Airport Administration Building

The Airport Administration Building is a one-story building constructed in 1970. The 6,034 square foot building is located at 801 Airport Road, Ann Arbor, Michigan. The building supports the administrative functions for the Airport.

Figure 1: Airport Administration Building

CURRENT CONDITIONS

Building Structure/Envelope

The Airport Administration Building is a one-story building with a brick exterior finish. The building has double pane windows. The roof was not accessible on our site visit. The largest areas of infiltration/ex-filtration are the door sweeps.

Lighting System

The Airport Administration building has mostly LED fixtures throughout the common spaces. Other fixtures include T8 lamp (32 watt) fixtures and compact fluorescent fixtures. The exterior fixtures are mostly LED and the main parking lot pole fixtures are HID.

The maintenance garage has mostly 8' T8 HO fixtures and office areas with T8 lamp (32 watt) fixtures. Exterior lighting fixtures are HID, LED, and CFL plug-in lamp style

HVAC and Mechanical Systems

The Airport Administration Building is served by three (3) gas-fired, DX-cooled, Rooftop Units (RTU's). Two (2) of the RTU's are older units, and one (1) has recently been replaced. There is also electric fintube heaters throughout the building to handle skin losses from the building.

Building Temperature Controls

This building is controlled by standalone, programmable wall thermostats.

Renewable Energy Systems

There are no renewable energy systems installed on this building.

Building Summary

Year Built: 1970 **Primary Usage:** Airport Administration **Square Footage:** 6,034 SF	**Heating Equipment:** 3 gas-fired RTU's w/DX cooling	**Cooling Equipment:** 3 gas-fired RTU's w/DX cooling
Mechanical Equipment: **DHW**: 1 Electric Water Heater (40 Gallon) **Piping**: Insulated DHW	**Space Distribution:** 3 gas-fired RTU's w/DX cooling	**Temperature Controls:** Programmable T-Stat's **Primary hours:** Summer Mon-Sun, 7AM-9PM Winter Mon-Sun, 7AM-7PM **HVAC hours:** Summer, Mon-Sun, 7AM-9PM Winter, Mon-Sun, 7AM-7PM
Electric Equipment: No Issues Noted	**Lighting:** **Interior Lighting:** LED, T8 fluorescent **Exterior Lighting:** LED, HID, CFL **Sensors**: None	**Building Envelope:** **Roofs**: Inaccessible **Exterior**: Brick **Windows**: Double Pane **Exterior Doors**: Insulated Metal

Table 1: Building Information and Current Conditions

UTILITY ANALYSIS

The energy consumption for the Airport Administration Building from October 2016 through September 2017, was analyzed and is presented below.

Utility Summary	
Electricity Used	112,160 kWh
Electricity Cost	$ 15,466
Natural Gas Used	2,717 CCF
Natural Gas Cost	$ 2,285
Total Energy Cost	$ 17,751
Energy Use Index	109.8 kBTU / ft²
Energy Cost Index	**$2.94 / ft²**

Table 1: Energy Utilization and Cost

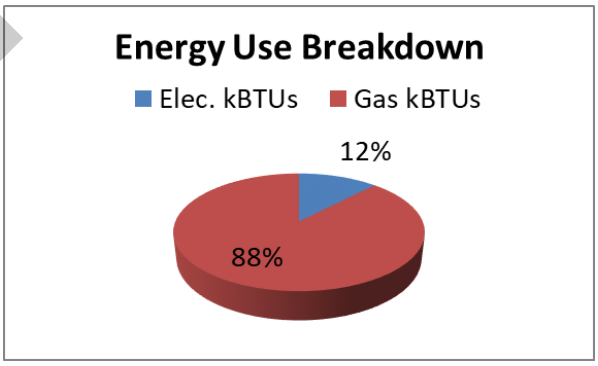

Figure 2: Energy Use Breakdown

Electricity

Description and Analysis of Electric Consumption Trend.

