 and site observations with the following clarifications / exclusions:

1. The control system will be a BACnet compliant web enabled system as manufactured by Schneider Electric Inc. Customized web graphics will be constructed for each piece of equipment and floor plan layouts with links to individual zones will be included. Trend archiving is included and will be available for use in developing system analytical profiles created by others.

2. BACnet compliant DDC controls and associated low voltage interlock wiring for two boilers and associated pumps is included. Variable frequency drives for the two main heating loop pumps are included. The drives for P1 and P2 will be 3hp @ 208vac. All drives will be Nema-1 rated GS series, as manufactured by Franklin Controls Inc. Pump operating status will be monitored and alarmed.

3. BACnet compliant DDC controls and associated low voltage interlock wiring serving two air handling units is included. New damper actuators are included. New control valves for unit heating coils are included. Supply air temperature, and room temperature sensors are included. Supply fan variable frequency drives are included. Heating coil freeze protection is included. Supply fan operating status will be monitored and alarmed. Valve installation is included.

4. BACnet compliant DDC controls and associated low voltage interlock wiring for seventy-six (76) variable air volume boxes is included. The existing units do not have control valves. We have included two-way, two-position control valves for each associated piece of baseboard radiation. Valve installation is included.

5. BACnet compliant DDC controls and associated low voltage interlock wiring for fourteen (14) unit / cabinet unit heaters is included. The existing units do have control valves. We have included two-way, two-position control valve for each unit.

6. BACnet compliant DDC controls and associated low voltage interlock wiring for one building exhaust fan is included. Fan status will be monitored and alarmed.

7. Demolition of existing pneumatic controls is included.

8. All work will be performed between the hours of 7am and 3:30 pm.

ECM 2- VAV Air Handler Replacement

The county hall spaces are conditioned by a VAV (Variable Air Volume) air handler located in the attic space (Fig. 3). This unit was installed in 1978 and is hard to access and work on due to the tight space and remote location up in the attic.

To replace the air handler, the roof would need to be remove to gain access to the unit. This makes the construction work more costly and takes more time for system integration from time of the existing unit demolition to startup and commissioning of the new AHU. Additionally, the existing controls on this system are antiquated which create poor air quality, controllability and zoning.

Fig. 3: County Hall attic showing air handler.

We propose installing a new VAV Air Handling unit with energy recovery to bring the building up to current mechanical codes and to provide HVAC energy improvements. The proposed location would be on the adjacent roof to provided better access for filter changing and maintenance. The installation would include new roof mounted AHU, roof curb, controls integration, ductwork modifications, ductwork insulation modifications, roofing, rigging, electrical and removal of existing unit.

ECM 3-Dry Chip Boiler with City Gas Back Up

The existing boilers at the city hall are oiled fired boilers that are beyond the industry life expectancy. The heating system has integrated pneumatic controls and old system controls that are less efficient than the new systems available in the industry today.

