Farnsworth GROUP

Engineers | Architects | Surveyors | Scientists

IGNACIO MIDDLE SCHOOL

Retro-Commissioning Report_DRAFT 2

November 2024

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Scope of Effort

The purpose of this study is to evaluate the facility to:

1. Assess the condition of the major systems in this building.
2. Identify key issues contributing to de-rate and required maintenance of the facility with recommended corrective action.
3. Support Ignacio School District in documenting present and future needs regarding maintenance, repair, capital improvements, and energy conservation opportunities.

Component Priority

1. **SAFETY –** Situations or conditions which pose an immediate danger to life, limb, or property, if the deficiency is not corrected. Matches the Health and Safety Hazard operational criteria used in the CM evaluation scoring process.
2. **DAMAGE/WEAR OUT –** Potential for serious damage to the building or the building components if the deficiency is not corrected. Matches the Disruption Operations (Agency Programs) operational criteria used in the CM evaluation scoring process.
3. **CODES/STANDARDS –** Building codes and/or institutional standards were not met during construction or renovation. Condition may or may not represent an urgent situation if deficiency is not corrected.
4. **ENVIRONMENTAL IMPROVEMENTS –** Correctable deficiencies that will improve system operations and increase the comfort level of the building occupants. Matches the causing damage or deterioration operational criteria used in the CM evaluation scoring process.
5. **ENERGY CONSERVATION –** Amelioration or upgrading of the operating systems to reduce energy consumption or increase energy efficiency in the building.

SYSTEM CONDITION RATING	CONDITION RATING
Acceptable or Needs maintenance: No deficiencies noted or additional routine or minor maintenance needed.	A
Major Maintenance: The recurring need to keep in good repair building systems or components which have known maintenance cycles of greater than one year.	B
Remodel: Reworking of components in a system.	C
Extensive Renovation: Major replacement, alteration, or upgrading of building systems or components that is necessitated by facility obsolescence.	D
Demolition: Unsatisfactory and cannot be renovated; replace system.	F

Executive Summary

Building Condition Assessment (B)

Overall, the facility appears to be in good condition and well maintained. Individual systems were analyzed for deficiencies and potential improvements with an emphasis on reducing maintenance requirements. Individual components of these systems for which repairs or replacements have been recommended are recorded in greater detail in this report.

Each component of the major MEP systems in the middle school was assessed and given an observed condition rating between "A" and "F". The middle school generally exhibits fewer significant issues with respect to the MEP systems. However, it was noted that maintenance access to the heat pumps is inadequate in multiple locations. This may result in inadequate routine maintenance and significant issues in the future.

The mechanical, power distribution, domestic hot water, interior lighting, and snow melt systems were given overall observed condition ratings.

The table below reflects the system conditions observed during the assessment.

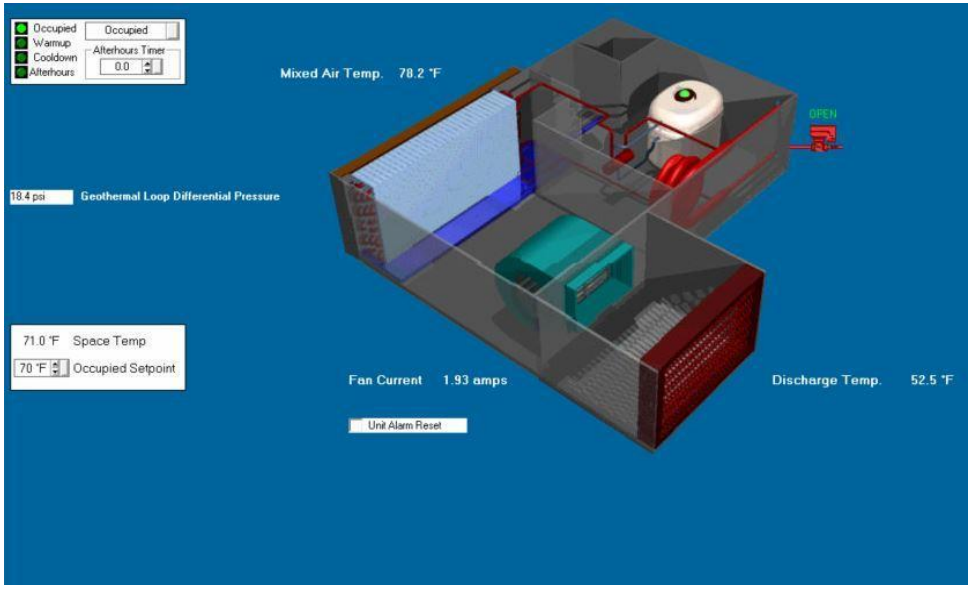
BUILDING	SYSTEM NAME	DISCIPLINE	OBSERVED CONDITION	SYSTEM CONDITION GRADE
Middle School	Interior Lighting	Electrical	Good	A-
Middle School	Power Distribution	Electrical	Good	A-
Middle School	Fluid Cooler	Mechanical	Fair	C+
Middle School	Heat Pumps	Mechanical	Good	B+
Middle School	Heating Hot Water System	Mechanical	Good	B+
Middle School	Kitchen Air Systems	Mechanical	Fair	C-
Middle School	Snow Melt	Mechanical	Good	B-
Middle School	Domestic Hot Water	Plumbing	Good	A
Middle School	DDC_Direct Digital Controls	Controls	Good	B-

Executive Summary (continued)

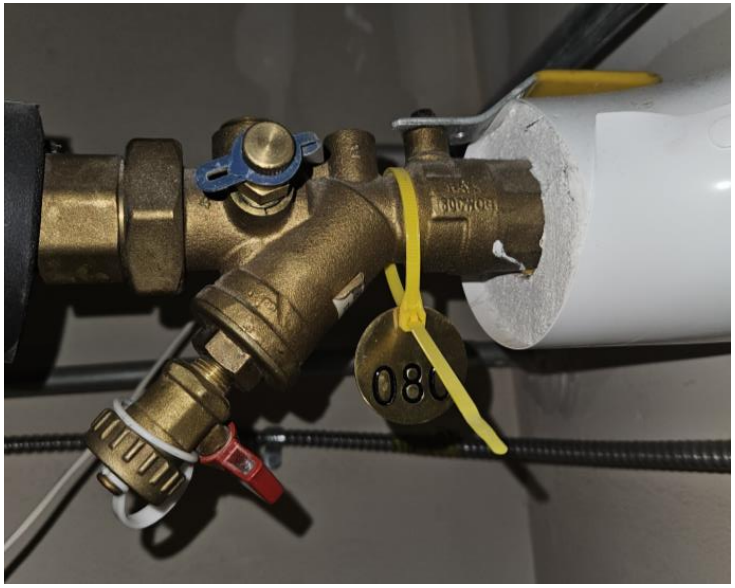
High Priority Recommendations

High priority recommendations pertaining to the Middle School building recorded include the following:

- Replace defective or removed heat pump control valves with Belimo control valves and actuators
- Replace specified heat pump autoflow valve orifices to meet recommend flow rates as indicated in Appendix A. Existing distribution pumps are sufficient to accommodate recommended increased flow rates through heat pumps.
- Clean all strainers in the hydronic system twice per year.
- Implement occupied/unoccupied building schedule in BAS ERVs. Eliminate night setbacks of space temperature setpoints.
- Add position points for all hydronic heating and cooling 3-way valves on the heating hot water system graphic
- Add fan and compressor failure/alarm points to all heat pump graphics for diagnostics
- Distribution pumps are in alarm. Recommend controls contractor investigate and clear alarms.
- Secondary pumps operate in parallel. Recommend re-sequencing to configure pumps to operate in a lead/lag configuration.



