# Energy Feasibility Study Report

for

## Summer Gardens

1470 Summer Street, Halifax, NS

**August 10th, 2023**

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**Summer Gardens**
1470 Summer Street
Halifax, NS

Attention: **Condominium Board**
Re: **Energy Feasibility Study Report**

To Whom it May Concern,

PMC Energy Ltd. is pleased to provide you with the following Draft Energy Feasibility Study Report and associated proposal outlining the budgets, savings, and benefits of various Energy Efficiency and Conservation Measures at 1470 Summer Street, Halifax, NS.

The purpose of this study is to identify and analyze feasible energy efficiency and conservation opportunities resulting in energy savings for the facility. This report will serve two purposes; submission to Efficiency NS for review and approval of the estimated incentives through their various incentive programs, and as a guide for pursuing energy projects to improve building performance and reduce its carbon footprint.

The implementation of the Energy Conservation and Efficiency Measures (ECMs) outlined in this report is recommended. The comprehensive energy measures present the best opportunity to reduce the facility's operating costs and environmental footprint. It should be noted that the ECM costs shown in this report are a mix of budgetary and true costs for PMC to complete the work in a turn-key manner.

If you have any questions or require clarifications regarding any specific items addressed in this proposal, please feel free to contact me at your convenience.

Kind Regards,

**Scott Hue**, B.Eng., CEM
*Director of Energy*
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# TABLE OF CONTENTS

## LIST OF TABLES AND FIGURES



## LIST OF APPPENDICES

# 1. BUILDING AND SYSTEMS DESCRIPTION

## 1.1 General Description of Building

Summer Gardens located in the heart of downtown Halifax with lovely private property surrounding. There are 118 residential suites, through the focus of this report are the common area systems and areas within the facility. The facility includes an indoor year-round pool/hot tub/sauna and exercise facility, underground parking, guest parking, and common room with kitchen and outside patio for meetings and parties.

Summer Garden wished to explore opportunities associated with the building automation, space heating (and cooling), ventilation as well as pool heating and dehumidification to create a more efficient facility with reduced operating costs and improved system performance. A strong interest was also expressed in the implementation of demand management system, with the intent to be able to minimize peak loads in real time.

## 1.2 Occupancy Summary

PMC's audit scope included a detailed audit and review of all the common area systems. Most areas are currently being operated 24/7/365, though there is an opportunity to reduce run-hours or equipment capacities on targeted equipment, such the dedicated outdoor air system (DOAS) located in the penthouse.

## 1.3 Common Area Mechanical Equipment

The mechanical systems serving all the facilities common areas is summarized in the table below.

Table 1 - Equipment List

| Tag | Description of Equipment | Qty | Area Served |
|---|---|---|---|
| **SF-1 (New)** | Supply Fan Grid | 1 | New SF Array |
| **DH-1** | Duct Heater 162kW | 1 | DOAS (SF-1 & EF-1) |
| **EF-1** | Exhaust Fan (DOAS) | 1 | Bathrooms, Kitchen Range, Dryers |
| **EF-2** | Dryer Exhaust Fan | 1 | Dryer Exhaust Riser 26/16 |
| **EF-3** | Dryer Exhaust Fan | 1 | Dryer Exhaust Riser 34/12 |
| **RE-1** | Roof Exhauster-1 | 1 | Smoke Extractor from Supply Duct |
| **RE-2** | Roof Exhauster-2 | 1 | General Penthouse Exhaust |
| **RE-3** | Roof Exhauster-3 | 1 | Elevator Machine Room |
| **HUH-1** | Elec Unit Heater | 1 | General Penthouse Area |
| **HUH-2** | Elec Unit Heater | 1 | Elevator Room |
| **CUH-1** | Cabinet Unit Heater - Sidewall | 1 | Front Entrance Vestibule |
| **CUH-2** | Cabinet Unit Heater - Recessed Ceiling | 2 | Front Entrance Vestibule |
| **CUH-3** | Small Recessed Wall Heater in Mail Room | 1 | Ground Floor Mail Room |
| **CUH-4** | Electric Wall Heater | 1 | Rear Delivery Area |
| **CUH-5** | Cabinet Unit Heater - Sidewall | 1 | Rear Vestibule |
| **EF-12** | In-Line EF | 1 | Lounge and Mail Room |
| **MS-1** | Mini-Split | 1 | Common Area / Lobby |
| **MS-2** | Mini-Split | 1 | Lounge |
| **CUH-6** | Cabinet Unit Heater - Sidewall | 1 | Stairwell to Pool Area |
| **Portable Dehum** | Portable Dehum Running in Pool Area | 2 | Stairwell to Pool Area |
| **CUH-7** | Electric Wall Heater | 2 | Men's & Women's Washrooms by Pool |
| **SH's** | Sauna Heaters | 3 | Sauna |
| **P-1** | Pool Pump | 1 | Pool |
| **PH-1** | Pool Electric Heater | 1 | Pool |
| **AH-1** | Air Handling Unit (HHU-1-2) | 1 | Maintenance, Elevator Lobby, Men's and Ladies Change Rm, Gym |
| **Duct Heater-1** | Duct Heater for AH-1 | 1 | Maintenance, Elevator Lobby, Men's and Ladies Change Rm, Gym |
| **EF-5** | Exhaust Fan | 1 | Storage Room, Gym, Washrooms, Sauna, Maintenance Room |
| **AH-2** | Air Handling Unit | 1 | Parking Level - Storage Lockers |
| **AH-3** | Air Handling Unit | 1 | Parking Level - Stairwell Pressurization |
| **TF-1** | Wall Mounted **Transfer Fan** | 1 | Air Pushed Into Pool Mech Room |
| **TF-2** | Wall Mounted **Transfer Fan** | 1 | Exhaust from DCM Pump Room (Pulled from Storage Room) |
| **EF-4** | Garbage Room EF | 1 | Garbage Room EF |
| **EF-6,7** | Parkade CO/NO EF's | 2 | Parking Level - Car Wash Area |
| **EF's 8,9,10** | Parkade CO/NO EF's | 3 | Parkade |
| **EF- 11** | Parkade Vault EF | 1 | Elec Vault |
| **Dectron** | Dry-O-Tron | 1 | Pool Room |
| **Dectron Duct Heater** | Duct Heater for Dectron | 1 | Pool Deck |
| **Dehum** | Small Dehum Unit in Storage Area | 1 | Storage Area - Parkade Level |
| **BP-1** | Booster Pumps | 2 | Booster Pumps |
| **SP-1** | Sump Pumps | ? | Parkade |
| **DHT** | DHW Tank | 1 | Janitor Room |
| **DHT** | DHW Tank (Car Wash) | 1 | Wash Bay |
| **SM** | Snowmelt Boiler | 1 | Parkade Ramp |
| **Burner** | Burner | 1 | Ramp |
| **P-2** | Pump | 1 | Boiler |
| **Jacuzzi** | Jacuzzi | 1 | Pool Area |

## 1.4 Lighting Systems

Most of the interior and exterior lights at Summer Gardens have already been upgraded to LED fixtures. There is a variety of lighting fixture styles and lamp types throughout the building. The timer for the exterior lights was missing its pins and lights appear to be operating 24/7 vs just at night when required. Occupancy sensors could be considered in some areas to provide additional energy savings.

A summary of lighting fixtures can be viewed below in Table 2.

Table 2 – Lighting Summary

| Area / Room / Zone | Type | Fixture Quantity | Watts per Fixture | Schedule (hr/year) | kWh/year |
|---|---|---|---|---|---|
| | Phillips 5W 4000K PL-S | 164 | 5 | **8,736** | **7,164** |
| Front + Rear Entrance Canopy | Phillips 13W PAR38 + E26 Socket | 2 | 13 | **4,368** | **114** |
| Operations Office | Philips 9.5T8/48-4000K IF + 2L Vol. Parabolic | 1 | 21 | **1,560** | **33** |
| Lobby + Elevator Tray Ceiling | Philips 9.5T8/48-4000K IF | 60 | 21 | **8,736** | **11,007** |
| Mail Box Alcove | Philips 9.5T8/48-4000K IF | 2 | 21 | **8,736** | **367** |
| Rear Service Hall | Philips 13T8/48-4000K HO IF + 1L Vol. Parabolic | 2 | 16 | **8,736** | **280** |
| Rear Exit Hallway | Philips 9.5T8/48-4000K IF + 1L Vol. Parabolic | 3 | 13 | **8,736** | **341** |
| Suite Door Bulkheads | Philips 9.5T8/48-4000K IF | 122 | 13 | **8,736** | **13,855** |
| Parkade Main Hallway | Philips 9.5T8/48-5000K IF + 2L Vol. Parabolic | 6 | 21 | **8,736** | **1,101** |
| Parkade Air Locks | Philips 9.5T8/48-5000K IF | 4 | 21 | **8,736** | **734** |
| Pool Tray Ceiling | Philips 9.5T8/48-5000K IF | 20 | 21 | **8,736** | **3,669** |
| Pool Change + Washrooms | Philips 9.5T8/48-5000K IF | 8 | 21 | **8,736** | **1,468** |
| Pool | LED-8008M57-MHBC (PWB1KNSC) | 4 | 50 | **8,736** | **1,747** |
| Exercise Room | Philips 9.5T8/48-5000K IF + 2L Vol. Parabolic | 3 | 21 | **8,736** | **550** |
| Parkade | Philips 9.5T8/48-5000K IF | 58 | 21 | **8,736** | **10,640** |
| Vehicle Wash Bay | Philips 15W Daylight A19 + E26 Socket | 4 | 15 | **260** | **16** |
| Recycle & Refuse Rooms | Philips 9.5T8/48-5000K IF | 5 | 21 | **2,080** | **218** |
| Utility + Rear Hallways | Philips 9.5T8/48-5000K IF | 5 | 21 | **8,736** | **917** |
| Parkade Service Stairwell | TuroLight DL-EC/4F/35W/50/120-347V/D | 2 | 3 | **8,736** | **52** |
| Tenant Storage Lockers | TuroLight DL-EC/4F/35W/50/120-347V/D | 26 | 3 | **8,736** | **681** |
| Stairwells + Alcove | TuroLight DL-EC/4F/35W/50/120-347V/D | 45 | 3 | **8,736** | **1,179** |
| Mechanical Stairwell | TuroLight DL-EC/4F/35W/50/120-347V/D | 2 | 3 | **8,736** | **52** |
| Mechanical Stairwell | TuroLight DL-EC/4F/35W/50/120-347V/D | 1 | 3 | **8,736** | **26** |
| Mechanical Penthouse Fixtures | Ecolux F34CW-RS-WM-ECO | 16 | 34 | **780** | **424** |
| Totals | | 565 | 405 | **8635** | **56,636** |

## 1.5 Building Automation System (BAS)

There is very little in place in terms of a building automation system aside from a Honeywell controller currently in place for the Penthouse DOAS system. Control and scheduling of most other equipment is achieved through local thermostats and in some cases timeclocks.