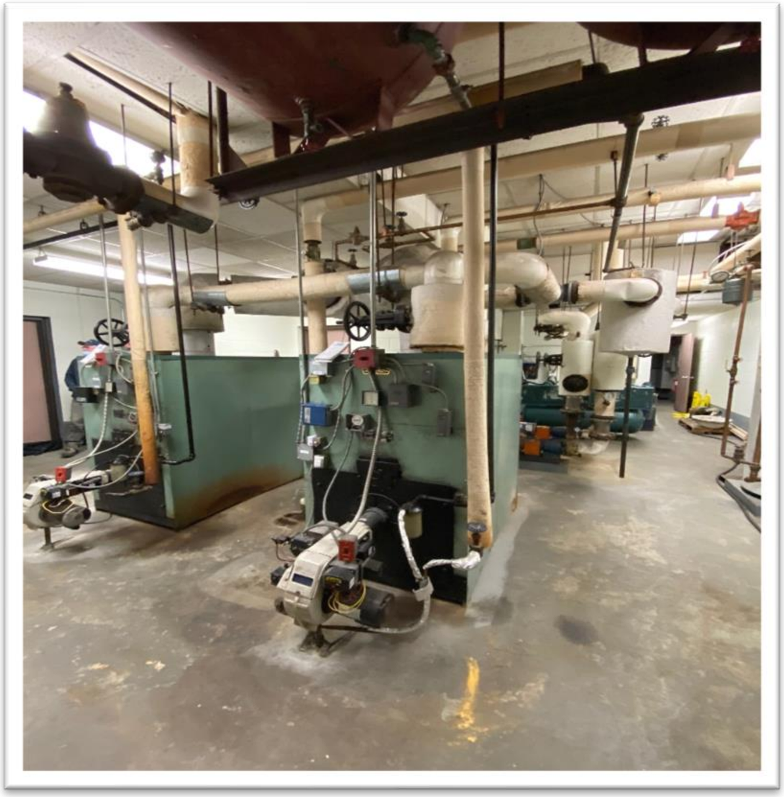


Fig. 4: Existing County Hall oil-fired boilers.

The existing hydronic system also has older pumps that and system components that are of the same vintage as the boiler system. These should also be replaced to take advantage of more efficient components and be designed with new hydronic systems for required flow performances.

Fig. 5: Existing County Hall Pumps.

The existing oiled fired boilers and hydronic equipment should be replaced with a new system. We propose installing a wood chip boiler system with a LP gas boiler for a standby/duty type boiler installation. The LP gas boiler would provide duty functions when the woodchip is down for maintenance/repairs or is out of commission.
Scope of work would include removing the existing oil-fired systems, installing a wood chip system, LP gas boiler, new piping headers, pumps, controls and hydronic components. The new pump and controls upgrade provides better controllability, better efficiencies and the ability for remote access and monitoring.

The wood chip option will guide the facility away from using fossil fuels and use a local fuel source. Wood chips provide the option of utilizing a fuel source that is harvested and developed in the area of Southern New Hampshire.

Fig. 6: Wood chip Harvesting.

Fig. 7: Typical Woodchip Boiler.

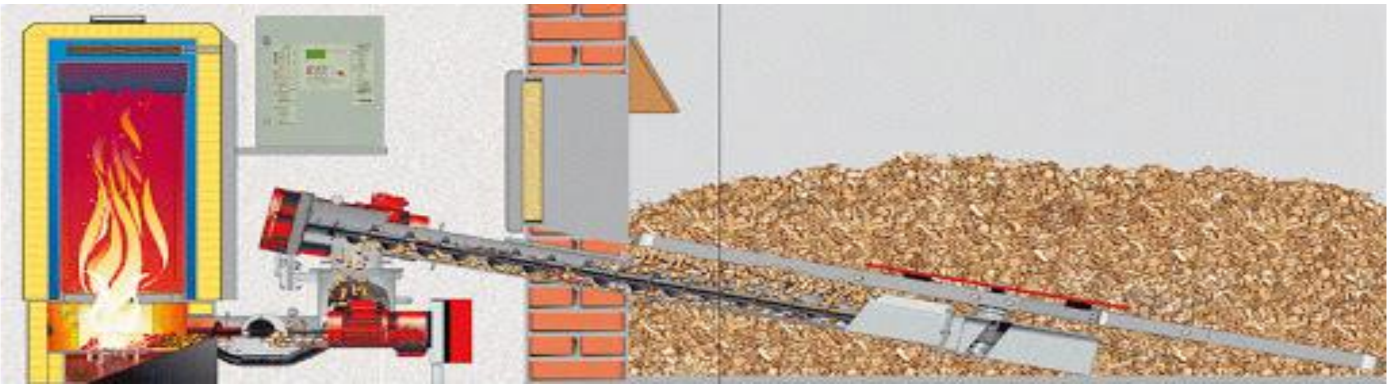


Fig. 8: General wood chip diagram.

The general components for the wood chip plant are the chip storage area, chip conveyor system, burner assembly, gasifier chamber, heat exchanger and the flue venting system. A consolidated heating plant will provide better maintenance access and controllability.

The wood chip installation would be similar to the Maplewood Assisted Living facility.