Typical Heat Pump graphic



Typical strainer – clean out twice per year

Building Description

Building Overview

The assessed building is a middle school that consists of a gymnasium, locker rooms, classrooms, office space, classrooms, and restrooms. The building is approximately 48,000 square feet. The building was constructed originally in 2012.

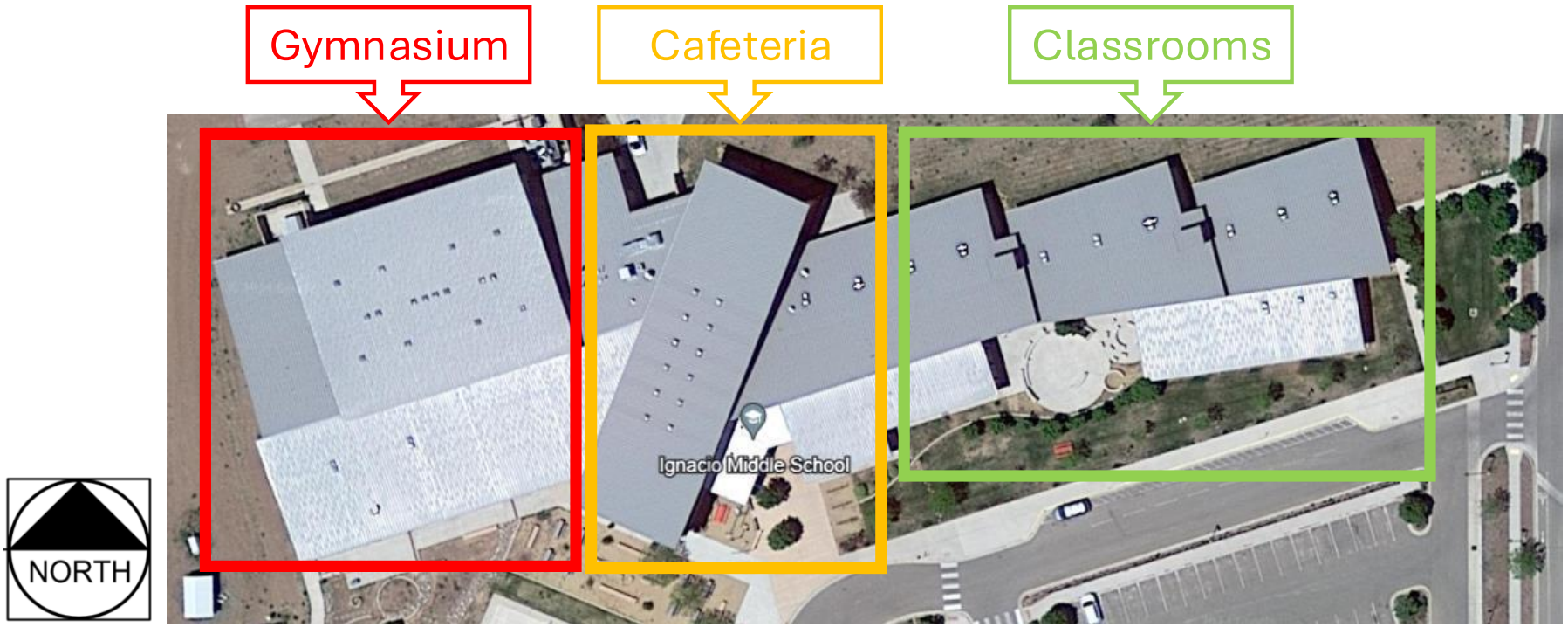
The school has three distinct areas. The west area consists of the gymnasium. Immediately east of the auxiliary gym area is the cafeteria. The easternmost area of the building consists of classrooms.

The HVAC system is a water-source heat pump system served by two natural gas-fired boilers and an evaporative fluid cooler.

The electrical distribution system consists of 1 utility transformer, which feeds a 2,500 Amp service entry switchboard. From there the power steps down through interior transformers to various panels for use throughout the building.

The domestic hot water system is served by two gas-fired hot water heaters and two circulating pump.

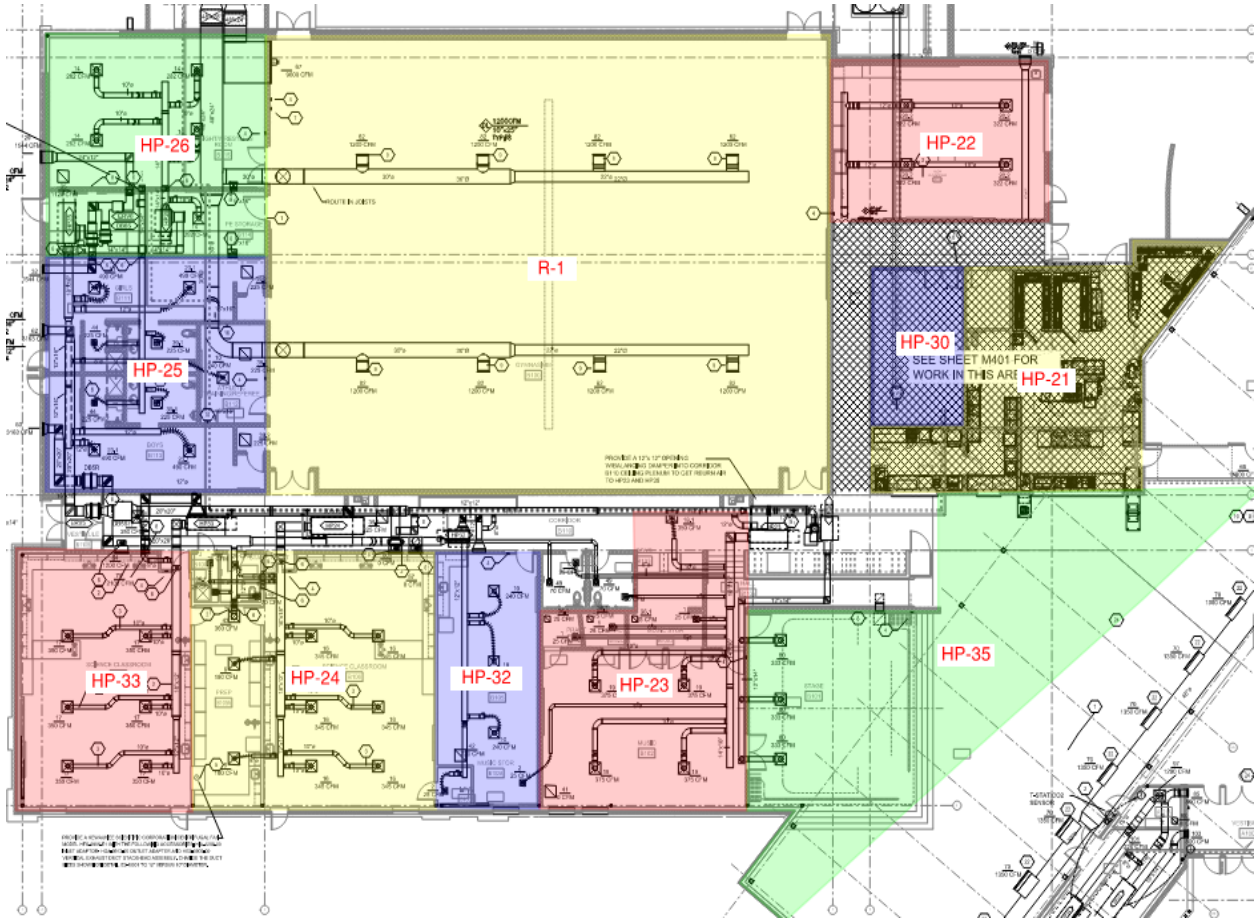
There are two snow melt systems which tie into the heating hot water system.