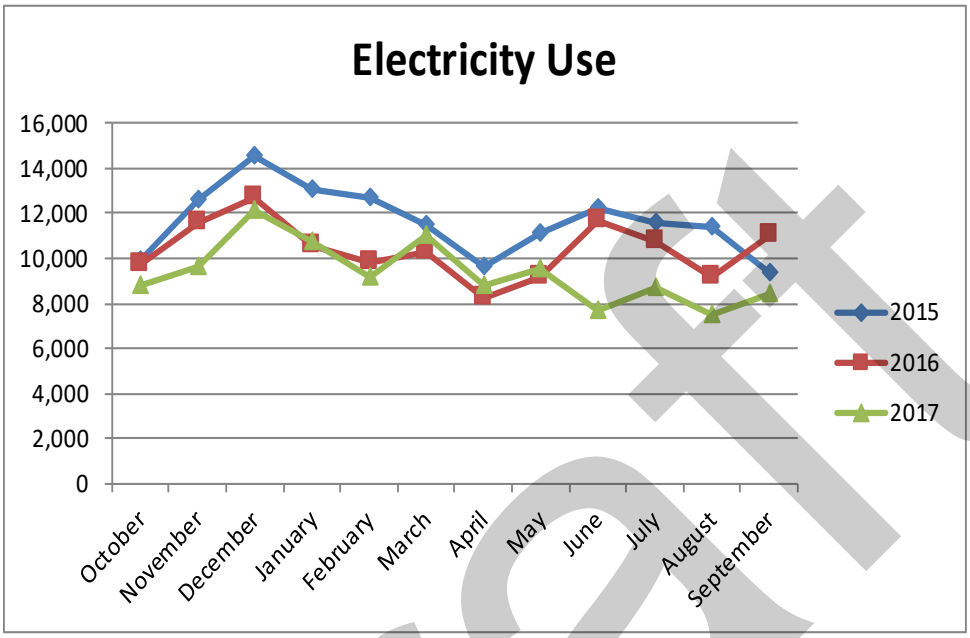

Figure 3: Airport Administration Building Electric Consumption, October 2015-September 2017 (kWh)

Natural Gas Usage

Description and Analysis of Natural Gas Consumption Trend.

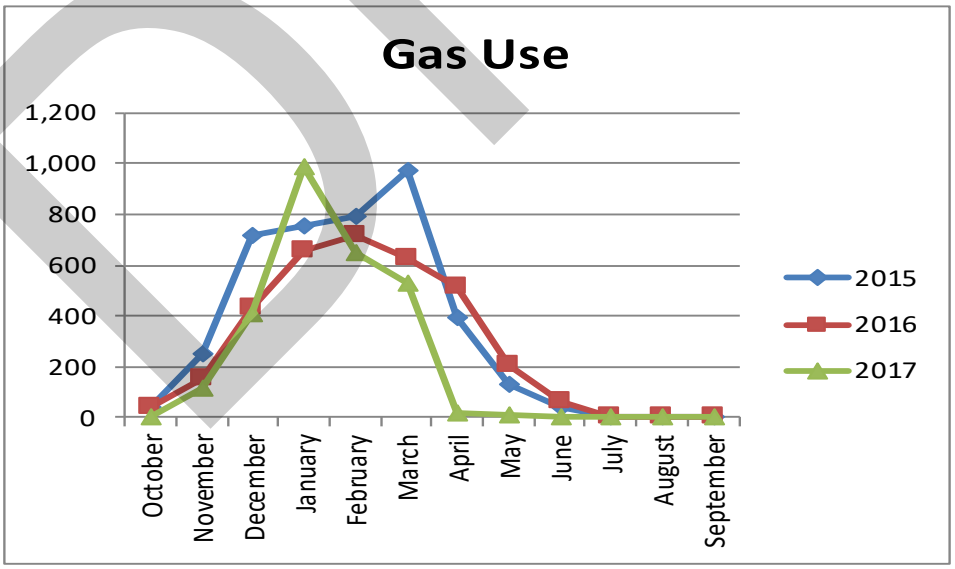

Figure 4: Airport Administration Building Natural Gas Consumption, October 2015-September 2017 (CCF)

Benchmarking

The building energy usage is benchmarked with a similar type building in the regional area, using ENERGY STAR. ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy.