# 2. ENERGY SUMMARY

## 2.1 Historical Utility Consumption and Demand – Baseline Data

Summer Garden has two electrical meters serving the common area systems. Consumption and demand summary tables were assembled from historical data from 2020 and can be found in Appendix A. A summary of the annual consumption and demand is shown below for reference.

**2020 Baseline Utility Data**

| | |
|---|---|
| **Baseline** Annual ELECTRICAL Consumption (kWh) | 937,880 |
| **Baseline** Annual ELECTRICAL Demand (kW) | 2,324 |
| **Baseline** TOTAL Energy Costs (Using Current Rates) | **$138,519.94** |
| **Baseline** Energy Cost per Square Foot (Using Current Rates) | **$5.861** |

The peak electrical load of the facility occurs during the winter months. January of 2020 recorded a peak demand of 275.4 kW. The major contributors to the peak demand are the electric coils associated with the Penthouse DOAS unit and AH-1 in the Parkade Level.

## 2.2 Calculated Annual Energy Distribution

The annual energy consumption and annual demand for each system (or piece of equipment) was calculated (refer to Appendix B – Energy Calculations) and the summary table is shown below.

| | % | ekWh/yr |
|---|---|---|
| Lighting | 5.67% | 56,636.42 |
| Plugs | 0.00% | 0.00 |
| Fans | 18.68% | 186,383.52 |
| Pumps | 7.22% | 72,101.53 |
| Cooling | 1.73% | 17,273.00 |
| Heating | 15.65% | 156,206.93 |
| Ventilation | 45.06% | 449,684.60 |
| Hot Water | 1.05% | 10,482.00 |
| Misc (i.e., Elevators) | 4.93% | 49,247.01 |
| | **100.0%** | **998,015.02** |

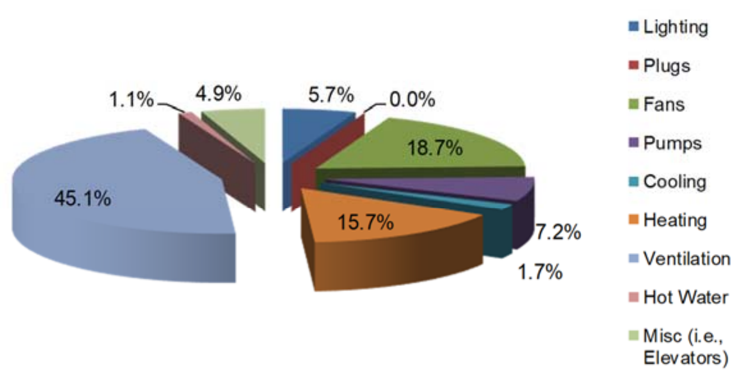


Figure 1 - Calculated Annual Energy Distribution

The calculated figures shown above were then compared to the established utility baseline data provided in Appendix A. As shown below the calculated values are within 10% of the actual utility baseline.

Table 3 - Energy Calculation vs. Utility Baseline

| | Consumption (kWh) | (Demand kW) |
|---|---|---|
| **Calculated Totals:** | 998,015.02 | 2,466.32 |
| **Proposed Baseline (2020):** | 937,880.00 | 2,323.90 |
| **Percent of Actual:** | 106.41% | 106.13% |

## 2.3 Regression Analysis (RETScreen Expert)

RETScreen Expert was used to analyze the baseline consumption data and to develop a model which allows us to accurately predict the future energy consumption of the building under the scenario where no upgrades are completed. The model uses hourly weather data which will ensure that future energy consumptions are automatically adjusted for weather conditions.

As seen in Figure 3 below there is a strong correlation between heating degree days (balance point 16°C) and consumption which returned an $R^2$ value of 0.9811. These balance points have been used in the calculations through this report.

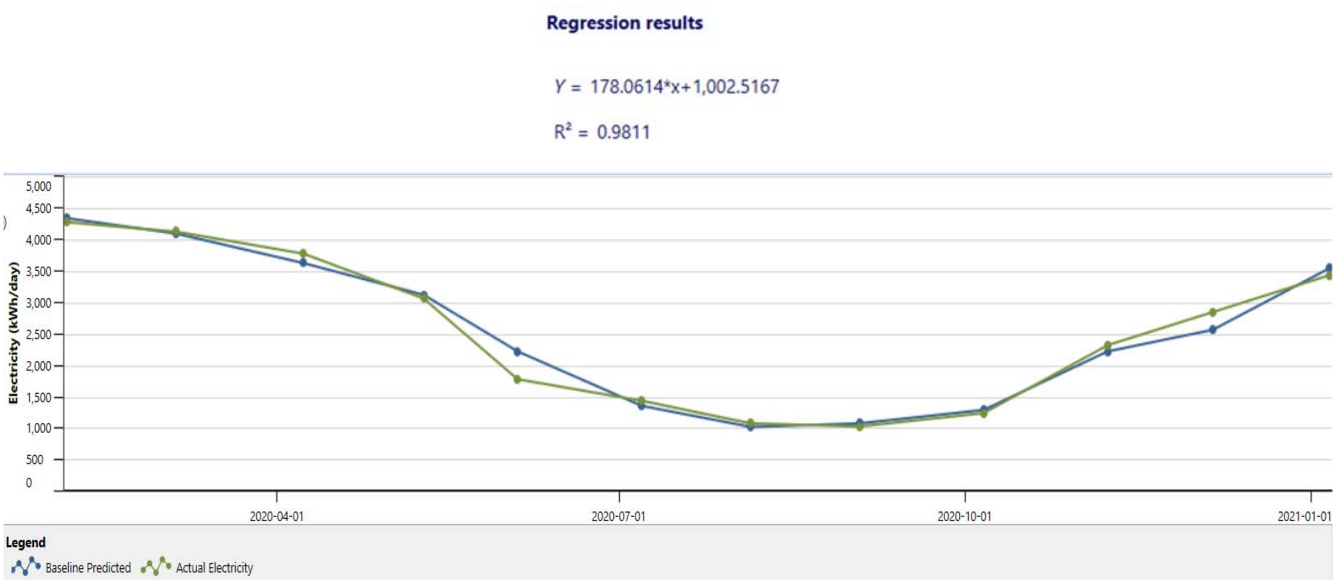


Figure 3 - HDD Regression Analysis Graph – Baseline Predicted vs Actual Consumption (kWh's)

Given these results; PMC will use the developed RETScreen model and regression formulas to adjust future energy consumption as compared to the baseline.

# 3. ENERGY EFFICIENCY AND CONSERVATION MEASURES

PMC has completed a detailed review of the site conditions and equipment and has identified the following list of investigated Energy Efficiency and Conservation Measures (ECM's).

## 3.1 ECM-1: New Building Automation System, Repairs, Recommissioning

### 3.1.1 Existing Conditions

The existing Dedicated Outdoor Air Unit (DOAS) unit includes a passive heat recovery coil that is approximately 60% efficient. There is also a 162kW electric coil providing additional heat to the supply to ensure a neutral air temperature is delivered to the hallways. This creates a high electric demand when all stages are active. The DOAS unit's energy consumption is more than 30% of the total energy consumption associated with the two meters.

### 3.1.2 Proposed Measure

PMC completed a detailed inspection of the current DOAS unit and its associated components. We noted failed actuators and worn-out dampers as well as opportunities to refine the control and sequencing on the DOAS through the implementation of a modern control system. The scope below is comprehensive and provisions have been made to provide connection and control over all major energy consumers serving the common areas. Scope details include;

- Supply & install a BACnet IP Building Automation System (BAS), complete with controls wiring, connections and web-based graphical interface.
- Supply & install new controllers and sensors for equipment located in the P1 Parkade Level including pool equipment (i.e., pumps, heaters), Dectron DH unit, new VRV system proposed in ECM-2, AH-1, AH-2, EF-4, EF-5 and new domestic booster pump set proposed in ECM-3.
    - Supply and install new ultra-low leakage insulated dampers to replace the seized dampers associated with the Dectron unit.
    - Supply and install new SCRs on the Dectron duct heater as well as the pool heater.
- Supply & install new controllers and sensors for equipment located in the Penthouse including the DOAS system (SF-1, EF-1) as well as dryer exhaust fans, penthouse and elevator room exhaust fans and heaters.
    - Supply and install new ultra-low leakage insulated dampers to replace the intake damper in the elevator machine room and the intake dampers associated with RE-2.
    - Supply and install new isolation dampers for EF-2, and EF-3 to reduce stack effect when these fans are commanded OFF at night.
    - Supply and install new isolation dampers on the kitchen range duct risers to provide a means of reducing airflow of the DOAS at night.
    - Provide an air balance of the DOAS. Ensure air balance and recommissioning results in two balanced modes of operation including daytime off-peak operation.
- Supply & install new controllers and sensors for equipment located on the Ground Floor level including the cabinet heaters in the front and rear entrances.