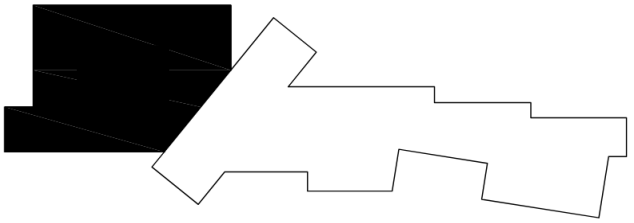


HVAC Zoning Plans

Zoning Plans

The following plans reflect the existing HVAC zones labelled with the heat pumps serving each zone. These plans are intended to be a reference for the maintenance team. This zoning plan reflects the gymnasium area and surrounding spaces.

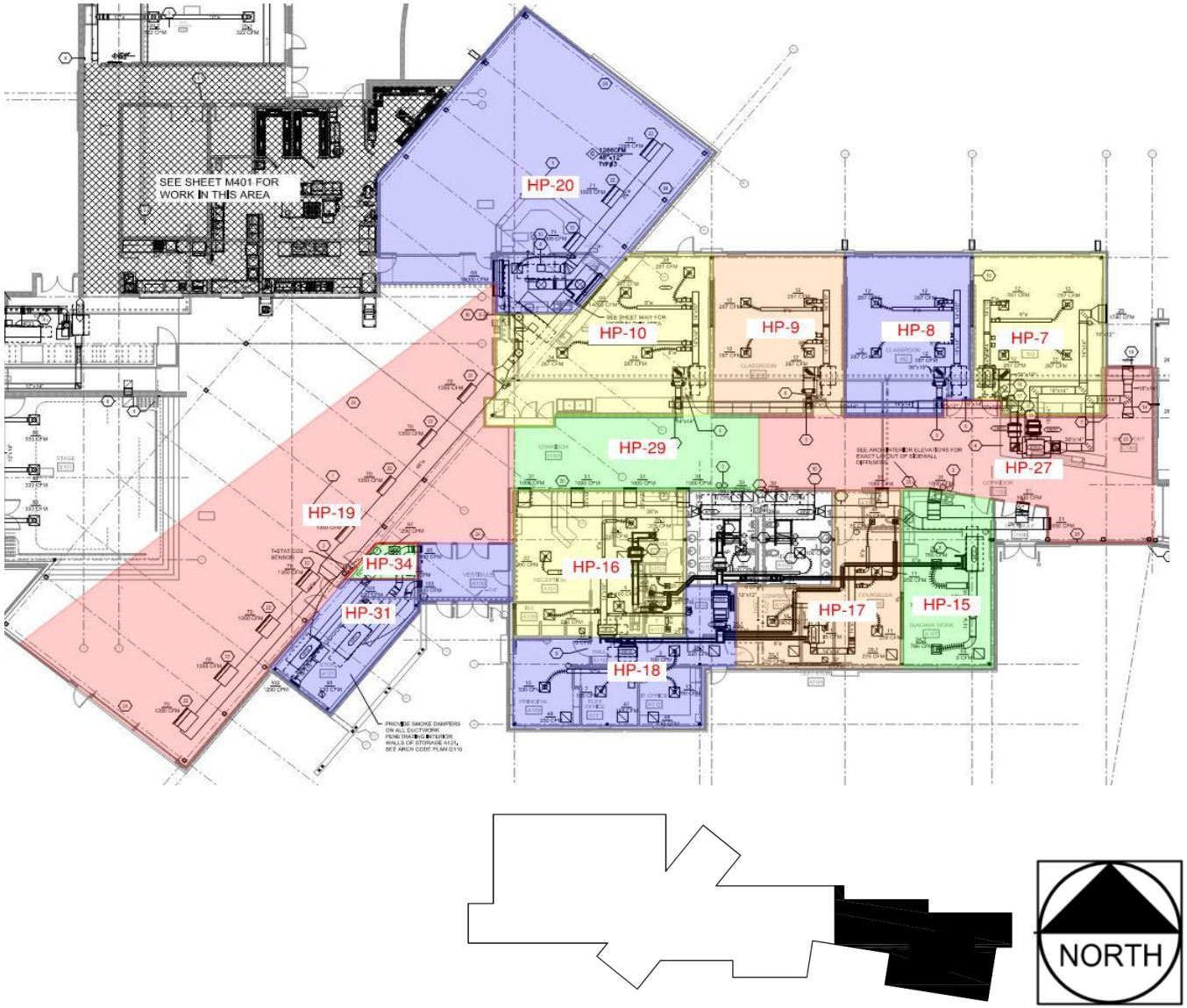




HVAC Zoning Plans

Zoning Plans

The following plans reflect the existing HVAC zones labelled with the heat pumps serving each zone. These plans are intended to be a reference for the maintenance team. This zoning plan reflects the cafeteria area and surrounding spaces.



HVAC Zoning Plans

Zoning Plans

The following plans reflect the existing HVAC zones labelled with the heat pumps serving each zone. These plans are intended to be a reference for the maintenance team. This zoning plan reflects the easternmost classrooms and corridor.