Building:	Airport Administration Building		
Energy Star Space Type	Office		
Floor Area (Sq. Ft.)	6,034		
Results for Estimated Energy Use			
Energy	**Actual**	**Target**	**Median Building**
Energy Performance Rating (1-100)	70	75	50
Energy Star Site EUI (kBtu/Sq. Ft./yr)	110	103	139
Total Annual Site Energy (kBtu)	662,694	619,432	837,492
Total Annual Energy Cost ($)	17,751	16,635	22,490
Pollution Emissions			
CO2-eq Emissions (metric tons/year)	93.3	87.4	118.1

Table 2: Airport Administration Building Energy Utilization Comparison using EnergyStar

POTENTIAL ENERGY CONSERVATION MEASURES

Honeywell has developed a comprehensive list of energy measures that are evaluated on every project. The following tables represent a comprehensive list of potential Energy Conservations Measures (ECMs) which should be considered by the City of Ann Arbor for the Airport Administration Building.

These possible ECMs outline the assessment and findings of the Honeywell team during the site visits. Provided below are the descriptions of the ECMs, their benefits and specific observations based on the building's structural and energy analysis.

ECM #1: Lighting Retrofits

Existing Condition

Honeywell surveyed the facility and found opportunities to save energy and improve the lighting.

Proposed Solution

Honeywell recommends the following:

1. Existing 2x4 T8 lamp troffers will be retrofitted with LED T8 lamps and electronic ballasts.
2. Existing 4' T8 lamp fixtures will be retrofitted with LED T8 lamps and electronic ballasts.
3. Existing 8' T8 HO lamp fixtures will be retrofitted with LED board kits and electronic drivers.
4. Existing drum fixtures with CFL plug-in lamps will be replaced with new LED fixtures.
5. Existing CFL lamp fixtures will be retrofitted with LED lamps.
6. Existing LED fixtures are energy efficient and no modifications will be performed.
7. Existing LED exit signs are energy efficient and no modifications will be performed.
8. Exterior - Existing HID fixtures will be replaced with new LED fixtures.
9. Exterior – Existing CFL plug-in lamp fixtures will be replaced with new LED fixtures.
10. Exterior - Existing LED fixtures are energy efficient and no modifications will be performed.
11. Exterior – New/Replace photocells on exterior lighting to turn off lights during daylit hours.
12. Existing broken, missing or yellowed fixture lenses will be replaced with new.
13. Existing EMU lighting integral to lighting fixtures will be replaced with new EMU units compatible with LED technology.
14. Lighting Controls - Install occupancy sensors in areas where lighting has long hours of operation and intermittent usage.

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	0	0
Natural Gas (MMBtu)	-36	-$221
Electric (KWH)	20,984	$2,803
Total Savings		**$2,582**

Table 3: Calculated Energy Savings for Proposed Solutions

ECM #2: Water Retrofits

Existing Condition

Honeywell surveyed the building to identify opportunities to reduce water usage. The water consuming fixtures were identified and reviewed to identify any opportunities to reduce water usage.

Proposed Solution

Honeywell recommends the following:

1. Replace toilets with 1.6-gallon models (Qty. 3)
2. Install faucet aerators with low flow 0.5-gpm aerators.

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	108	$1,214
Natural Gas (MMBtu)	0	$0
Electric (KWH)	0	$0
Total Savings		**$1,214**

Table 5: Calculated Energy Savings for Proposed Solutions

ECM #3: Building Envelope Retrofits

Existing Condition

Air leakage has been shown to represent the single largest source of heat loss or gain through the building envelopes. Beyond representing potential for energy savings, uncontrolled air leakage can affect thermal comfort of occupants, air quality through ingress of contaminants from outside, the imbalance of mechanical systems, and the structural integrity of the building envelope - through moisture migration.