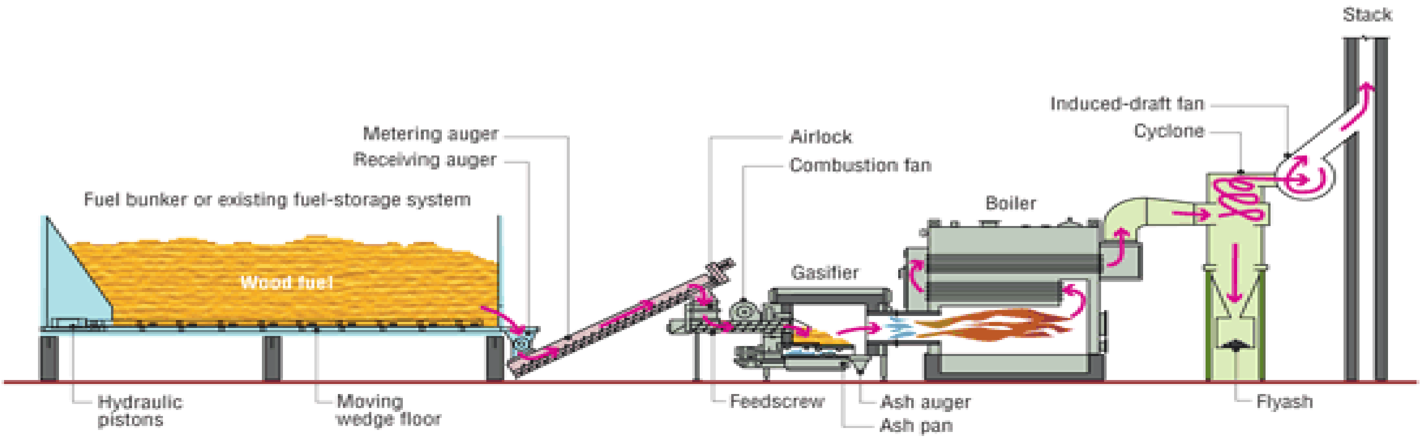


Fig. 9: Wood chip system layout.

ECM 4 - Building LED Lighting

The current lighting system is all florescent with incandescent accent lighting through out the facility. The existing lighting should be upgraded to new LED lighting. This will provide better area lighting and energy savings. We recommend the following upgrades:

Install (261) LED 2x4, 2x2 and 1x4 retrofit fixtures with Space wise controls and dimming

Install (209) LED 4’ wrap fixtures with Space wise control and dimming

Install (76) LED recessed can fixtures

Install (15) LED wall sconce fixtures

Install (16) LED track heads

Install (22) LED pendant fixtures

ECM 5 - VAV BOX Replacements

The existing VAV (Variable Air Volume) boxes at the County Hall were installed in 1978 and earlier. These boxes provide control of space temperature into the space by varying the airflow and heating coil water flow. We recommend installing new DDC controlled boxes with hot water reheat coils to replace the existing VAV boxes. This will provide better controls integration with the new DDC system and interlock controls with the main AHU system.

Fig. 10: Typical VAV Box with Reheat.

ECM 6 - Ceiling Tiles

County Hall has several areas with spline ceiling. This tile a no longer manufactured and should be replaced with new 2x4 drop in Armstrong Ceiling tiles.

Administration Building

ECM 1 - LED Lighting

The existing lighting should be upgraded to new LED lighting. This will provide better area lighting and energy savings. We recommend the following upgrades:

Install (126) LED 2x4 and 2x2 retrofit fixtures with Spacewise controls and dimming

Install (43) LED 4' wrap fixtures with Spacewise control and dimming

Install (7) LED recessed can fixtures

ECM 2 – VRV (Variable Refrigerant Volume) AC System

The HVAC system at the administration system was constructed over multiple renovation periods with a gas boiler and heating system that were installed in the 1970's and a Chiller than was installed in the 1990's for cooling.

There are multiple ventilation units scattered throughout the building. Rather than Replacing this system in kind, EEI proposes to install a Highly efficient VRV heating and cooling system integrated with a heat recovery unit for building ventilation.

Fig. 11: Roof mounted VRV heat pump system.