HVAC DDC System Assessment

Overall Condition: Good (B-)

The DDC system reflects the ERV's, heat pumps, heating hot water plant, fluid cooler, and multiple exhaust fans. The DDC system is dated, but functional. The control points are linked and operational. The kitchen makeup air and exhaust systems are missing from the BAS graphics. The BAS does not reflectdata from the plumbing or electrical systems.

System Expandability:

We recommend that the kitchen exhaust/makeup air system and space pressurization be added to the BAS graphics.

Recommended Replacement/Capital Improvement:

The heat pumps a controlled in a "daisy-chain" fashion. This leaves the heat pumps vulnerable to a global failure upon failure of one "master" heat pump. We recommend wiring a redundant controls wire to the last heat loop in the chain to decrease chances of a global failure.

Recommended Repairs:

Kitchen exhaust fans are not on the kitchen MAU graphics. Recommend adding kitchen hood exhaust fan and dishwasher exhaust fans to the MAU graphics for ease of use. Slab temperature is not on the snow melt BAS graphics. Recommend adding slab temperature point. We recommend that the snow-melt pump status alarm be added to the BAS graphics to notify the maintenance team. This will allow for the maintenance team to be notified if the slab temperature sensor is not calling for snow melt system enable during a snow event.

Energy Conservation Opportunity:

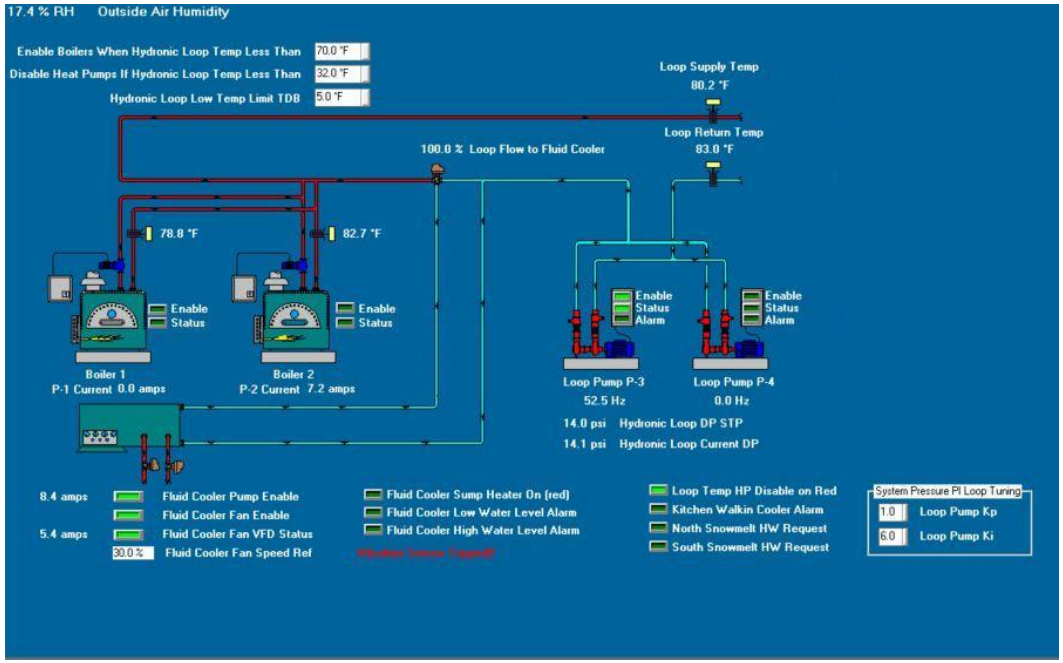
Unoccupied mode is not typically enabled during unoccupied hours. Recommend implementing unoccupied mode for all ERVs. Ventilation is not required during occupied hours. Eliminating all night setbacks with the space temperature setpoints will reduce energy consumption during morning warmup and allow for stable operations. Aggressive night setbacks can be counterproductive to energy savings as more energy is required to heat the building back up to occupied temperatures than what was saved overnight through setbacks of the space temperature.

NAME	DESCRIPTION	ASSET	PRIORITY	STATUS
CHK-21-3	MS - The snow melt graphic does not reflect slab temperature. Recommend adding slab temperature point to graphic.	DDC_Digital Direct Controls	Codes/Standards	Maintenance
CHK-24-3	Recommend adding kitchen range hood exhaust fan and dishwasher exhaust fans to the MAU graphic.	DDC_Digital Direct Controls	Codes/Standards	Replacement/Capital Improvement
CHK-23-3	MS - Fluid Cooler - The BAS graphic reflects a constant vibration alarm. Recommend further investigation into alarm.	DDC_Digital Direct Controls	Damage/Wear Out	Maintenance
CHK-25-7	MS ERVs - Fan status is reflected on the graphics as an amperage. Recommend on/off status for clarity.	DDC_Digital Direct Controls	Codes/Standards	Repair

HVAC DDC System Assessment

NAME	DESCRIPTION	ASSET	PRIORITY	STATUS
CHK-2-3	Building pressure setpoint is not on graphics. Recommend adding setpoint on new exhauster graphic page.	DDC_Digital Direct Controls	Codes/Standards	Repair
CHK-25-6	Middle School - ERVs are not on an occupancy schedule. Recommend enacting unoccupied setback schedule for ERV's to conserve energy.	DDC_Digital Direct Controls	Energy Conservation	Repair
CHK-31-4	Middle School - R-1: economizer operation does not appear to be implemented. OAT was 60deg and OA damper was at 0% open. Min damper position is set to 0%. Economizer is a means for energy savings. Correcting the programming and operation of the economizer damper will improve energy usage.	DDC_Digital Direct Controls	Energy Conservation	Repair
CHK-31-3	Middle School - R-1: Demand control ventilation does not appear to be implemented. Space CO2 is present and reading correctly but unit did not react to Increase in CO2. Programming needs to be corrected to incorporate demand control ventilation.	DDC_Digital Direct Controls	Energy Conservation	Repair
CHK-31-2	Middle School - R-1: Unit was in occupied mode however RA damper was at 100%, OA dampers closed. Not making ventilation requirements or utilizing economizer. There is an opportunity for energy savings.	DDC_Digital Direct Controls	Energy Conservation	Repair
CHK-2-4	Implement unoccupied schedule for all HVAC equipment, including ERV's and heat pumps. Unoccupied space temperature septoints should be set to +-3 degrees F deviation from occupied space temperature setpoints.	DDC_Digital Direct Controls	Energy Conservation Opportunity	Repair

Heating Hot Water and Fluid Cooler System Assessment



Overall Condition: Fair (B+)

The heating hot water plant is located in the mechanical space adjacent to the kitchen in the northwest corner of the building. It consists of two 3500 MBH condensing, gas-fired boilers with in-line boiler pumps. Two base-mounted pumps provide heating and cooling water distribution to water source heat pumps. A 210-ton evaporative fluid cooler provides cooling and ties into the distribution system via a three-way valve.

System Expandability:

Pump speed may exceed 60 hz if overall flow to heat pumps is increased. The existing pumps will accommodate the increased flow rate through the heat pumps recommended in the Appendix of this document.