The buildings were inspected visually, with an infrared camera, and using a smoke puffer to identify location and severity of air leakage paths. Air leakage paths are detailed in the scope of work below.

Figure 5: Exterior Door: Cold spots around perimeter (dark areas)

Proposed Solution

Honeywell recommends the following:

1. Add weather stripping and door sweeps to doors (Qty.3).

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	0	$0
Natural Gas (MMBtu)	18	$111
Electric (KWH)	0	$0
Total Savings		**$111**

Table 6: Calculated Energy Savings for Proposed Solutions

ECM #4: Controls Retrofits

Existing Condition

The Airport has no central Building Management System (BMS). The three (3) Rooftop Units (RTU's) have standalone programmable wall thermostats for control. Adding a BMS would allow the Owner to remotely monitor and make changes to the control set-points and equipment schedules. This would be a convenience to the Owner, but for this building the standalone thermostats are adequate.

The programmable thermostats are setup for occupied / unoccupied schedules, and the temperature logger data indicates there is some setback occurring in the occupant spaces. This can be seen in the logger data below:

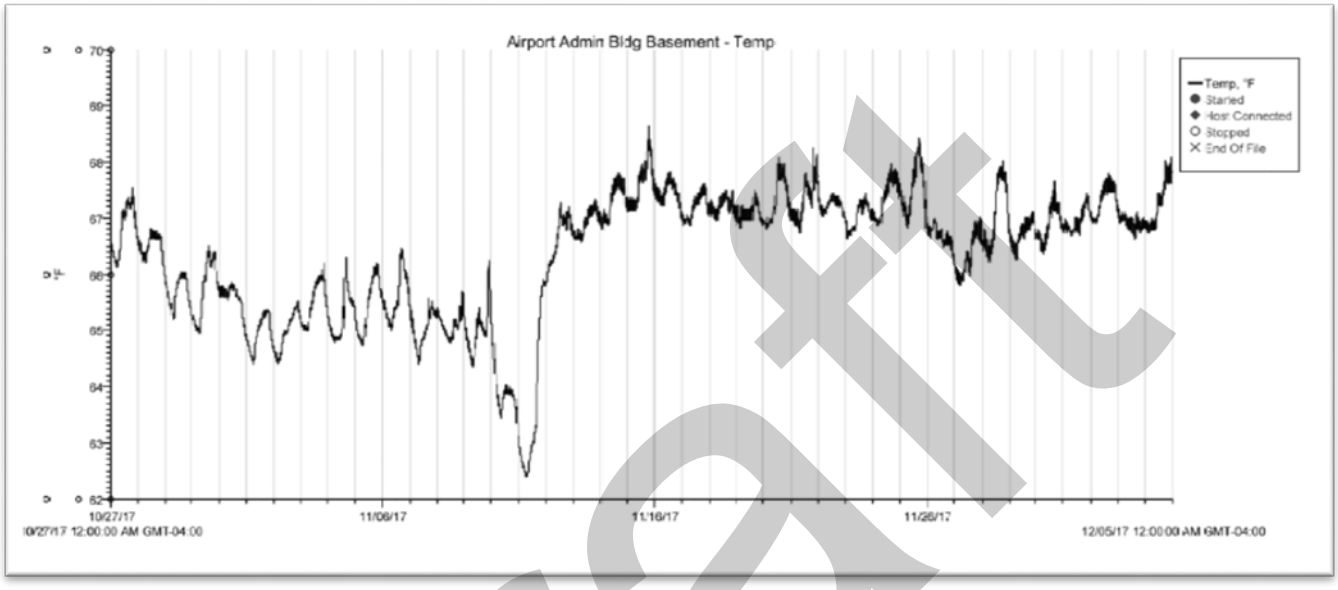

Figure 6: Temperature Logger, located in Basement

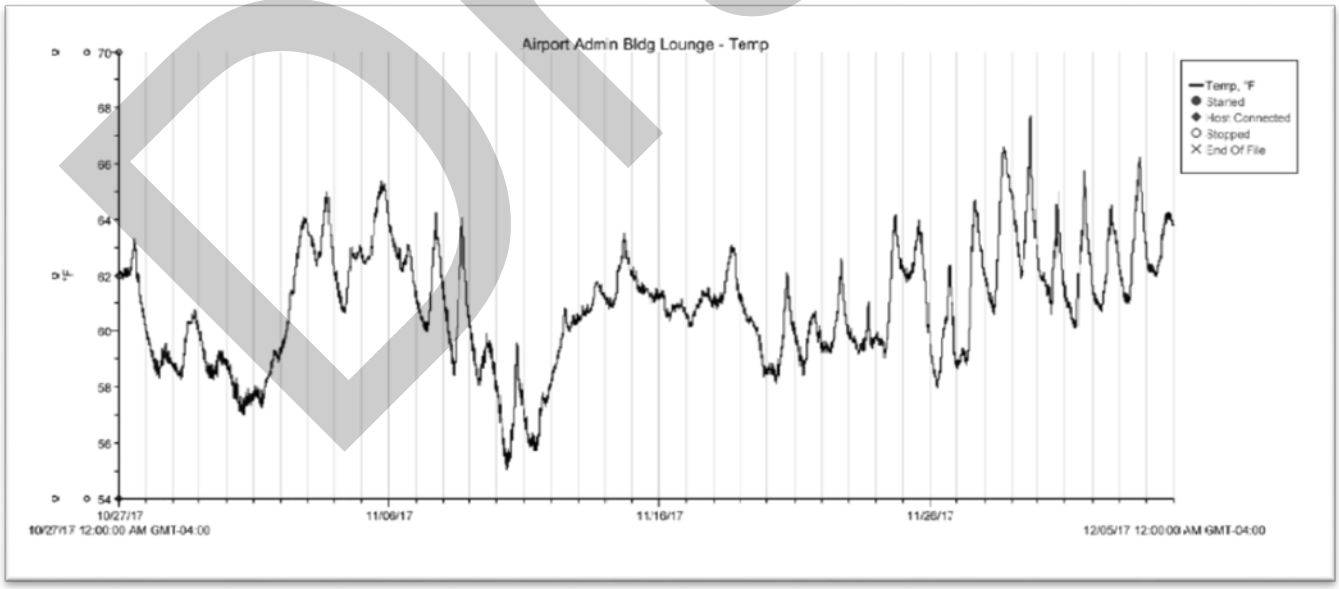

Figure 7: Temperature Logger, located in First Floor Lounge

Honeywell recommends adjusting the setback temperatures lower in the heating season, and higher in the cooling season, as outlined below.

Proposed Solution

1. **Occupied/Un-occupied Scheduling:** Honeywell proposes to review the occupancy schedules and make any changes needed, such that the RTU's run only during occupied periods.
2. **Review Occupied Temperature Settings:** Honeywell proposes to utilize Energy Star recommended settings:
   - 68^0F for heating
   - 72^0F for cooling
3. **Review Unoccupied Temperature Settings:** Honeywell proposes to utilize Energy Star recommended settings:
   - 60^0F for heating
   - 80^0F for cooling
4. **Outdoor Air:**
   - When the existing RTU's are replaced, they should be purchased with DCV (demand control ventilation) integrated into the packaged controls. Retrofitting the existing RTU controls with DCV would not be cost effective.

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	0	$0
Natural Gas (MMBtu)	8	$49
Electric (KWH)	641	$34
Total Savings		**$83**

Table 7: Calculated Energy Savings for Proposed Solutions

ECM #5: Miscellaneous Retrofits

Existing Condition

The vending machines use high intensity lighting and cooling compressors to keep the unit well lit and the product cold, which consumes a significant amount of energy.