The VRV heat pump system can provide simultaneous heating and cooling for areas of dissimilar building conditioning loads.

Picture shows problems with the heating system unit on right provides heating. Duct to left provides ventilation and cooling. Building has 2 systems and lacks central control.

Fig. 12: Existing fan coil unit.

We propose using the VRV heat pump system for higher energy efficiencies and a HRU for building fresh air. The new DDC controls would integrate all the mechanical systems into a single Architectural graphics platform and aid in programing efficiencies.

ECM 3 - Building Controls System

A DDC controls system installation is proposed based on Schneider.

1. BACnet compliant DDC controls and associated low voltage interlock wiring for the boiler plant and associated pumps is included. Variable frequency drives serving the heating loop pumps are included. Drives will be nema-1 rated and provided by Franklin Controls.

2. BACnet compliant DDC controls and associated low voltage interlock wiring for twenty (20) four-pipe fan-coil units are included. New space temperature sensors, fan status switches, two-way, two-position control valves are included. Valve installation is included.

3. BACnet compliant DDC controls and associated low voltage interlock wiring for seven (7) zones of standalone baseboard heat is included. New two-way, two-position control valves are included. Valve installation is included.

4. Graphic pages for each system will be added to the existing graphical user interface panel.

5. All work will be performed between the hours of 7am and 3:30 pm.

6. A one-year warranty is included.

Maplewood (Assisted Living Facility)

ECM 1&2 - HVAC Unit Replacements

Maplewood ALF wing includes 5 VAV style roof top units that were installed in 1998. They use R-22 Refrigerant which is no longer manufactured and are just pass there anticipated useful life. These will be replaced in kind.

New Courthouse

ECM 1 - LED Lighting

The existing lighting should be upgraded to new LED lighting. This will provide better area lighting and energy savings. We recommend the following upgrades:

Install (116) LED 2x4 and 2x2 retrofit fixtures with Space-wise control and dimming

Install (59) LED recessed can fixtures

Install (2,167) LED Tubes and (862) LED drivers

Install (20) LED exterior pole fixtures

Install (49) LED floodlight and wall pack fixtures

ECM 2 - Controls

Provide standardization of controls integration and removal of all pneumatic devices and systems. Furnish, install, integrate and commission a new DDC control system for all building HVAC systems.

Cheshire County Corrections

Geothermal Improvements (Heating & cooling)

The existing facility consist of a boiler plant for primary heating, and a geothermal HP (Heat Pump) system that provides cooling and additional system heating. The plant utilizes gas for the boilers and domestic water heating. The system has pumps and hydronic equipment for distributing the chilled and hot water through the facility.

Existing system components.

Existing HP system is composed of:

MANUFACTURER:	(6) Multistack
MODEL #:	MS50Z6H26
BUILDING FLOW:	560 GPM
EWT:	108 F
LWT:	120F *(as specified in design documents for heating)*
Delta-T:	12F
HEATING OUTPUT:	3,360,000 BTUH

Fig. 13: Existing HP skid.

Existing Boiler Heating system is composed of:

MANUFACTURER:	(3) Cleaver Brooks
MODEL #:	CFC-2500
BUILDING FLOW:	900 GPM
EWT:	165 F
LWT:	180 F. *(normal operation)*
HEATING OUTPUT EACH:	2,156,000 BTUH
TOTAL OUTPUT:	6,468,000 BTUH

The existing heat pump skid can produce about 1/2 the heat requirement of the boiler system at a maximum of 120F.

Geothermal Imbalance

The existing operational conditions of the heat pump system for the summer cooling capacity is not being met through the well field. As the summer peak loads increase and a higher summer wet bulb temperature increase, cooling systems begins to fail while the supply chilled water temperatures rise.

This would indicate that the well field is imbalanced with a higher demand for cooling and a small demand for heating. As the chilled water demand increases, the system rejects the heat from the building into the ground causing the ground temperatures to rise over time. This thermal storage builds up making the temperatures less ideal to reject heat as more energy is dissipated into the surrounding earth. The stored high ground temperatures are ideal to extract the heat from the earth back into the building in the heating season and for process loads such as heating domestic water.