Recommended Replacement/Capital Improvement:

A scheme check was performed on the heating water and distribution system against drawings provided by Mechanical, Electrical, & Environmental Engineering Inc. dated 12/9/2013. No pressure/temperature ports are installed within the mechanical space. Recommend installing p/t ports at locations provided in design drawings.

Heating Hot Water and Fluid Cooler System Assessment

Recommended Maintenance and Repairs:

Propylene glycol must be refilled frequently, but no apparent leak was found in the system. It is suspected that the snow melt system is leaking, but no leak was found during the assessment. We recommend recording the frequency of snow melt glycol refills to determine if leak exists in the snow melt piping or within the heating hot water distribution piping.

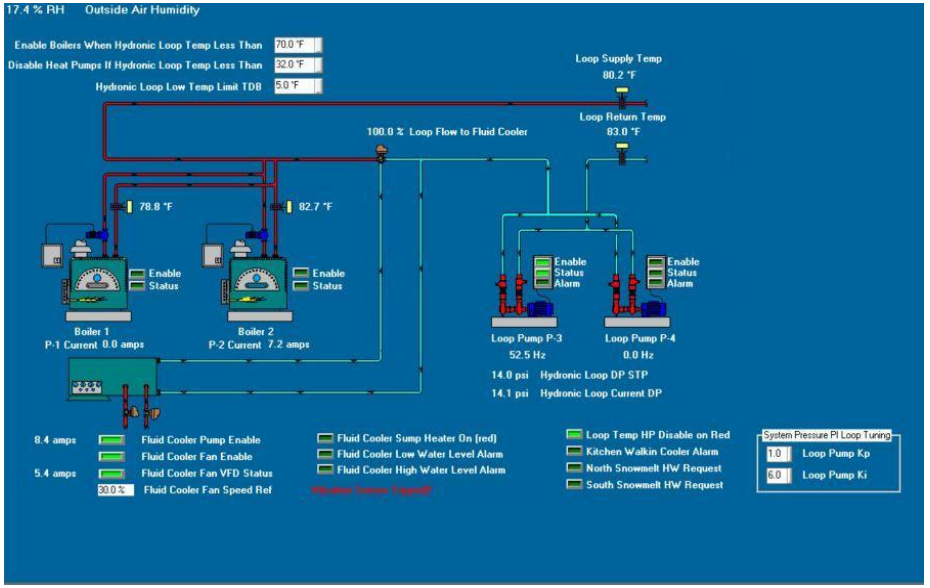
Maintain routine boiler inspection schedule provided by manufacturer, check pump belt tensions/alignment, provide pump belt replacement schedule for distribution pumps.

Fluid cooler failed on 7/9/2024 due to an apparent electrical overload. A contactor was replaced and the fluid cooler is functional. This issue has since been resolved by the maintenance team.

Regularly inspect fluid cooler for water clarity and cleanliness, fan alignment, and spray pump operation.

Energy Conservation Opportunities:

It is recommended that the sequence of operation for the pumps be adjusted to a lead/standby configuration to provide redundancy and energy savings.



EQUIPMENT NAME	SYSTEM	DISCIPLINE	OBSERVED CONDITION	YEAR INSTALLED
MS-B1	Heating Hot Water System	Mechanical	Good	2014
MS-B2	Heating Hot Water System	Mechanical	Good	2014
MS-FC	Fluid Cooling System	Mechanical	Fair	2014
MS-P1	Heating Hot Water System	Mechanical	Good	2014
MS-P2	Heating Hot Water System	Mechanical	Good	2014
MS-P3	Heating Hot Water System	Mechanical	Good	2014
MS-P4	Heating Hot Water System	Mechanical	Good	2014

Heat Pump System Assessment

Overall Condition: B+

The main source for heating and cooling in the high school is handled by 37 water source heat pumps. The heating hot water system and fluid cooler system temper the building loop water that is distributed to each water source heat pump.

The heat pumps are the ClimateMaster Tranquility series water to air heat pumps that include two stage scroll compressors, ECM variable fan motors, and microprocessor controls. Each heat pump maintains the room temperature at each room mounted thermostat by cycling the compressors and control valve. Heat pumps R-1 is a Tranquility Rooftop unit that includes an economizer section that serves the gymnasium.

A diagrammatic scheme check was performed on more than 25% of the heat pumps as a sample size. The heat pump installations were reviewed against drawings provided by Mechanical, Electrical, & Environmental Engineering Inc. dated 12/9/2013. Several heat pumps that were problematic as identified by the O&M staff were also a focus during the on-site assessment. The equipment conditions were reviewed, known issues documented, and installation conditions reviewed as part of the assessment. The following is a summary and includes recommendations for improvements.

Recommended Maintenance:

Maintain routine filter changes, clean strainers as necessary, and routinely check amperage draws of compressor and fans for all heat pumps.

Recommended Repair:

OA dampers on R1 was not operational in economizer or minimum ventilation. Recommend temperature controls contractor correct OA damper modulation for minimum operation and during economizer events.

Energy Conservation Opportunities:

Correcting the economizer damper operation of the gym units will provide energy savings.

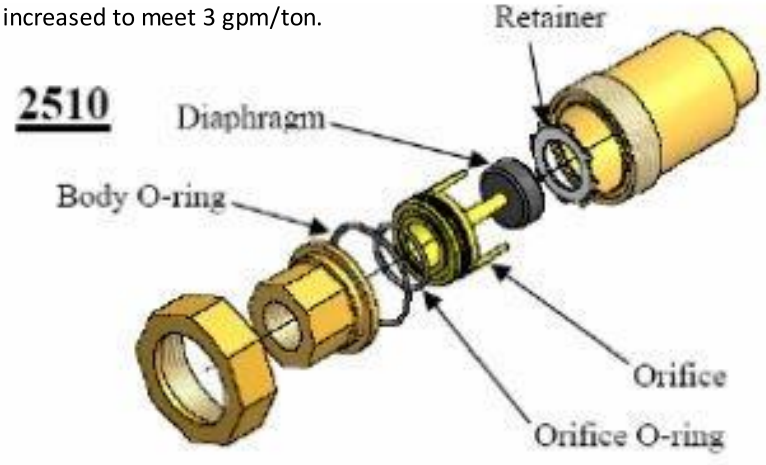
Recommended Replacement/Capital Improvement:

Access to the heat pumps above ceiling is difficult. Many are located above 4'x4' access panels. These panels are heavy and difficult for O&M staff to remove. After review of the original Code Study drawings, no fire rating of the panels is required. These panels should be replaced with a lighter weight material to improve access for maintenance staff.

HP-34 and 31 that serve the IT/MDF room and Vestibule, respectively have incorrectly sized autoflow valves. The autoflow valve for HP 31 was installed on HP 34. The O&M staff have reported issues with HP34 maintaining space temperature requirements in the MDF room. Replacing the flow cartridge for HP-34 with a 9-gpm cartridge will improve operation and reliability of HP-34.