- Supply and install Smart Power Meters for the metering of the two power feeds associated with the meter sets examined in the baseline. The power meters will integrate into the BAS server for monitoring and recording purposes. The overall intent is to measure and meter the demand (kW) at a building level and then utilize the controls system to reduce and minimize the overall peak levels by staging, controlling, measuring, and verifying the high energy consumers. A draft list of recommended loads and strategies include;
    - Shut-Off Dryer EF-2, EF-3
    - Night Mode on DOAS - Reduced Airflow
    - Supply Air Temperature (SAT) Reset of DOAS
    - SAT and/or Setpoint (SP's) Resets of AH-1
    - Shut-Off AH-2
    - Disable RE-2 (General Penthouse Exhaust)
    - Disable HUH-1, HUH-2, CUH-1, CUH-2's, CHU-5
    - Reset SPs for New Gym and Pool Area Wall Mount Unit
    - Disable Pool Pump
    - Disable Pool Heater
    - Disable Dectron Pool Unit (or reset SAT's) and Associated Duct Heater
- Building Automation System (BAS) with Graphics, Alarm Reporting, and Remote Connection Capabilities, as well as Maintenance Manual, Labels, Panel Points Lists, and Training is included.
    - Internet connections will be required for building automation systems. PMC to work with owners for requirements and access.
    - PMC to provide remote alarms that will be sent to the building representative for the equipment controlled in this proposal.
- Please note that the car charging systems being contemplated do not appear to be capable of communicating with the proposed building automation system; however, further investigation is currently underway.
- As this is an existing building access to equipment can be difficult. Therefore, coring, firestopping, minimal drywall demolition, and painting may be required. PMC has not included these costs in the proposal. PMC to coordinate and work with owners for accommodations and gathering proposals for such work as required.

### 3.1.3 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback.

| ECM-1: New Building Automation System, Repairs, Recommissioning | |
|---|---|
| Measure Description | Supply and install a complete new buildign automation system to proivide contreol asnd sequences of the major enewrgy users in the Penthouse, Ground Floor and P1 Levels. To also include new dameprs, recomissioning and air balancing on the DOAS system. |
| Impact on System Performance | Occupant comfort will be improved slightly via new sequences and system performance. |
| Impact on Operations and Maintenance | Minor and incremental improvements to the existing systems and components so relatively little change to operations and maintenance tasks and associated costs. |

**Energy and Financial Summary**

| | | | |
|---|---|---|---|
| Total Project Cost: | $159,660.00 | Total Utility Bill Savings in Dollars: | $14,825.80 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $12,349.86 | + Additional Annual Savings (Maint): | $0.00 |
| **= Total Investment:** | **$147,310.14** | **= Total Annual Savings Estimate:** | **$14,825.80** |
| Annual Consumption Savings (kWh's): | 123,498.62 | Simple Payback: | 9.9 |
| Annual Demand Savings (kW): | 106.88 | Useful Life (years): | 20 |
| | | Return on Investment: | 5.06% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

Notes:

- Simple payback and ROI are based on fixed rates and do not account for NS Power's annual rate increases.

## 3.2 ECM-1b: Heat Pump Retrofit for Penthouse DOAS

### 3.2.1 Existing Conditions

The existing DOAS unit includes a passive heat recovery coil that is approximately 60% efficient. There is also a 162kW electric coil providing additional heat to the supply to ensure a neutral air temperature is delivered to the hallways. This creates a high electric demand when all stages are active and is responsible for a larger portion of building energy consumption. New heat technology and equipment options are becoming more widely available.

### 3.2.2 Proposed Measure

PMC explored several options during our investigations of this measure. The manufacturer AIR has proposed a retrofit kit that utilizes the refrigeration cycle to heat or cool the ventilation air by turning the exhaust air into a heat sink or source. In the winter exhaust air can provide COPs of greater than 5 because exhaust temperatures are much higher than outdoor ambient conditions.

### 3.2.3 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback.

| ECM-1b: Heat Pump Retrofit of Penthouse DOAS (or New Combined ERV, Heat Pump) | |
|---|---|
| Measure Description | Heat Pump Retrofit of DOAS or New High Efficiency Unit |
| Impact on System Performance | Occupant comfort will be improved slightly via new sequences and system performance. |
| Impact on Operations and Maintenance | A heat pump system will require more maintenance compared to the passive heat recovery coils and electric heating coil currently in place. |

Energy and Financial Summary

| | | | |
|---|---|---|---|
| Total Project Cost: | $625,000.00 | Total Utility Bill Savings in Dollars: | $30,207.62 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $17,390.27 | + Additional Annual Savings (Maint): | -$3,000.00 |
| **= Total Investment:** | **$607,609.73** | **= Total Annual Savings Estimate:** | **$27,207.62** |
| Annual Consumption Savings (kWh's): | 173,902.65 | Simple Payback: | 22.3 |
| Annual Demand Savings (kW): | 694.70 | Useful Life (years): | 20 |
| | | Return on Investment: | -0.52% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

Please note that the cost presented in the table above is a budget only for the purpose of exploring the feasibility of this option.

## 3.3 ECM-1c: Solar Air Preheat for Penthouse DOAS

### 3.3.1 Existing Conditions

The existing DOAS unit includes a passive heat recovery coil that is approximately 60% efficient. There is also a 162kW electric coil providing additional heat to the supply to ensure a neutral air temperature is delivered to the hallways. This creates a high electric demand when all stages are active and is responsible for a large portion of building energy consumption.

### 3.3.2 Proposed Measure

PMC explored the option of trying to pre-heat the outdoor air using solar air heating panels. The picture below is a good representation of the concept.


Figure 4 - Example Solar AIR Preheat System

### 3.3.3 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback.

**ECM-1c: Solar Air Preheat for Penthouse DOAS**

| | |
|---|---|
| Measure Description | Install solar air heating system on roof using Matrix Air Delta modules. The system will provide 20,200 CFM of pre-heated fresh air to the penthouse AHU for distribution throughout the residential floors. |
| Impact on System Performance | From the perspective of the occupants there will be no noticeable change. |
| Impact on Operations and Maintenance | Solar air heating system will require additional maintenance for inspections and periodic snow removal. |

**Energy and Financial Summary**

| | | | |
|---|---|---|---|
| Total Project Cost: | $161,520.00 | Total Utility Bill Savings in Dollars: | $7,101.68 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $6,750.00 | + Additional Annual Savings (Maint): | -$250.00 |
| **= Total Investment:** | **$154,770.00** | **= Total Annual Savings Estimate:** | **$6,851.68** |
| Annual Consumption Savings (kWh's): | 67,500.00 | Simple Payback: | 22.6 |
| Annual Demand Savings (kW): | 0.00 | Useful Life (years): | 25 |
| | | Return on Investment: | 0.43% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

## 3.4 ECM-2: Parkade Level Heat Pump Retrofit with VRV

### 3.4.1 Existing Conditions

There is considerable ventilation load associated with AH-1 in the basement providing temperature ventilation air to the elevator lobby, the hallways, the pool change rooms and the maintenance shop. PMC therefore explored opportunities to implement heat recovery between AH-1 and EF-5. We then examined how this new heat recovery system could be expanded to provide dehumidification to the storage areas via replacement of AH-2, replacement of the cabinet unit heater in the pool room stairwell as well as the addition of new dedicated cassette style unit in the gymnasium area.

### 3.4.2 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback.

| ECM-2: Parkade Level Heat Pump Retrofit with VRV | |
|---|---|
| Measure Description | This ECM explored the opportunity to replace the aging make-up air and air handling equipment serving the P1 Parkade Level with heat pump, heat recovery technology. This ECM targets replacing AH-1 and EF-5 with a new ERV and also a post-heat VRV ducted air handling unit. ECM include replacement of AH-2 top proved dehumidification, a new cassettes style split for the gym, and a new wall-mount heat pump for the pool stairwell. |
| Impact on Occupant Comfort | Occupant comfort will be improved via new sequences and system performance. The addition of cooling capacity should reduce or eliminate the need for portable dehumidification units and will also provide improved comfort to the gymnasium. |
| Impact on Operations and Maintenance | A heat pump system will require more maintenance compared to the electric heating coils and heaters currently in place. |

| Energy and Financial Summary | | | |
|---|---|---|---|
| Total Installation Estimate: | $220,840.00 | Total Utility Bill Savings in Dollars: | $14,825.80 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $12,349.86 | + Additional Annual Savings (Maint): | $0.00 |
| **= Total Investment:** | **$208,490.14** | **= Total Annual Savings Estimate:** | **$14,825.80** |
| Annual Consumption Savings (kWh's): | 123,498.62 | Simple Payback: | 14.1 |
| Annual Demand Savings (kW): | 106.88 | Useful Life (years): | 20 |
| Annual Consumption Savings (GJ's): | 0.00 | Return on Investment: | 2.11% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

***NOTE:*** *A follow-up site visit will be required to verify some installation details of the above ECM. This includes items such as condensing unit locations, electrical connections, etc.*

## 3.5 ECM-3 – DCW Booster Pump Replacement with High Efficiency Variable Speed System

### 3.5.1 Existing Conditions

The existing domestic booster pump system appears to be original to the building and is comprised of two 10-hp pumps (lead/lag). It is a constant speed pumping system that does not provide any automatic variable capacity control and instead relies on pressure reduction valves at the outlet of the pump.

### 3.5.2 Proposed Measure

Supply and install a new high efficiency variable speed booster system to provide constant pressure at variable flow rates in an efficient manner.