Proposed Solution

Control Vending Machine Energy Use: Honeywell proposes to install a vending machine occupancy sensor which will turn off the vending machine compressor and lighting when the space is sensed to be unoccupied. The sensor will automatically re-power the unit when the area is reoccupied and at regular intervals to maintain product temperatures. There was one (1) vending machine identified in this building.

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	0	$0
Natural Gas (MMBtu)	0	$0
Electric (KWH)	1,372	$67
Total Savings		**$67**

Table 8: Calculated Energy Savings for Proposed Solutions

Energy Conservation Measure Summary

The following table is a summary table of all the Energy Conservation Measures proposed for consideration by the City of Ann Arbor.

Potential ECM Cost and Savings Summary

ECM #	ECM	Budget	Energy Savings	Oper Savings	Potential Savings	Simple Payback (Years)
1	Lighting Retrofit	$47,808	$2,582	$221	$2,803	17
2	Water Retrofit	$3,231	$1,214	$0	$1,214	2.7
3	Building Envelope Retrofit	$1,660	$111	$0	$111	15
4	Controls Retrofit	$0	$83	$0	$83	---
5	Miscellaneous Retrofit	$605	$67	$0	$67	9.0

Table 4: Estimated Cost and Savings of Potential ECMs

Total Cost and Energy Reduction by Utility

Energy Type	Current Usage	Predicted Usage	Savings	Cost Savings	Percent Savings
Water	---	---	108.0	$1,214	---
Natural Gas	2,717	2,727	-10	-$172	0%
Electric	122,160	100,535	21,625	$2,836	17.7%
Total				**$3,878**	

Table 5: Estimated Savings by Utility of Potential ECM's

The savings indicated above are based on all the measures being installed. A final savings calculation will be generated once the final ECMs are selected.

"Net Zero" / Renewable Energy Opportunities

Existing Condition

"Net-Zero" City Resolution: The City of Ann Arbor has passed a resolution calling for the City-Owned buildings to shift off of gas-fired equipment to electric. Additionally, a "Net-Zero" Resolution was passed which calls for the City-Owned buildings to reach a "Net-Zero" status by the year 2035.

In order to accomplish these goals, the City must convert the gas-fired equipment to electric and then offset the total annual electric usage by the addition of power generation.

This building has no renewable energy sources currently installed.

Gas-Fired Equipment: This building has three (3) gas-fired Rooftop Units (RTU's).

Proposed Solution

In order to eliminate gas from the building, Honeywell proposes a geothermal heat pump system. Further, in order to reach a "Net Zero" level of renewables at this site, a solar array needs to be installed to meet or exceed the electric usage after conversion to geothermal, and after proposed energy upgrades are made to the building equipment.

Geothermal Heat Pump System

1. Each gas-fired RTU will be replaced with a heat pump RTU that serves the same air distribution system the gas-fired RTU currently does. The existing electric perimeter fintube heating and electric heaters will remain intact.
2. Currently, an electric water heater is used. A solar thermal heating system will be installed to supplement the domestic hot water for this building, and the electric heat could be used as a back-up source. The solar thermal system will be installed on the roof of the building.
3. The site this building is has green space surrounding it, as well as a parking lot. Either would be a potential location for the geothermal wells to be installed.