The scheduled flow rate for the heat pumps appears to be based on the calculated cooling capacity. The installed heat pump in most cases is a nominal size larger than the calculated capacity. Many of the heat pump flow rates are less than the optimal 3 gpm/ton. Increasing the flow rate to each individual heat pump will improve reliability, function, and equipment durability.

See figure below. The flow to each heat pump is limited by a Hays autoflow valve. The diaphragm and orifice are set from the factory to the designated flow rate. To increase the flow output of each valve the diaphragm and orifice can be replaced by a new factory set cartridge at the higher flow rate. Farnsworth Group recommends increasing the flow rate to heat pumps that are less than 2 gpm/ton. The system operates with far less issues than the elementary school and high school. Replacing all flow cartridges across the entire school is not recommended. The units that are currently operating at less than 2 gpm/ton are highlighted in Appendix A. The flow cartridges in these units are recommended to be increased to meet 3 gpm/ton.



Kitchen Ventilation and Exhaust System Assessment

Overall Condition: Fair (C-)

The kitchen hood fan and the make-up air unit are interlocked and enable upon enabling of the gas range in the kitchen. The exhaust fan VFD increases the fan speed when additional burners enable.

Recommended Maintenance and Repair:

Maintain routine filter changes, check belt tensions/alignment, routine cleaning of grease hood and ductwork.

Kitchen exhaust and makeup air system is not displayed or operated through the graphical user interface. Recommend integrating kitchen controls with BAS for operability by maintenance team.

Kitchen pressurization was tested with a manometer. Kitchen exhaust and ventilation air system produce a net positive pressurization of the kitchen if fewer than four gas range burners are on. Recommend re-sequencing exhaust fan to operate at 100% capacity any time range is enabled.

Recommended Replacement/Capital Improvement:

Kitchen MAU is in fair condition. Reznor MAU specified in 2013 design drawings was never installed. Recommend replacing MAU within ten years.

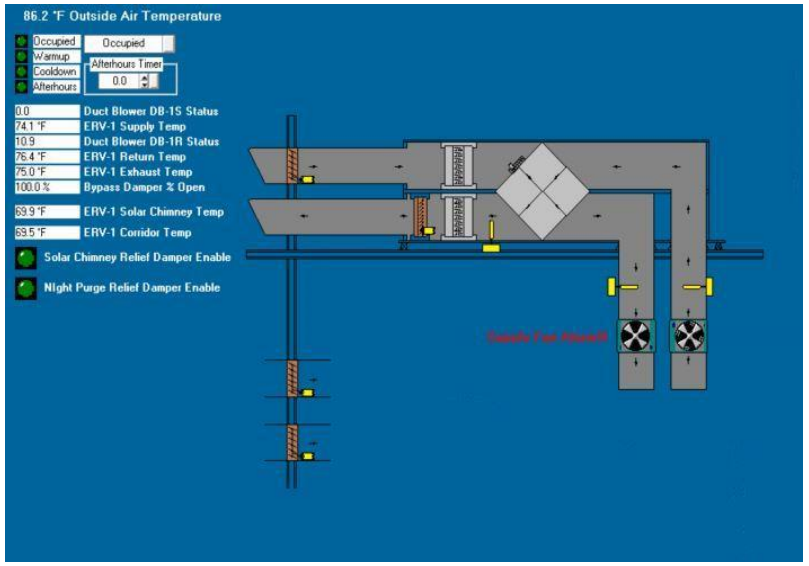
Design makeup air ventilation rate is 3900 cfm, design exhaust flow is ~4100 cfm. Actual exhaust airflow reading is ~2000 cfm, creating positive pressure in space. Hood exhaust increases as additional burners enable, but makeup airflow is relatively constant. Recommend sequencing kitchen hood exhaust fan to enable at 100% with the enabling of any range burner to avoid positive pressurization of kitchen while cooking.

EQUIPMENT NAME	SYSTEM	DISCIPLINE	OBSERVED CONDITION
MS-MAU	HVAC_Kitchen Air Systems	Mechanical	Fair
MS-K1	HVAC_Kitchen Air Systems	Mechanical	Good
MS-K2	HVAC_Kitchen Air Systems	Mechanical	Good

Energy Recovery Ventilator System Assessment

Overall Condition: Fair (B-)

The energy recovery ventilators provide ventilation air to the distributed water to air heat pumps throughout the school. There are seven (7) ERVs with aluminum flat plate heat exchangers, motorized dampers and supply and exhaust fans.



System Expandability:

Limited with current sizing of fans and ductwork.

Recommended Maintenance:

Maintain routine filter changes, check belt tensions/alignment, implement routine cleaning of cotton build-up on intakes, set OA minimums. Access is a problem to most equipment, causing filter replacements to be labor intensive. Recommend replacing the ERV filters more frequently to lesson filter loading on HPs downstream. Many of the supply fan and exhaust fans were in alarm due to difficult access.

Recommended Repair:

A rebalance of ERV is recommended to ensure minimum outside air requirements are being met.

Recommended Replacement/Capital Improvement:

The supply and exhaust fan motors are belt driven without a soft start. The O&M staff replace belts often. Recommend providing VFDs for supply and exhaust fans for a soft start function and for future air balancing.

Energy Conservation Opportunities:

The ERVs were not on an occupancy schedule and appear to operate 24/7. Recommend putting ERVs on a schedule to disable during unoccupied hours. This will result in fan energy savings.

EQUIPMENT NAME	SYSTEM	DISCIPLINE	OBSERVED CONDITION
MS-ERV-1	HVAC Air Systems	Mechanical	Fair
MS-ERV-2	HVAC Air Systems	Mechanical	Fair
MS-ERV-3	HVAC Air Systems	Mechanical	Fair
MS-ERV-4	HVAC Air Systems	Mechanical	Fair
MS-ERV-5	HVAC Air Systems	Mechanical	Fair
MS- ERV-6	HVAC Air Systems	Mechanical	Fair
MS-ERV-7	HVAC Air Systems	Mechanical	Fair

Domestic Hot Water System Assessment

Overall Condition: Fair (A)

The domestic hot water (DHW) system consists of (2) 200 kbtu/h 97% efficient gas fired water heater with 100 gallons of storage each, installed in 2014. The DHW has Point-Of-Use thermostatic mixing valves set at 105 deg F for non-kitchen plumbing fixtures, cold water at 50 deg F and hot water at 120 deg F. Recirculation of the 120 deg F and 105 deg F system is accomplished through a DHW circulator controlled by an aquastat.
Note: distribution system is provided with Circuit Setters through-out.