### 3.5.3 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback.

ECM-3: DCW Booster Pump Replacement with High Efficiency Variable Speed System

| | |
|---|---|
| Measure Description | Replace the existing fixed speed domestic booster pump system with a new variable flow high efficiency booster pump system. |
| Impact on Occupant Comfort | There may be some adjustment period as the system water pressures are recommissioned. |
| Impact on Operations and Maintenance | This is a new domestic pumping system which should operate reliably for many years compared to the aging system which appeared to experience failures based on audit observations. |

Energy and Financial Summary

| | | | |
|---|---|---|---|
| Total Installation Estimate: | $68,880.00 | Total Utility Bill Savings in Dollars: | $5,579.16 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $5,500.00 | + Additional Annual Savings (Maint): | $0.00 |
| **= Total Investment:** | **$63,380.00** | **= Total Annual Savings Estimate:** | **$5,579.16** |
| Annual Consumption Savings (kWh's): | 52,585.87 | Simple Payback: | 11.4 |
| Annual Demand Savings (kW): | 2.72 | Useful Life (years): | 20 |
| Annual Consumption Savings (GJ's): | - | Return on Investment: | 3.80% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

## 3.6 ECM-4: Replace DHW Tank with Heat Pumps (Qty.2)

### 3.6.1 Existing Conditions

The audit identified three (3) domestic hot water (DHW) tanks in the common areas on the ground floor and on the P1 level serving independent loads. There is a 61-gallon tank in the P-1 janitors' closet/storage room, a 45-gallon tank in the car wash area, and a tank of unknown size in the laundry room located behind the security office.

### 3.6.2 Proposed Measure

PMC proposes the replacement of two of the three existing DHW tanks serving the P-1 janitors' closet/storage room and the car wash area with heat pump water heaters (HPWH). Switching to HPWH's will yield energy savings through more efficient DHW generation. Based on manufacturer recommendations and PMC's experience with heat pump water heaters, this ECM is not suggested in the laundry room due to conflicting space limitations and ventilation requirements. It may be beneficial for Summer Gardens to implement HPWH's after the useful life of the current DHW tanks, rather than pursuing an immediate replacement.

### 3.6.3 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback. It is difficult to determine the current domestic hot water usage of the car wash area and janitors' closet, due to unconventional applications. The following summary demonstrates the expected energy savings by transitioning an electric DHW tank serving **standard household loads** to a heat pump water heater. Energy savings will vary based on actual DHW consumption.

| ECM-4 - Replace DHW Heaters with Heat Pumps - Qty.2 | |
|---|---|
| Measure Description | Replace a standard electric DHW tank at Summer Gardens with a heat pump water heater. Replacement opportunities include the DHW tanks serving the car wash area and P-1 janitors closet/ storage area. |
| Impact on Occupant Comfort | No change to occupant comfort. |
| Impact on Operations and Maintenance | The heat pump water heater will require a different maintenance procedure than the existing electric DHW tank. |

| Energy and Financial Summary | | | |
|---|---|---|---|
| Total Installation Estimate: | $11,360.00 | Total Utility Bill Savings in Dollars: | $542.88 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $600.00 | + Additional Annual Savings (Maint): | $0.00 |
| **= Total Investment:** | **$10,760.00** | **= Total Annual Savings Estimate:** | **$542.88** |
| Annual Consumption Savings (kWh's): | 5,160.00 | Simple Payback: | 19.8 |
| Annual Demand Savings (kW): | 0.00 | Useful Life (years): | 15 |
| | | Return on Investment: | -1.62% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

***NOTE:*** *Efficiency Nova Scotia offers a Commercial Water Heating Rebate which can allow for up to $800 of each HPWH purchase to be recovered. Efficiency Nova Scotia must be consulted for confirmation of this incentive. For the purposes of this measure summary, a rebate of $600 was applied assuming a 50-gallon HPWH is installed.*

## 3.7 ECM-5 – Rooftop Solar PV Option

### 3.7.1 Existing Conditions

Summer Gardens has a roof area of approximately 6,650 $ft^2$ (after deducting the penthouse area) and combined with the fact that it is a tall building that is not shaded from neighbouring buildings it makes it an opportune location for rooftop solar photovoltaics. This measure analyses the feasibility of rooftop solar and provides high level budgets, and for all intents and purposes it is assumed that 2,800 $ft^2$ of this roof area can be used for solar.

### 3.7.2 Proposed Measure

Install a solar PV system on the roof of 1470 Summer St. Scope includes:

- Supply and install a 47-kW capacity solar PV system.
- Low profile ballasted racking system certified for flat roof.
- Micro inverter and accessories wired to electrical panel and integrated with NS Power net-metering.
- Combiner box and disconnect.
- Crane for lifting materials to roof area.
- Startup and commissioning.

### 3.7.3 Measure Summary

The table below provides a summary of the energy efficiency and conservation measure highlighting the impact in tenant comfort, maintenance requirements, energy savings and financial indicators such as payback.

| ECM-5: Rooftop Solar PV Option | |
|---|---|
| Measure Description | Install solar PV system on roof. Estimated system capacity is 47kW. System will be net-metered with NS Power so that at any time where excess energy is being produced and not used in the building it will be sent exchanged to the grid in the form of credits. |
| Impact on Occupant Comfort | No change to occupant comfort. |
| Impact on Operations and Maintenance | Solar PV will require additional maintenance for inspections and periodic snow removal. |

**Energy and Financial Summary**

| | | | |
|---|---|---|---|
| Total Installation Estimate: | $140,000.00 | Total Utility Bill Savings in Dollars: | $8,491.46 |
| + Eng. & Proj. Mgmt.: | $0.00 | - Additional Annual Costs: | $0.00 |
| - Efficiency NS Incentive (Pending Approvals): | $0.00 | + Additional Annual Savings (Maint): | $0.00 |
| **= Total Investment:** | **$140,000.00** | **= Total Annual Savings Estimate:** | **$8,491.46** |
| Annual Consumption Savings (kWh's): | 50,866.67 | Simple Payback: | 16.5 |
| Annual Demand Savings (kW): | 183.12 | Useful Life (years): | 30 |
| | | Return on Investment: | 2.73% |
| Elect. Consumption Rate - 1st Tier (per kWh): | $0.13817 | Elect. Consumption Rate - 2nd Tier (per kWh): | $0.10521 |
| Electrical Demand Rate (max monthly kW): | $10.554 | | |

NOTE:

- Simple payback and ROI are based on fixed rates and does not account for NS Power annual rate increases.
- Accelerated CCA rate incentives are also available, however, not included in the above analysis.

## 3.8 Additional Opportunities & Recommendations

In addition to the formal ECMs identified and summarized above, PMC also completed a high-level review of other potential opportunities and capital replacement recommendations for consideration.

**Winter Vestibule**

The main entrance to Summer Gardens uses motion-activated double sliding doors and a single manual door for access into the building. These doors open to a small vestibule placed alongside the security office, served by three unit heaters. While on site, it was observed that many residents will stop in the vestibule to chat with the Commissionaire, which frequently causes the automatic sliding doors to open unnecessarily. In the winter, gusts of cold air enter the building each time the main doors are opened increasing the heating load required to maintain comfortable conditions in the vestibule.

PMC examined the concept of a seasonal vestibule outside of the main entrance to Summer Gardens during the winter months, to prevent these gusts of cold air from entering the building. The temporary structure will serve as a barrier against the strong head winds faced by the main entrance. The vestibule will be designed with both cosmetics and accessibility in mind (see examples below), and can be installed/removed by Summer Gardens staff.


Figure 5 - Example Winter Vestibule

As an additional measure, the motion sensors operating the sliding double doors can be replaced with interior and exterior push buttons. This will prevent the doors from opening unnecessarily from accidental motion sensor trips, therefore reducing the amount of cold air entering the space.

**Replace Dectron Unit**

At the time of the inspection the Dectron unit appeared to be functional, and reports indicated that it may have been recently repaired.

The unit is quite old and has exceeded it ASHRAE recommended lifespan. Dectron offers many variations within their product line and there are other options that are more efficient that the current unit. We reached out the Dectron representative and they are providing several efficiency options for review (still pending at time of this report).

In the short term, PMC recommends implementation of ECM-1 which will provide connection and control over the existing Dectron unit, its duct heater, and the pool heater. ECM-1 also included replacement dampers and new control sequences to maximize the opportunities for cooling or low-cost dehumidification using outdoor air when conditions were favourable. With the new BAS in place additional trend data will allow for more accurate assessment of the current units, functionality and efficiency so that its replacement can be more carefully considered.

**Life Safety Systems**

If not already completed PMC recommends a thorough inspection of the life safety systems observed during our audit. This includes the fire alarming and smoke exhaust system associated with the Penthouse DOAS system as well as the CO/NO system serving the parkade. The dampers associated with the CO/NO system should also be scheduled for replacement. **UPDATE:** The board confirmed that these system have recently been inspected and minor repairs were underway.

## 3.9 ECM Summary Table

| ECM # | Description of Item | Total Annual kWh Savings | Total Annual kW Savings | Total Annual ($) Utility Savings | Additional Costs or Savings ($) | Construction & Engineering Cost ($) | Total Estimated Incentive ($) | Net Project Investment ($) | Life Expectancy (years) | Simple Payback (years) | Return on Investment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | New Building Automation System (BAS), Repairs, Recommissioning | 123,498.62 | 106.88 | $14,825.80 | $0.00 | $159,660.00 | $12,349.86 | $147,310.14 | 20 | 9.94 | 5.06% |
| 1b | Heat Pump Retrofit for Penthouse DOAS | 173,902.65 | 694.70 | $30,207.62 | -$3,000.00 | $625,000.00 | $17,390.27 | $607,609.73 | 20 | 22.33 | -0.52% |
| 1c | Solar Air Preheat for Penthouse DOAS | 67,500.00 | 0.00 | $7,101.68 | -$250.00 | $161,520.00 | $6,750.00 | $154,770.00 | 25 | 22.59 | 0.43% |
| 2 | Parkade Level Heat Pump Retrofit with VRV | 123,498.62 | 106.88 | $14,825.80 | $0.00 | $220,840.00 | $12,349.86 | $208,490.14 | 20 | 14.06 | 2.11% |
| 3 | DCW Booster Pump Replacement with High Efficiency Variable Speed System | 52,585.87 | 2.72 | $5,579.16 | $0.00 | $68,880.00 | $5,500.00 | $63,380.00 | 20 | 11.36 | 3.80% |
| 4 | Replace DHW Heaters with Heat Pumps - Qty.2 | 5,160.00 | 0.00 | $542.88 | $0.00 | $11,360.00 | $600.00 | $10,760.00 | 15 | 19.82 | -1.62% |
| 5 | Rooftop Solar PV Option | 50,866.67 | 183.12 | $8,491.46 | $0.00 | $140,000.00 | $0.00 | $140,000.00 | 30 | 16.49 | 2.73% |
| 6 - HM | Winter Vestibule Enclosure (see pictures) | *Hard to Calculate* | N/A | *Hard to Calculate* | $0.00 | $10,000.00 | *N/A* | $10,000.00 | *Unknown* | *Unknown* | *Unknown* |
| CAP REC | Pool - Replace Dectron Unit | *TBD* | *TBD* | *TBD* | *TBD* | *TBD* | *TBD* | *TBD* | 20 | *TBD* | *TBD* |
| CAP REC | Replace CO/NO System, Replace OA Dampers, Inspect Fans | N/A | N/A | N/A | N/A | *TBD* | N/A | *TBD* | 20 | N/A | N/A |

**Please Note:** Figures shown in red in the table above are budget costs only. These items require further investigation and revisions should the ECM be pursued.