Extracting the heat from the geothermal field in the winter helps drop the earth temperature back down closer to the steady state or natural temperature between 50F and 60F. The existing system does not appear to be performing any energy extraction for heating or is not maximizing the potential for heating. This cycle of only injecting heat into the ground will

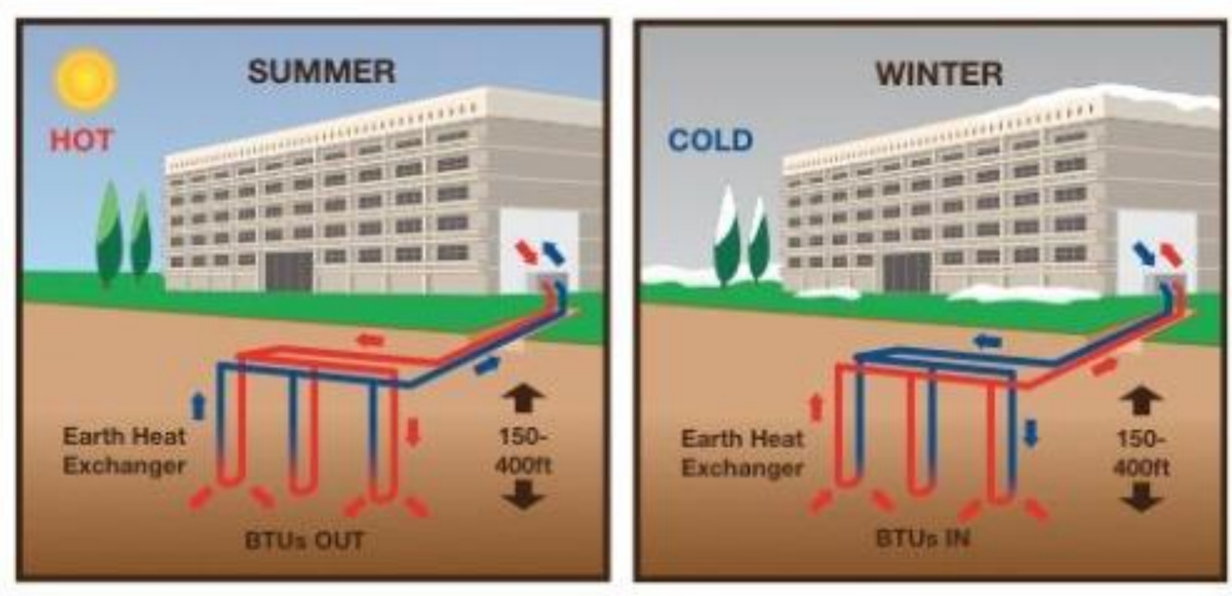


Fig. 14: Geothermal Heat Pump System.

cause the system to become less efficient at cooling and creates additional equipment fatigue. *The heat pump system works harder to reject heat into the system and uses more energy.*
The use of extracting heat out of the ground in the winter will help normalize the geothermal field and prep the ground for cooling the next season by dropping the ground temperatures.

To accomplish field normalization heating loads should be added into to the system for ground heat extraction.

There are 2 practical options for using the HP system for heating at this facility.

1. Preheating the domestic water before the water heaters &
2. Supplementing the boiler system heating

Any use of the geothermal HP system for heating will require a seasonal switch over control point such as outside air temperature. If outside air temperature is below 40 F the geothermal system would switch over to heating. The system only operates in a cooling or heating mode and does not operate in heating/cooling mode simultaneously. Additionally, the system should be controlled not to switch back and forth frequently between heating and cooling in short periods of time as it will be less efficient during these transitions.

ECM 1a - Domestic Water Integration

The domestic hot water is currently heated indirectly by 2 boilers that are dedicated for that purpose. To incorporate the HP cycle into the domestic water system a SHEX (Shell and Tube Heat Exchanger) can be added.
The heat exchanger will require the tubes in the bundle to be double wall due to the glycol and other chemicals in the HP loop. As required by plumbing code.