Recommended Repair:
N/A

EQUIPMENT NAME	SYSTEM	DISCIPLINE	OBSERVED CONDITION	YEAR INSTALLED
HS-WH1	Domestic Hot Water	Plumbing	Good	2014
HS-WH2	Domestic Hot Water	Plumbing	Good	2014
HS-RP	Domestic Hot Water	Plumbing	Good	2014

Snow Melt System Assessment

Overall Condition: Good (B-)

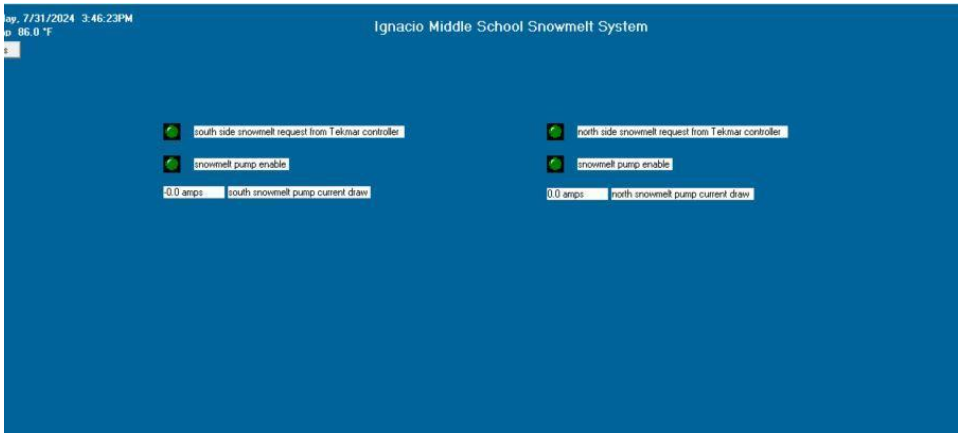
There is one snow melt systems in the building; one which serves the east entrance and one which serves the south entrance. The snow melt system consists of two (2) 1/8 hp pumps, a flat plate heat exchanger, a glycol feeder, an expansion tank, and piping accessories. The snow melt piping manifolds are downstream of the in-line pumps. The supply and return piping is tied into the heating hot water mains. The snow melt temperature sensors are located within the concrete slab and enable the snow melt systems when the slab temperature is below 35 deg F.

Recommended Maintenance:

Periodic inspection of glycol levels within the glycol feeder tanks will mitigate reduction in glycol within the heating hot water system. The frequent refilling of the main glycol feeder on the heating hot water system may be due to a glycol leak within the snow melt system.

Recommended Repair:

Snow melt system enable slab sensor is located under the roof overhang. We recommend moving the sensor out from under the overhang such that it enables during snow events without intervention by the maintenance team.



Snow-melt graphics – points noted, no display.

Snow-melt temperature sensor installed under roof overhang.

Electrical Distribution and Lighting System Assessment

Overall Condition: Good (A-)

The electrical distribution system has a utility transformer, that feeds a 2,500 Amp service entry switchboard. The voltage of the switchboard is 480Y277V. The 480/277V services larger mechanical and plumbing systems and the general lighting loads. The distribution system also uses 480V-208Y/120V step down transformers, feeding multiple interior panels. The 208V panels are used for the small mechanical and plumbing loads, task lighting and receptacle loads.

System expandability:

There is approximately 500 amps of load which may be served by a future photovoltaic array.

Recommended Maintenance:

We recommend that the electrical panels be thermally scanned and that all feeders be re-torqued.

Perform routine electrical maintenance on all disconnects check movement of disconnects as lubricate/exercise as needed, tighten all conductors which land on lugs - entering and exiting the disconnects.

Test batteries of all interior and exterior emergency fixtures.

Recommended Replacement/Capital Improvement:

Add a surge protection device to protect the building from outages during severe lighting storms.

Recommended Repair:

In classroom B124 Tech, there is no exit sign over the exterior door number 12.

Identified Deficiencies

NAME	DESCRIPTION	ASSET	SYSTEM(S)	BUILDING	PRIORITY	STATUS
CHK-23-2	On 7/09/2024, the fluid cooler disabled due to an apparent overload. Circuitry requires replacement.	MS-FC	HVAC_Condenser Water System_MS	Ignacio Middle School	Environmental Improvements	Repair
CHK-21-2	No Manual air vents noted in mechanical space for HHW system. Recommend addition of manual air vents in high points of piping per heating hot water diagram.	HVAC_Heating Hot Water System_MS	HVAC_Heating Hot Water System_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-23-1	No manual air vents installed for fluid cooler plant. Recommend installation of manual air vents at high point in piping.	Ignacio Middle School	HVAC_Heating Hot Water System_MS	Ignacio Middle School	Damage/Wear Out	Replacement/ Capital Improvement
CHK-24-2	Scheduled Reznor MAU never installed. Greasemaster MAU installed is in fair condition and operable. Recommend replacement of MAU and interlocking with kitchen hood within 10 years.	MS-MAU	HVAC_Kitchen Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Replacement/ Capital Improvement
CHK-24-1	Design makeup air ventilation rate is 3900 cfm, design exhaust flow is ~4100 cfm. Actual exhaust airflow reading is ~2000 cfm, creating positive pressure in space. Hood exhaust increases as additional burners enable, but makeup airflow is relatively constant. Recommend sequencing kitchen hood exhaust fan to enable at 100% with the enabling of any range burner to avoid positive pressurization of kitchen while cooking.	HVAC_Kitchen Air Systems_MS	HVAC_Kitchen Air Systems_MS	Ignacio Middle School	Environmental Improvements	Repair

Identified Deficiencies

NAME	DESCRIPTION	ASSET	SYSTEM(S)	BUILDING	PRIORITY	STATUS
CHK-21-1	As reported by maintenance staff, glycol must be refilled frequently. There is a potential leak in snow melt system	HVAC_Heating Hot Water System_MS	HVAC_Heating Hot Water System_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-25-6	Middle School - ERVs are not on an occupancy schedule. Recommend enacting unoccupied setback schedule for ERV's to conserve energy	DDC_Digital Direct Controls		Ignacio Middle School	Energy Conservation	Repair
CHK-31-5	HP-29 is not responding, needs repair or board replacement	MS-HP29	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-25-5	ERV-7: Ef is in alarm	MS-ERV-7	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-25-4	ERV-6: SF and EF are in alarm	MS-ERV-6	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-25-3	ERV-1 supply fan is in alarm	MS-ERV-1	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-25-2	ERV-5: supply fan and exhaust fan were in alarm	MS-ERV-5	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Repair
CHK-31-1	MS - HP-34 and 31 auto flow valve sizes are switched. 34 is a 2.5-ton unit with a 5-gpm auto flow valve. 31 is a 1-ton unit with a 6-gpm valve. Recommend upsizing the autoflow valve for HP-34 to a 9-gpm autoflow valve.	MS-HP34	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Replacement/ Capital Improvement
CHK-25-1	Filters in ERVs are difficult to access	HVAC_Air Systems_MS	HVAC_Air Systems_MS	Ignacio Middle School	Damage/Wear Out	Maintenance