# APPENDIX A – Utility Baseline

PMC ENERGY PERFORMANCE

Summer Gardens

## 2020 ELECTRICAL CONSUMPTION & DEMAND - 1470 Summer St

**METER NUMBER: 1128897** | **Acct No.: 0465129-5**

| Period | 6-Jan-2020<br>6-Feb-2020 | 6-Feb-2020<br>6-Mar-2020 | 6-Mar-2020<br>9-Apr-2020 | 9-Apr-2020<br>11-May-2020 | 11-May-2020<br>5-Jun-2020 | 5-Jun-2020<br>8-Jul-2020 | 8-Jul-2020<br>6-Aug-2020 | 6-Aug-2020<br>4-Sep-2020 | 4-Sep-2020<br>7-Oct-2020 | 7-Oct-2020<br>9-Nov-2020 | 9-Nov-2020<br>7-Dec-2020 | 7-Dec-2020<br>7-Jan-2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2020** | **JAN** | **FEB** | **MAR** | **APR** | **MAY** | **JUN** | **JUL** | **AUG** | **SEP** | **OCT** | **NOV** | **DEC** | **TOTAL** |
| **Days in billing period** | **31** | **29** | **34** | **32** | **25** | **33** | **29** | **29** | **33** | **33** | **28** | **31** | **367** |
| **Consumption (kWh)** | 18,880 | 19,440 | 20,640 | 15,440 | 6,480 | 8,240 | 6,960 | 6,640 | 7,680 | 9,120 | 8,640 | 13,040 | **141,200** |
| **Demand (kW)** | 47.2 | 44.5 | 38.0 | 34.2 | 35.3 | 13.5 | 13.9 | 12.8 | 16.6 | 23.4 | 25.6 | 34.8 | **340** |
| **Energy Cost ($-HST)** | $1,158.85 | $1,092.56 | $932.98 | $839.68 | $795.48 | $331.45 | $341.27 | $314.27 | $407.56 | $574.52 | $628.53 | $1,409.35 | **$8,826.50** |
| **Energy Cost ($-HST)** | $849.32 | $948.28 | $1,173.21 | $773.74 | | $498.43 | $376.07 | $367.08 | $392.27 | $399.47 | $316.69 | | **$6,094.56** |
| **Demand Cost ($-HST)** | $495.46 | $467.12 | $398.89 | $359.00 | $370.54 | $141.71 | $145.91 | $134.36 | $174.25 | $245.63 | $268.72 | $365.30 | **$3,566.89** |
| **Total Cost ($-HST)** | $2,503.63 | $2,507.96 | $2,505.08 | $1,972.42 | $1,166.02 | $971.59 | $863.25 | $815.71 | $974.08 | $1,219.62 | $1,213.94 | $1,774.65 | **$18,487.95** |
| **Average Cost per kWh** | $0.11 | $0.10 | $0.10 | $0.10 | $0.12 | $0.10 | $0.10 | $0.10 | $0.10 | $0.11 | $0.11 | $0.11 | **0.106288304** |
| **Average Cost per kW** | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | **10.4970175** |

**METER NUMBER: 1128898** | **Acct No.: 0115159-6**

| Period | 6-Jan-2020<br>6-Feb-2020 | 6-Feb-2020<br>6-Mar-2020 | 6-Mar-2020<br>9-Apr-2020 | 9-Apr-2020<br>11-May-2020 | 11-May-2020<br>5-Jun-2020 | 5-Jun-2020<br>8-Jul-2020 | 8-Jul-2020<br>6-Aug-2020 | 6-Aug-2020<br>4-Sep-2020 | 4-Sep-2020<br>7-Oct-2020 | 7-Oct-2020<br>9-Nov-2020 | 9-Nov-2020<br>7-Dec-2020 | 7-Dec-2020<br>7-Jan-2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2020** | **JAN** | **FEB** | **MAR** | **APR** | **MAY** | **JUN** | **JUL** | **AUG** | **SEP** | **OCT** | **NOV** | **DEC** | **TOTAL** |
| **Days in billing period** | **31** | **29** | **34** | **32** | **25** | **33** | **29** | **29** | **33** | **33** | **28** | **31** | **367** |
| **Consumption (kWh)** | 113,940 | 100,440 | 108,000 | 82,800 | 38,160 | 39,420 | 24,480 | 23,400 | 33,480 | 67,680 | 71,280 | 93,600 | **796,680** |
| **Demand (kW)** | 228.2 | 221.9 | 207.0 | 176.0 | 199.8 | 110.3 | 86.9 | 71.1 | 92.3 | 187.0 | 201.8 | 201.8 | **1,984** |
| **Energy Cost ($-HST)** | $5,602.77 | $5,448.09 | $5,082.26 | $4,321.15 | $4,684.52 | $2,708.09 | $2,133.57 | $1,745.65 | $2,266.15 | $4,591.22 | $4,954.59 | $9,801.45 | **$53,339.51** |
| **Energy Cost ($-HST)** | $6,144.95 | $5,043.72 | $5,992.00 | $4,282.57 | | $1,561.88 | $638.79 | $825.92 | $1,351.35 | $2,724.29 | $2,781.87 | | **$31,347.34** |
| **Demand Cost ($-HST)** | $2,395.42 | $2,329.28 | $2,172.88 | $1,847.47 | $2,097.30 | $1,157.82 | $912.19 | $746.34 | $968.87 | $1,962.94 | $2,118.29 | $2,118.29 | **$20,827.09** |
| **Total Cost ($-HST)** | $14,143.14 | $12,821.09 | $13,247.14 | $10,451.19 | $6,781.82 | $5,427.79 | $3,684.55 | $3,317.91 | $4,586.37 | $9,278.45 | $9,854.75 | $11,919.74 | **$105,513.94** |
| **Average Cost per kWh** | $0.103 | $0.10 | $0.10 | $0.10 | $0.12 | $0.11 | $0.11 | $0.11 | $0.11 | $0.11 | $0.11 | $0.10 | **0.10813582** |
| **Average Cost per kW** | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | **$10.50** |

## SUMMARY OF TWO METERS

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6-Jan-2020 | 6-Feb-2020 | 6-Mar-2020 | 9-Apr-2020 | 11-May-2020 | 5-Jun-2020 | 8-Jul-2020 | 6-Aug-2020 | 4-Sep-2020 | 7-Oct-2020 | 9-Nov-2020 | 7-Dec-2020 | |
| Period | 6-Feb-2020 | 6-Mar-2020 | 9-Apr-2020 | 11-May-2020 | 5-Jun-2020 | 8-Jul-2020 | 6-Aug-2020 | 4-Sep-2020 | 7-Oct-2020 | 9-Nov-2020 | 7-Dec-2020 | 7-Jan-2021 | |
| 2020 | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTAL |
| Days in billing period | 31 | 29 | 34 | 32 | 25 | 33 | 29 | 29 | 33 | 33 | 28 | 31 | 367 |
| **Consumption (kWh)** | 132,820 | 119,880 | 128,640 | 98,240 | 44,640 | 47,660 | 31,440 | 30,040 | 41,160 | 76,800 | 79,920 | 106,640 | **937,880** |
| **Demand (kW)** | 275.4 | 266.4 | 245.0 | 210.2 | 235.1 | 123.8 | 100.8 | 83.9 | 108.9 | 210.4 | 227.4 | 236.6 | **2,324** |
| **Energy Cost ($-HST)** | $6,761.62 | $6,540.65 | $6,015.24 | $5,160.83 | $5,480.00 | $3,039.54 | $2,474.84 | $2,059.92 | $2,673.71 | $5,165.74 | $5,583.12 | $11,210.80 | **$62,166.01** |
| **Energy Cost ($-HST)** | $6,994.27 | $5,992.00 | $7,165.21 | $5,056.31 | $0.00 | $2,060.31 | $1,014.86 | $1,193.00 | $1,743.62 | $3,123.76 | $3,098.56 | $1,409.35 | **$38,851.25** |
| **Demand Cost ($-HST)** | $2,890.88 | $2,796.40 | $2,571.77 | $2,206.47 | $2,467.84 | $1,299.53 | $1,058.10 | $880.70 | $1,143.12 | $2,208.57 | $2,387.01 | $2,483.59 | **$24,393.98** |
| **Total Cost ($-HST)** | $16,646.77 | $15,329.05 | $15,752.22 | $12,423.61 | $7,947.84 | $6,399.38 | $4,547.80 | $4,133.62 | $5,560.45 | $10,498.07 | $11,068.69 | $15,103.74 | **$125,411.24** |
| **Average Cost per kWh** | $0.10 | $0.10 | $0.10 | $0.10 | $0.12 | $0.11 | $0.11 | $0.11 | $0.11 | $0.11 | $0.11 | $0.12 | **$0.11** |
| **Average Cost per kW** | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | $10.50 | **$10.50** |