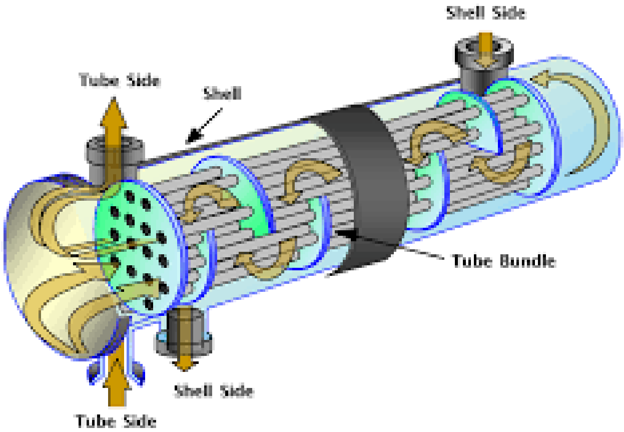


Fig. 15: Shell and Tube Heat Exchanger Diagram.

Installation will require piping, valves and a pump (5hp 460/3/60) on the HP side of the SHEX. The HP side would connect to the shell side of the SHEX and the domestic water would connect to the tube side of the SHEX.

Temperature sensors should be installed on either side of the SHEX bundle to monitor temperature differences.

**During the summer time the domestic water can also be used as a heat sink and potentially add cooling to the HP loop with the incoming 55F domestic water. This would also temper the incoming domestic water and pre-heat it.

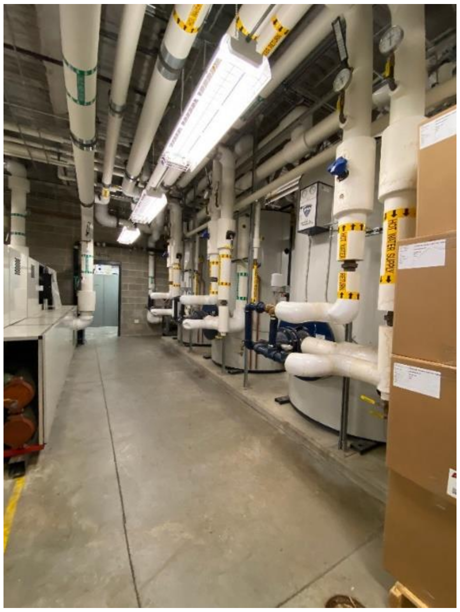


Fig. 16: Domestic water storage system.

ECM 1b – Geothermal System Improvements

The existing HP system only heats the RTU coils and there could be an additional potential to add heat on the heating system. Although the HP system is not able to heat the building under extreme design conditions when 180F supply water temperature is needed, it would be able to heat the building during the shoulder months of the year-Fall & Spring. This could provide heating water (115F) to the building VAV boxes and other unitary devices thus reducing the boiler operation.

The HP integration would incorporate a SHEX to keep the HP glycol solution and the heating water separated. The SHEX would transfer the HP loop heat when the HP system is out of the cooling cycle mode. When the outside air temperatures drop to a point that the HP system is unable to maintain zone temperatures, the Boiler System will take over the heating requirement and the HP system will divert the HP load to other parts of the HP system.

The existing geothermal system contains 35% Propylene Glycol. This helps protect the coils in the RTU's from freezing. Any other connection to this system by non-glycol systems will require separation.

Installation of a heating system integration would comprise of a SHEX, pump (5hp 460/3/60), welded sch-40 piping, valves, gauges, pipe insulation and pipe supports.

<u>Heat Pump Skid</u>

The existing heat pump skid was installed in 2008 and was designed to support the building expansion that did not happen as of this time. The HP system currently serves only 1/3 of the intended load.

During our site observations we did not see the system provide temperatures above 96F while in the heating mode. The system has the potential to reach higher temperatures and 120F temperatures were specified in the original design.   The system either is unable to reach 120F or has been programed only to a set point of 95F.

If the system unable to produce the higher temperatures or is damaged, the heat pump skid should be replaced with a new system providing better efficiencies and control integration.