Energy Consumption Summary

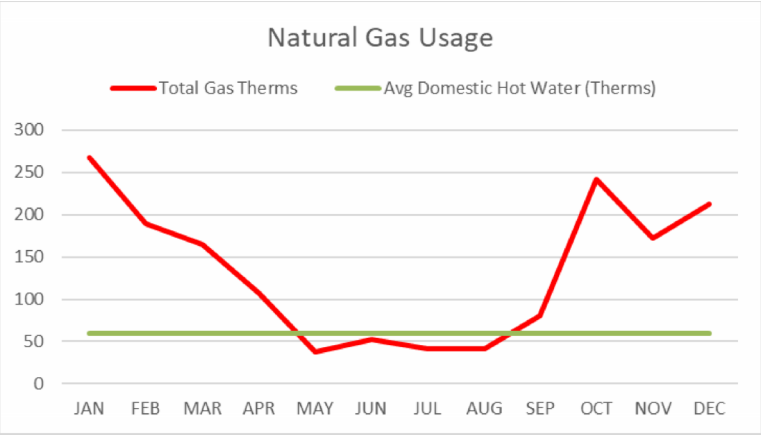
Energy Consumption Grade: A

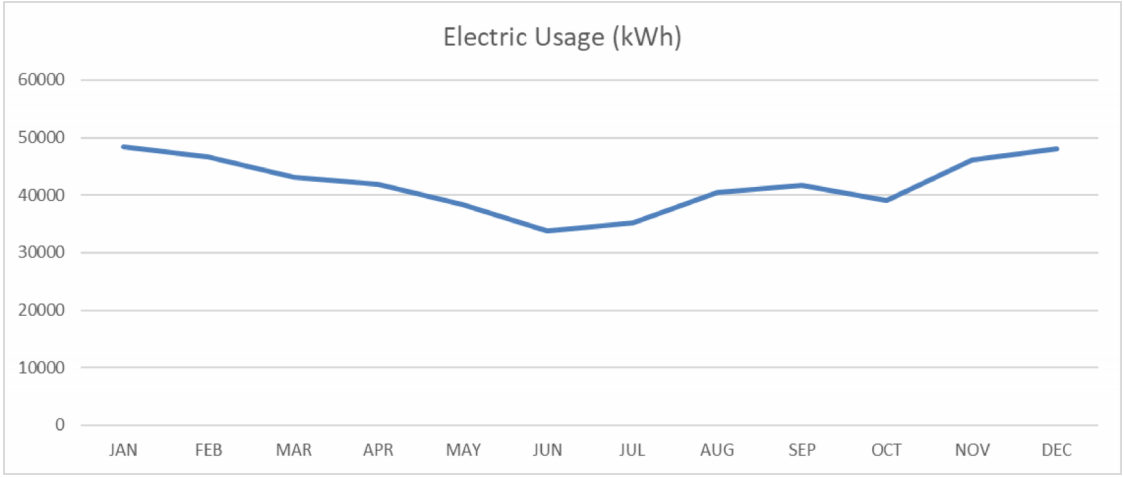
Overall energy consumption at the MS exceeds expectations, with a site EUI of approximately 39 kbtu/sf/yr over the last (2) 12-month periods. A typical similar school could be expected to have a site EUI of 59 kbtu/sf/yr according to Energy Star. Overall energy cost at this facility is slightly better than average at $1.15/sf/yr over the last two years.

The average electric purchase rate over the last three years is $0.1085/kWh, which meets expectations. Electricity is steadily trending more expensive with the last 12 months: averaging $0.107/kWh. We recommend projecting a blended rate of $0.115/kWh, with a 3% per year escalation. Electricity consumption peaks in the winter and is lower in the summer months when school is not in session. This is a typical trend for electricity consumption within a school.

The average gas rate over the last three years is $1.13/therm, though for the last 12 months the rate has been trending downward. Since September of last year, the cost of natural gas has averaged $0.76/therm. Our observations have been that gas prices have been falling precipitously across multiple markets. Conservatively, we recommend projecting a natural gas purchase rate of $0.925/therm. Natural gas only consists of approximately 9% of the annual energy consumption and 3% of the annual energy cost in the middle school.

	IGNACIO MIDDLE SCHOOL BUILDING	BENCHMARK FACILITY
Natural Gas Usage (kBtu/Year)	161,132	1,339,983
Natural Gas Cost ($/Year)	$1,817	$15,111
Natural Gas EUI (kBtu/SF/Year)	3	28
Natural Gas ECI ($/SF/Year)	$0.04	$0.31
Natural Gas blended rate ($/therm)	$1.1277	-
Electric Usage (kBtu/Year)	1,715,099	1,504,991
Electric Cost ($/Year)	$53,679	$47,089
Electrical EUI (kBtu/SF/Year)	36	31.3
Electrical ECI ($/SF/Year)	$1.12	$0.98
Electrical blended rate ($/kwh)	$0.1068	-
Combined EUI (kBtu/SF/Year)	39	59
Combined Energy Cost	$55,496	$62,200
Combined ECI ($/SF/Year)	$1.15	$1.29





Appendix

Recommended Heat Pump Flow Rates

The following table reflects the designed flow rates through the heat pumps and the increased flow rates recommended by FGI. Therecommended flow rate is approximately 3 gpm/ton of cooling.

Unit	Model	Installed Model	Installed Cooling MBH	Installed Nominal Tonnage	Installed GPM/Ton	Design Cooling MBH	Design Nominal Tonnage	Design/ Installed GPM	Design GPM/Ton	GPM/Ton Deficiency	Recommended Flow Rate (GPM)
HP11	NB026	TTH046	46	3.83	1.04	21.0	1.8	4.0	2.3	-1.2	**11.5**
HP13	NL120		120	10.00	2.10	79.0	6.6	21.0	3.2	-1.1	**30.0**
HP14	NB049	TTH049	49	4.08	2.20	30.0	2.5	9.0	3.6	-1.4	**12.3**
HP15	NB049	TTH064	64	5.33	1.88	41.0	3.4	10.0	2.9	-1.1	**16.0**
HP18	NB026	TTH026	26	2.17	2.31	18.0	1.5	5.0	3.3	-1.0	**6.5**
HP27	NL120		120	10.00	2.10	78.0	6.5	21.0	3.2	-1.1	**30.0**
HP28	NL120		120	10.00	2.10	78.0	6.5	21.0	3.2	-1.1	**30.0**
HP29	NL120		120	10.00	2.10	78.0	6.5	21.0	3.2	-1.1	**30.0**
HP30	NB026	TTH026	26	2.17	2.31	17.0	1.4	5.0	3.5	-1.2	**6.5**
HP31	NB026	TTH026	26	2.17	2.31	17.0	1.4	5.0	3.5	-1.2	**6.5**
HP32	NB026	TTH026	26	2.17	2.31	17.0	1.4	5.0	3.5	-1.2	**6.5**