**Common Area (sq.ft):** **23,633**

**Energy Index (kWh / sq.ft / year):** **39.685**

# APPENDIX B – Energy Calculations

## Calculation of Energy Consumption by Equipment End-Use

### Lights

| Lights | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Description of ECM** |
| Lighting as per Previous Audit | 56,636.42 | 85.76 | 7.15 | 56,636.42 | 85.76 | 7.15 | 0.00 | 0.00 | |
| Watts per Square Foot (interior only) | | | 0.302 | | | 0.03 | | | |
| | **56,636.42** | **85.76** | **7.15** | **56,636.42** | **85.76** | **7.17** | **0.00** | **0.00** | Annual Savings |
| | | | | | | | 0.000 | | $0.000 |
| | | | | | | | Equiv. GJ's | | |

### Fans - Motor Savings

| Fans - Motor Savings | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Description of ECM** |
| SF-1 - New EC Fan Grid for Penthouse DOAS | 106,872.00 | 146.40 | 12.20 | 80,190.34 | 129.71 | 10.81 | 26,681.66 | 16.69 | ECM-1 - New BAS, Improved Scheduling & Sequence |
| EF-1 - Exhaust Fan for Penthouse DOAS | 49,362.16 | 67.62 | 5.63 | 32,673.43 | 57.81 | 4.82 | 16,688.73 | 9.80 | ECM-1 - New BAS, Add VFD, Improved Scheduling & Sequence |
| Exhaust Fans - Qty.14 | 19,805.35 | 35.39 | 5.90 | 16,778.23 | 36.47 | 6.08 | 3,027.12 | -1.09 | ECM-1 - New BAS, Improved Scheduling & Sequence |
| Unit Heater Fans | 2,422.85 | 7.14 | 1.02 | 2,198.16 | 6.63 | 0.95 | 224.69 | 0.51 | ECM-2 - New VRV System (for Unit Heaters at Rear Entrance) |
| AH-1 | 7,921.16 | 10.85 | 0.90 | 6,657.60 | 9.12 | 0.76 | 1,263.56 | 1.73 | ECM-2 - New VRV System to Replace AH-1 |
| AH-2 | 0.00 | 0.00 | 0.00 | 6,657.60 | 9.12 | 0.76 | -6,657.60 | -9.12 | ECM-2 - New VRV System to Replace AH-2 (hasn't been workgin in a while!) |
| | **186,383.52** | **267.40** | **25.66** | **145,155.35** | **248.87** | **24.17** | **41,228.17** | **18.53** | Annual Savings |
| | | | | | | | 148.421 | | $4,655.252 |
| | | | | | | | Equiv. GJ's | | |

### Pumps - Motor Savings

| Pumps - Motor Savings | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Description of ECM** |
| Pool Pump 1-hp | 8,378.15 | 11.48 | 0.96 | 8,378.15 | 11.48 | 0.96 | 0.00 | 0.00 | ECM-1 Connect to BAS for Demand Limiting |
| Domestic Booster Pumps | 63,723.38 | 100.02 | 8.34 | 11,137.51 | 97.30 | 8.11 | 52,585.87 | 2.72 | ECM-3 - New Booster Pumps |
| | **72,101.53** | **111.50** | **9.29** | **19,515.66** | **108.78** | **9.07** | **52,585.87** | **2.72** | Annual Savings |
| | | | | | | | 189.309 | | $5,579.162 |
| | | | | | | | Equiv. GJ's | | |

### Ventilation

$8,569.383

| Ventilation | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Description of ECM** |
| Penthouse DOAS - BAS Upgrades and Damper Retrofit | 317,071.44 | 1,054.70 | 162.00 | 257,849.72 | 949.23 | 162.00 | 59,221.72 | 105.47 | ECM-1 - New BAS, Dampers, Etc.. |
| ECM-1 plus ECM-1b (upgrade to A.I.R Heat Pump) | - | - | - | 143,168.79 | 360.00 | 40.00 | 173,902.65 | 694.70 | ECM-1b - Upgrade to A.I.R Heat Pump |
| ECM-1 plus ECM-1c (Matrix Air Preheat) | - | - | - | 0.00 | 0.00 | | 67,500.00 | 0.00 | ECM-1c - Matrix AIR Preheat |
| AH-1 - Ground Floor Lobby, Maint, Locker Rooms, Gym | 132,613.16 | 259.23 | 49.38 | 18,912.02 | 95.10 | 9.26 | 113,701.14 | 164.12 | ECM-2 - New ERV and VRV Head to Replace AH-1 and EF-5 |
| AH-2 - Storage Area | 0.00 | 0.00 | 0.00 | 6,835.43 | 24.13 | 0.77 | -6,835.43 | -24.13 | ECM-2 - Replace Inactive AH-2 with new VRV Head and Mixing Box |
| | **449,684.60** | **1,313.93** | **211.38** | **426,765.95** | **1,428.47** | **212.03** | **407,490.09** | **940.16** | Annual Savings |
| | | | | | | | 1,466.964 | | $58,992.017 |
| | | | | | | | Equiv. GJ's | | |

### Heating

| Heating | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Description of ECM** |
| Space Heating for HUH's, CUH's and Misc BB's | 87,722.88 | 360.00 | 60.00 | 83,279.49 | 360.00 | 60.00 | 4,443.39 | 0.00 | ECM-1 - Add Heaters to new BAS and Setback |
| Space Heating for CUH-6 | 20,470.10 | 112.00 | 14.00 | 8,529.21 | 112.00 | 14.00 | 11,940.89 | 0.00 | ECM-2 - New VRV System to Replace CUH-6 |
| Pool Water Heating | 27,867.00 | 156.00 | 30.00 | 18,450.00 | 180.00 | 30.00 | 9,417.00 | -24.00 | ECM-1 - Add to BAS for Demand Management |
| Jacuzzi Heater | 2,730.00 | 84.00 | 14.00 | 2,730.00 | 84.00 | 14.00 | 0.00 | 0.00 | |
| Mini-Split in Lounge / Lobby Areas - Qty.2 (H&C) | 7,416.96 | 36.36 | 3.03 | 7,416.96 | 36.36 | 3.03 | 0.00 | 0.00 | |
| Sauna Heaters (Qty.3 in Total) | 10,000.00 | 60.00 | 10.00 | 10,000.00 | 60.00 | 10.00 | 0.00 | 0.00 | |
| ~~Space Heating for Pool Area~~ | | | | | | | 0.00 | 0.00 | |
| | **156,206.93** | **808.36** | **131.03** | **130,405.65** | **832.36** | **131.03** | **25,801.28** | **-24.00** | Annual Savings |
| | | | | | | | 92.885 | | $2,303.049 |
| | | | | | | | Equiv. GJ's | | |

### Cooling

| Cooling | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Description of ECM** |

## Calculation of Energy Consumption by Equipment End-Use

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dectron - Pool Deck Cooling and Dehumidification | 17,273.00 | 119.76 | 9.98 | 13,254.00 | 119.76 | 9.98 | 4,019.00 | 0.00 | ECM-1 - Add Dectron to BAS, Update SP's, Purge Functionality |
| VRV Cooling for VRV IDU replacing CUH-6, Gym | 0.00 | 0.00 | 0.00 | 3,466.72 | 8.67 | 2.17 | -3,466.72 | -8.67 | ECM-2 - New VRV System to Rpelace CUH-6 and Add Cooling to Gym |
| | **17,273.00** | **119.76** | **9.98** | **16,720.72** | **128.43** | **12.15** | **552.28** | **-8.67** | **Annual Savings** |
| | | | | | | | **1.988** | | **-$90.496** |
| | | | | | | | **Equiv. GJ's** | | |

### Hot Water

| Hot Water | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | Description of ECM |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | |
| Electric DHW Heater x Qty.3 - See Claire's Estimate | 10,482.00 | 54.00 | 4.50 | 5,322.00 | 54.00 | 4.50 | 5,160.00 | - | ECM-4 - Heat Pump DHW Tank for Two of the Three Commmon Area Tanks |
| | **10,482.00** | **54.00** | **4.50** | **5,322.00** | **54.00** | **4.50** | **5,160.00** | **0.00** | **Annual Savings** |
| | | | | | | | **18.576** | | **$542.884** |
| | | | | | | | **Equiv. GJ's** | | |

### Miscellaneous

| Miscellaneous | Pre-Project Energy | | | Post-Project Energy | | | Annual Savings | | Description of ECM |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment Description** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | **Monthly Demand kW** | **Consumption (kWh/yr)** | **Demand (kW/yr)** | |
| Elevator | 46,169.07 | 314.54 | 26.21 | 46,169.07 | 314.54 | 26.21 | 0.00 | 0.00 | |
| Portable Dehum Units - Qty.3 | 3,077.95 | 7.65 | 1.53 | 0.00 | 0.00 | 0.00 | 3,077.95 | 7.65 | ECM-2 - Will provide dehum so these are not necessary |
| | **49,247.01** | **322.19** | **27.74** | **46,169.07** | **314.54** | **26.21** | **3,077.95** | **7.65** | **Annual Savings** |
| **Calculated TOTAL(s):** | **998,015.02** | **2,466.32** | | **846,690.84** | **2,560.97** | | **535,895.62** | **936.39** | **$72,436.930** |
| **Actual Utility Baseline:** | 937,880.00 | 2,323.90 | | | | | **151,324.18** | **-94.65** | **kWh and kW Savings** |
| **Percent of Actual:** | 106.41% | 106.13% | | | | | | | |
| **Difference:** | 60,135.02 | 142.42 | | | | | | | |

| | Consumption (kWh) | (Demand kW) |
|---|---|---|
| **Calculated Totals:** | 998,015.02 | 2,466.32 |
| **Proposed Baseline (2020):** | 937,880.00 | 2,323.90 |
| **Percent of Actual:** | 106.41% | 106.13% |

# DOAS Fan Energy

## Current Energy Use

*Nominal HP* — *Peak of 15kW (23-amp)

***SF-1 - Penthouse DOAS*** — -

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| - | 12.200 | 8760 | 106,872 |

kw = (hp*0.746) / (%EF)