<u>COOLING TOWER</u>

To aid in the geothermal field cooling we recommend that a small closed circuit cooling tower be installed. This would provide addition well field relief when there is a high demand of cooling during high wet bulb conditions/high humidity events.
The tower is composed of a dry coil to reject heat to the air stream and can be operated in 2 modes. Dry mode where air is pulled through the coil and a wet mode when water is sprayed on to the coil for increased cooling through evaporation.

Fig. 17: Cooling tower.

Pumps will circulate the well field water directly through the tower when loop temperatures cannot be maintained and will bypass the well field. This will allow the well field to relax and balance out or cool down when the rate of heat rejection is higher. A tower will also allow for quicker heat of rejection when systems are in high demand. The tower has the flexibility to operate as a side stream cooler or an independent source to reject heat.

Summary

The outline described above gives options or a combination of options that integrates the existing building heating and domestic hot water generation to the heat pump and geothermal field. With these options selected the Digital Controls should be incorporated and commissioned to maximize operational efficiencies and provide best operational strategies.

The recommended solutions outline above are
1. Add a domestic water heating
2. Connect the HP system in with the boiler system for temperate heating
3. Replace the existing heat pump skid
4. Integrate a closed-circuit cooling tower to the HP loop.

ECM 2 - Building Automation Integration

Integrate the existing KMC Control system into the County wide Schneider Electric graphical user interface currently being installed at Maplewood Nursing Home.

1. Install and commission two Schneider Electric Automation servers to replace the KMC graphical user interface and BAC-5050 router.

2. Create and commission graphical web pages for the 203 existing graphical pages on the KMC system.

3. Develop trend logs and automatic alarm notification for all existing KMC trend logs and alarms.

4. All work will be performed between the hours of 7am and 3:30 pm.

5. A one-year warranty is included.

ECM 3 - LED Lighting

The existing lighting should be upgraded to new LED lighting. This will provide better area lighting and energy savings. We recommend the following upgrades:

Install (116) LED 2x4 and 2x2 retrofit fixtures with Spacewise control and dimming

Install (59) LED recessed can fixtures

Install (2,167) LED Tubes and (862) LED drivers

Install (20) LED exterior pole fixtures

Install (49) LED floodlight and wall pack fixtures

ECM 4 - Walk in Cooler Controls

EEI recommends refrigeration controllers on walk-in coolers and freezers as well as installing electronically commutated (EC) motors on evaporator fans. A controller can start/stop the evaporator fans when operation is unnecessary. The EC motors are 30% more efficient than the standard two-pole motors. Energy savings will be realized by reducing the runtime of the compressors and evaporator fans in addition to the reduction in power load of the new fans. Each walk-in cooler or freezer will have a new EC fan motor and blade installed as well as a dedicated controller. In addition, controllers will be installed on the freezer to optimize the operation of the electric defroster and door heater. The controller unit senses when refrigerant has ceased flowing through the evaporator coil and controls the fan motors. Door and frame heaters are controlled based on dew point, reducing their run time by 95% in coolers and 60% in freezers. The controllers will reduce compressor and evaporator runtime by up to 10%.

Calculations

Energy savings will result from both reducing the fan power and the efficient control of the evaporator fans and door heaters. In general, EEI uses the following approach to determine savings for this specific measure:

Cost of Existing Equipment = Existing kW x Cost per kWh x Existing Effective Full Load Hours

Cost of Proposed Equipment Energy Savings = Existing kW x Cost per kWh x Full Load Hours Using Control

Savings = Existing Equipment Costs- Proposed Equipment Costs

ECM 6 - Transformers

EEI evaluated the electrical systems of the school buildings and determined that the existing transformers at Nashua North High School are standard efficiency models that are not designed to handle the loads of modern facilities.

The most common efficiency for commercial and industrial transformers supplying linear loads in the 30-150 kVA range is 95%, as compared to 98% for a high efficiency model. Further, conventional transformer losses, which are non-linear, increase by 2.7 times when feeding computer loads.

EEI recommends the replacement of existing inefficient transformers in order to improve the energy efficiency of the electrical distribution systems through the replacement of the transformers with new high efficiency units. The scope of work for this measure would include upgrading:

7 Transformers

(5) 75 KVA
(2) 30 KVA