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	0	$0
Natural Gas (MMBtu)	2,717	$2,285
Electric (KWH)	-34,965	-$1,710
Total Savings		**$574**

Table 11: Calculated Energy Savings for Proposed Solutions

PV Solar Array Installation – Net Zero

1. The current utility rates allow for "net-metering" credits to the Owner for any power not used on-site that gets distributed back to the Utility Grid.
   a. If the total installed solar array size is below 20 KW, the Owner will receive a credit for any excess production equivalent to energy AND delivery charges
   b. If the total installed solar array size is between 20 KW and 150 KW, the Owner will receive a credit for any excess production equivalent to energy charges ONLY.
   c. If the total installed solar array size is between 150 KW and 550 KW, the Owner will receive a credit for any excess production equivalent to a significantly lower, variable wholesale rate.
2. Honeywell proposes installing a 134 KW solar PV array which is projected to have annual electric production of 161,022 KWH. This will offset this usage in a typical year, accomplishing "Net Zero" for this building. However, it is estimated that at least 40% of the production will be distributed back to the Utility Grid, so that full value is not realized for that portion of excess production.
3. In order to produce this level of output, approximately 0.54 acres of space is needed to install the solar array on grade (571 panels, 77" x 39" each).

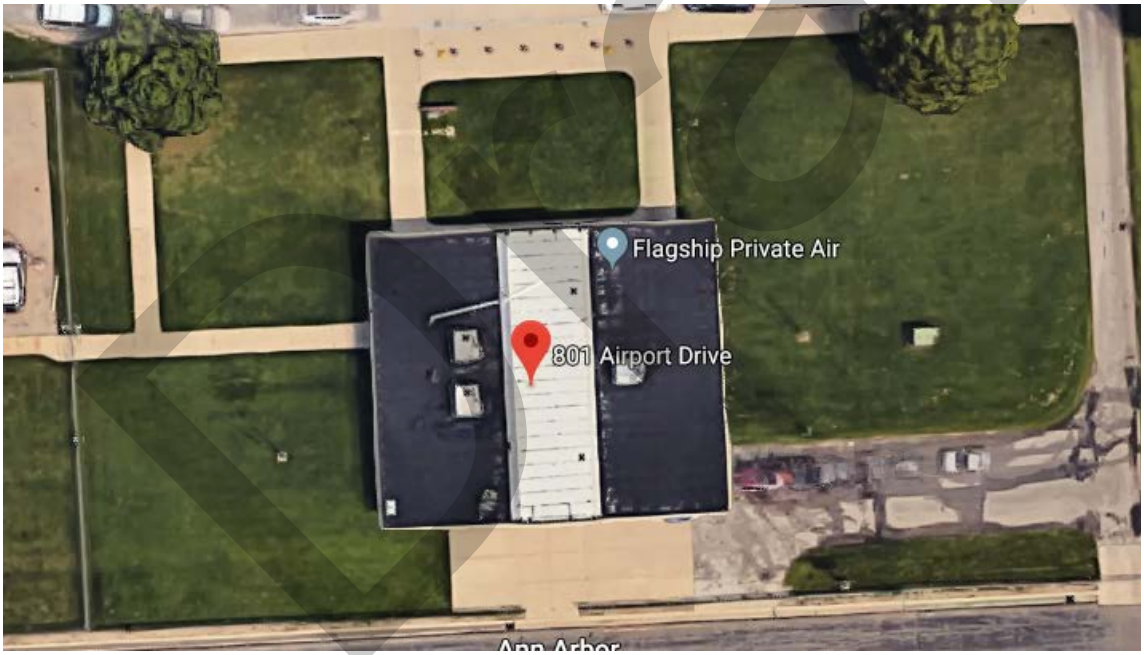

Figure 8: Close-Up Image of Building and Immediate Green Space

Figure 9: Image of Building and Green Space to Main Road

Projected Energy Savings

Energy Type	Savings	Cost Savings
Water (KGal)	0	$0
Natural Gas (MMBtu)	0	$0
Electric (KWH)	161,022	$5,523
Total Savings		**$5,523**

Table 12: Calculated Energy Savings for Proposed Solutions

Potential Renewable Measure Cost and Savings Summary

ECM #	ECM	Budget	Energy Savings	Simple Payback (Years)
1	Geothermal Heat Pump System	$330,000	$574	575
2	PV Solar Array Installation – Net Zero	$436,000	$5,523	79

Table 13: Estimated Cost and Savings of Renewable ECMs