Load Profile & Projected Annual Energy Use

| Flow | % of Time | Run Hours | kWh | | Weighted Demand |
|---|---|---|---|---|---|
| 100% | 100% | 8,760 | 106,872 | | 12.20 |
| 90% | 0% | 0 | 0 | | 10.98 |
| 80% | 0% | 0 | 0 | | 9.76 |
| 70% | 0% | 0 | 0 | | 8.54 |
| 60% | 0% | 0 | 0 | | 7.32 |
| 50% | 0% | 0 | 0 | | 6.10 |
| 40% | 0% | 0 | 0 | | 4.88 |
| 30% | 0% | 0 | 0 | | 3.66 |
| 20% | 0% | 0 | 0 | | 2.44 |
| 10% | 0% | 0 | 0 | | 1.22 |
| 0% | 0% | 0 | 0 | | 0.00 |
| | **100%** | **8,760** | **106,872** | **W.AVG:** | **12.20** |

*7.5 Nominal HP*

***EF-1 - Penthouse DOAS*** — 6.7 *bhp*

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 88.7% | 5.635 | 8760 | 49,362 |

kw = (hp*0.746) / (%EF)

Load Profile & Projected Annual Energy Use

| Flow | % of Time | Run Hours | kWh | | Weighted Demand |
|---|---|---|---|---|---|
| 100% | 100% | 8,760 | 49,362 | | 5.63 |
| 85% | 0% | 0 | 0 | | 4.79 |
| 80% | 0% | 0 | 0 | | 4.51 |
| 70% | 0% | 0 | 0 | | 3.94 |
| 60% | 0% | 0 | 0 | | 3.38 |
| 50% | 0% | 0 | 0 | | 2.82 |
| 40% | 0% | 0 | 0 | | 2.25 |
| 30% | 0% | 0 | 0 | | 1.69 |
| 20% | 0% | 0 | 0 | | 1.13 |
| 10% | 0% | 0 | 0 | | 0.56 |
| 0% | 0% | 0 | 0 | | 0.00 |
| | **100%** | **8,760** | **49,362** | **W.AVG:** | **5.63** |

| | kWh | kW |
|---|---|---|
| **TOTALS:** | **156,234** | **17.8** |

## Proposed Energy Use

*Nominal HP*

***SF-1 - Penthouse DOAS*** — -

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| - | 12.200 | 8760 | 106,872 |

kw = (hp*0.746) / (%EF)

Load Profile & Projected Annual Energy Use

| Flow | % of Time | Run Hours | kWh | | Weighted Demand |
|---|---|---|---|---|---|
| 100% | 62% | 5,431 | 66,261 | | 12.20 |
| 90% | 0% | 0 | 0 | | 10.98 |
| 80% | 0% | 0 | 0 | | 9.76 |
| 70% | 38% | 3,329 | 13,930 | | 8.54 |
| 60% | 0% | 0 | 0 | | 7.32 |
| 50% | 0% | 0 | 0 | | 6.10 |
| 40% | 0% | 0 | 0 | | 4.88 |
| 30% | 0% | 0 | 0 | | 3.66 |
| 20% | 0% | 0 | 0 | | 2.44 |
| 10% | 0% | 0 | 0 | | 1.22 |
| 0% | 0% | 0 | 0 | | 0.00 |
| | **100%** | **8,760** | **80,190** | **W.AVG:** | **10.81** |

*7.5 Nominal HP*

***EF-1 - Penthouse DOAS*** — 6.7 *bhp*

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 89% | 5.635 | 8760 | 49,362 |

kw = (hp*0.746) / (%EF)

Load Profile & Projected Annual Energy Use

| Flow | % of Time | Run Hours | kWh | | Weighted Demand |
|---|---|---|---|---|---|
| 95% | 62% | 5,431 | 26,240 | | 5.35 |
| 90% | 0% | 0 | 0 | | 5.07 |
| 80% | 0% | 0 | 0 | | 4.51 |
| 70% | 38% | 3,329 | 6,434 | | 3.94 |
| 60% | 0% | 0 | 0 | | 3.38 |
| 50% | 0% | 0 | 0 | | 2.82 |
| 40% | 0% | 0 | 0 | | 2.25 |
| 30% | 0% | 0 | 0 | | 1.69 |
| 20% | 0% | 0 | 0 | | 1.13 |
| 10% | 0% | 0 | 0 | | 0.56 |
| 0% | 0% | 0 | 0 | | 0.00 |
| | **100%** | **8,760** | **32,673** | **W.AVG:** | **4.82** |

| | kWh | kW |
|---|---|---|
| **TOTALS:** | **112,864** | **15.6** |

| Current Energy Use | | | |
|---|---|---|---|
| | | | *Nominal HP* |
| *AH-1* | | | 1.0 |
| Eff. | kW | Run Hours | kWh |
| 83% | 0.904 | 8760 | 7,921 |

kw = (hp*0.746) / (%EF)

| | | | | |
|---|---|---|---|---|
| | | | *Nominal HP* | |
| *AH-2* | | | 1.0 | *bhp* |
| Eff. | kw | Run Hours | kWh | |
| 83.0% | 0.899 | 0 | 0 | |

kw = (hp*0.746) / (%EF)

| Proposed Energy Use | | | |
|---|---|---|---|
| | | | *Nominal HP* |
| *AH-1 - Replace with VRV Unit* | | | - |
| Eff. | kW | Run Hours | kWh |
| - | 0.760 | 8760 | 6,658 |

kw = (hp*0.746) / (%EF)

| | | | | |
|---|---|---|---|---|
| | | | *Nominal HP* | |
| *AH-2 - Replace with VRV Unit* | | | - | *bhp* |
| Eff. | kw | Run Hours | kWh | |
| - | 0.760 | 8760 | 6,658 | |

kw = (hp*0.746) / (%EF)

# Exhuast Fan Energy

**Current Energy Use**

| | kWh | kW |
|---|---|---|
| EF-2 - Dryer Exhaust | 6,283.62 | 0.72 |
| EF-3 - Dryer Exhaust | 6,283.62 | 0.72 |
| RE-1 - Roof Exhauster | 0.00 | 0.24 |
| RE-2 - Roof Exhauster | 0.00 | 0.24 |
| RE-3 - Roof Exhauster | 1,075.96 | 0.72 |
| EF-4 - Garbage Rm Exhaust | 2,094.54 | 0.24 |
| EF-5 - Exhaust for AH-1 | 2,792.44 | 0.32 |
| EF-6 - Parkade Exhaust CO/NO | 159.39 | 0.32 |
| EF-7 - Parkade Exhaust CO/NO | 159.39 | 0.32 |
| EF-8 - Parkade Exhaust CO/NO | 239.10 | 0.48 |
| EF-9 - Parkade Exhaust CO/NO | 239.10 | 0.48 |
| EF-10 - Parkade Exhaust CO/NO | 239.10 | 0.48 |
| EF-11 - P1 Electrical Vault Exhaust | 239.10 | 0.32 |
| EF-12 - Ground Floor Lounge Exhaust | 0.00 | 0.32 |
| **TOTAL(s)** | **19,805.35** | **5.90** |

**Proposed Energy Use**

| | kWh | kW |
|---|---|---|
| EF-2 - Dryer Exhaust | 3,916.50 | 0.72 |
| EF-3 - Dryer Exhaust | 3,916.50 | 0.72 |
| RE-1 - Roof Exhauster | 0.00 | 0.24 |
| RE-2 - Roof Exhauster | 119.55 | 0.24 |
| RE-3 - Roof Exhauster | 1,075.96 | 0.72 |
| EF-4 - Garbage Rm Exhaust | 2,094.54 | 0.24 |
| EF-5 - Exhaust for AH-1 | 4,380.00 | 0.50 |
| EF-6 - Parkade Exhaust CO/NO | 159.39 | 0.32 |
| EF-7 - Parkade Exhaust CO/NO | 159.39 | 0.32 |
| EF-8 - Parkade Exhaust CO/NO | 239.10 | 0.48 |
| EF-9 - Parkade Exhaust CO/NO | 239.10 | 0.48 |
| EF-10 - Parkade Exhaust CO/NO | 239.10 | 0.48 |
| EF-11 - P1 Electrical Vault Exhaust | 239.10 | 0.32 |
| EF-12 - Ground Floor Lounge Exhaust | 0.00 | 0.32 |
| **TOTAL(s)** | **16,778.23** | **6.08** |

## Current

***EF-2 - Dryer Exhaust*** — HP **0.750**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.72 | **8760** | **6,284** |

kw = (hp*0.746) / (%EF)

***EF-3 - Dryer Exhaust*** — HP **0.750**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.72 | **8760** | **6,284** |

kw = (hp*0.746) / (%EF)

***RE-1 - Roof Exhauster (Smoke Extraction)*** — HP **0.250**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.24 | **0** | **0** |

kw = (hp*0.746) / (%EF)

***RE-2 - Roof Exhauster Penthouse Exhaust (BROKEN?)*** — HP **0.250**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.24 | **0** | **0** |

kw = (hp*0.746) / (%EF)

***RE-3 - Roof Exhauster Elevator Machine Room*** — HP **0.750**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.72 | **1500** | **1,076** |

kw = (hp*0.746) / (%EF)

***EF-4 - Garbage Rm Exhaust*** — HP **0.250**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.24 | **8760** | **2,095** |

kw = (hp*0.746) / (%EF)

***EF-5 - Exhaust for AH-1*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **8760** | **2,792** |

kw = (hp*0.746) / (%EF)

***EF-6 - Parkade Exhaust CO/NO (BROKEN?)*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **500** | **159** |

kw = (hp*0.746) / (%EF)

***EF-7 - Parkade Exhaust CO/NO (BROKEN?)*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **500** | **159** |

kw = (hp*0.746) / (%EF)

***EF-8 - Parkade Exhaust CO/NO*** — HP **0.500**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.48 | **500** | **239** |

kw = (hp*0.746) / (%EF)

***EF-9 - Parkade Exhaust CO/NO*** — HP **0.500**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.48 | **500** | **239** |

kw = (hp*0.746) / (%EF)

***EF-10 - Parkade Exhaust CO/NO*** — HP **0.500**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.48 | **500** | **239** |

kw = (hp*0.746) / (%EF)

***EF-11 - P1 Electrical Vault Exhaust*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **750** | **239** |

kw = (hp*0.746) / (%EF)

## Proposed

***EF-2 - Dryer Exhaust*** — HP **0.750**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.72 | **5460** | **3,917** |

kw = (hp*0.746) / (%EF)

***EF-3 - Dryer Exhaust*** — HP **0.750**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.72 | **5460** | **3,917** |

kw = (hp*0.746) / (%EF)

***RE-1 - Roof Exhauster (Smoke Extraction)*** — HP **0.250**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.24 | **0** | **0** |

kw = (hp*0.746) / (%EF)

***RE-2 - Roof Exhauster Penthouse Exhaust (BROKEN?)*** — HP **0.250**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.24 | **500** | **120** |

kw = (hp*0.746) / (%EF)

***RE-3 - Roof Exhauster Elevator Machine Room*** — HP **0.750**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.72 | **1500** | **1,076** |

kw = (hp*0.746) / (%EF)

***EF-4 - Garbage Rm Exhaust*** — HP **0.250**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.24 | **8760** | **2,095** |

kw = (hp*0.746) / (%EF)

***EF-5 - Exhaust Replace with ERV*** — HP **-**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| - | 0.50 | **8760** | **4,380** |

kw = (hp*0.746) / (%EF)

***EF-6 - Parkade Exhaust CO/NO (BROKEN?)*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **500** | **159** |

kw = (hp*0.746) / (%EF)

***EF-7 - Parkade Exhaust CO/NO (BROKEN?)*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **500** | **159** |

kw = (hp*0.746) / (%EF)

***EF-8 - Parkade Exhaust CO/NO*** — HP **0.500**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.48 | **500** | **239** |

kw = (hp*0.746) / (%EF)

***EF-9 - Parkade Exhaust CO/NO*** — HP **0.500**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.48 | **500** | **239** |

kw = (hp*0.746) / (%EF)

***EF-10 - Parkade Exhaust CO/NO*** — HP **0.500**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.48 | **500** | **239** |

kw = (hp*0.746) / (%EF)

***EF-11 - P1 Electrical Vault Exhaust*** — HP **0.333**

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | **750** | **239** |

kw = (hp*0.746) / (%EF)

Exhuast Fan Energy

| | | | |
|---|---|---|---|
| *EF-2 - Dryer Exhaust* | | | 0.750 |
| | | | HP |
| *EF-12 - Ground Floor Lounge Exhaust (BROKEN?)* | | | 0.333 |
| **Eff.** | **kw** | **Run Hours** | **kWh** |
| 78% | 0.32 | 0 | 0 |

kw = (hp*0.746) / (%EF)


| | | | |
|---|---|---|---|
| *EF-2 - Dryer Exhaust* | | | 0.750 |
| | | | HP |
| *EF-12 - Ground Floor Lounge Exhaust (BROKEN?)* | | | 0.333 |
| **Eff.** | **kw** | **Run Hours** | **kWh** |
| 78% | 0.32 | 0 | 0 |

kw = (hp*0.746) / (%EF)

Unit Heater Fan Energy

**Current Energy Use**

| | kWh | kW |
|---|---|---|
| HUH-1 - Penthouse | 0.00 | 0.00 |
| HUH-2 - Elevator Machine Room | 0.00 | 0.00 |
| CUH-1 - Front Entrance | 573.85 | 0.19 |
| CUH-2 - Front Entrance | 318.80 | 0.13 |
| CUH-3 Mail Room | 0.00 | 0.00 |
| CUH-4 Delivery Room | 0.00 | 0.00 |
| CUH-5 Rear Entrance | 573.85 | 0.19 |
| CUH-6 Pool Stairwell | 382.56 | 0.19 |
| CUH-7 Pool Area Washrooms | 573.79 | 0.32 |
| **TOTAL(s)** | **2,422.85** | **1.02** |

**Proposed Energy Use**

| | kWh | kW | ECM Summary |
|---|---|---|---|
| HUH-1 - Penthouse | 0.00 | 0.00 | - Add to BAS |
| HUH-2 - Elevator Machine Room | 0.00 | 0.00 | - Add to BAS |
| CUH-1 - Front Entrance | 526.03 | 0.19 | - Add to BAS |
| CUH-2 - Front Entrance | 286.92 | 0.13 | - Add to BAS |
| CUH-3 Mail Room | 0.00 | 0.00 | |
| CUH-4 Delivery Room | 0.00 | 0.00 | |
| CUH-5 Rear Entrance | 573.85 | 0.19 | |
| CUH-6 Pool Stairwell | 237.57 | 0.12 | - Replace with VRV |
| CUH-7 Pool Area Washrooms | 573.79 | 0.32 | - Add to BAS |
| **TOTAL(s)** | **2,198.16** | **0.95** | |

## Current

*Fan Energy Captured in Heating*

***HUH-1 - Penthouse***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | 0 | 0 |

kw = (hp*0.746) / (%EF)

*Fan Energy Captured in Heating*

***HUH-2 - Elevator Machine Room***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | 0 | 0 |

kw = (hp*0.746) / (%EF)

***CUH-1 - Front Entrance*** — HP 0.200

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.19 | 3000 | 574 |

kw = (hp*0.746) / (%EF)

***CUH-2 - Front Entrance*** — Qty.2 @ 1/15-hp Each 0.133

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.13 | 2500 | 319 |

kw = (hp*0.746) / (%EF)

*Fan Energy Captured in Heating*

***CUH-3 Mail Room***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | | 0 |

kw = (hp*0.746) / (%EF)

*Fan Energy Captured in Heating*

***CUH-4 Delivery Room***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | | 0 |

kw = (hp*0.746) / (%EF)

***CUH-5 Rear Entrance*** — HP 0.200

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.19 | 3000 | 574 |

kw = (hp*0.746) / (%EF)

***CUH-6 Pool Stairwell*** — HP 0.200

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.19 | 2000 | 383 |

kw = (hp*0.746) / (%EF)

***CUH-7 Pool Area Washrooms*** — HP 0.333

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | 1800 | 574 |

kw = (hp*0.746) / (%EF)

## Proposed

*Fan Energy Captured in Heating*

***HUH-1 - Penthouse***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | 0 | 0 |

kw = (hp*0.746) / (%EF)

*Fan Energy Captured in Heating*

***HUH-2 - Elevator Machine Room*** — 0.000

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | 0 | 0 |

kw = (hp*0.746) / (%EF)

***CUH-1 - Front Entrance*** — HP 0.200 — Add to BAS

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.19 | 2750 | 526 |

kw = (hp*0.746) / (%EF)

***CUH-2 - Front Entrance*** — HP 0.133 — Add to BAS

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.13 | 2250 | 287 |

kw = (hp*0.746) / (%EF)

*Fan Energy Captured in Heating*

***CUH-3 Mail Room***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | 0 | 0 |

kw = (hp*0.746) / (%EF)

*Fan Energy Captured in Heating*

***CUH-4 Delivery Room***

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.00 | | 0 |

kw = (hp*0.746) / (%EF)

***CUH-5 Rear Entrance*** — HP 0.200

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.19 | 3000 | 574 |

kw = (hp*0.746) / (%EF)

***CUH-6 Pool Stairwell*** — HP 0.124 — VRV - New Head FXAQ24PVJU

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.12 | 2000 | 238 |

kw = (hp*0.746) / (%EF)

***CUH-7 Pool Area Washrooms*** — HP 0.333

| Eff. | kw | Run Hours | kWh |
|---|---|---|---|
| 78% | 0.32 | 1800 | 574 |

kw = (hp*0.746) / (%EF)

| Current Energy Use | | | |
|---|---|---|---|
| ***Pool Pump*** | | | **1.0** |
| **Eff.** | **kw** | **Run Hours** | **kWh** |
| 78% | 0.956 | **8760** | **8,378** |

kw = (hp*0.746) / (%EF)

| | | | **HP** |
|---|---|---|---|
| ***Booster Pump*** | | | **10.00** |
| **Eff.** | **kw** | **Run Hours** | **kWh** |
| 90% | 8.335 | **8760** | **73,016** |

kw = (hp*0.746) / (%EF)

| Proposed Energy Use | | | |
|---|---|---|---|
| ***Pool Pump*** | | | **1.0** |
| **Eff.** | **kw** | **Run Hours** | **kWh** |
| 78% | 0.956 | **8760** | **8,378** |

kw = (hp*0.746) / (%EF)

| | | | **HP** |
|---|---|---|---|
| ***Booster Pump*** | | | **10.0** |
| **Eff.** | **kw** | **Run Hours** | **kWh** |
| 92% | 8.109 | **5000** | **40,543** |

kw = (hp*0.746) / (%EF)

# DOMESTIC WATER PRESSURE BOOSTER SYSTEM

| EQUIP. NO. | SERVICE LOCATION | NO. OF PUMPS | GPM/EA PUMP | SYSTEM PRESSURE VALUES | | | | MOTOR DATA AND VALUES | | | CONTROL PANEL | | | | REMARKS | DESIGN BASIS MODEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TDH [Feet] | SUCTION [PSI] | BOOST [PSI] | SET [PSI] | RPM | HP | kWh PER YR. | VOLTAGE | PHASE | FULL LOAD | MAX. SCCR | | |
| | | 2 | 45 | 180 | 35 | 77.92 | 112.92 | 3,450 | 5 | 11137.51 | 575 | Three Phase | 12.4 | 100KAIC | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,11 | QUANTUMFLO-35205: GENIUS DUPLEX QVD_ 10/5 |

1. NET BOOST PRESSURE IS CALCULATED BY SYSTEM SET PRESSURE MINUS SUCTION PRESSURE LESS SYSTEM LOSSES OF 5 PSI
2. SYSTEM SUBMITTALS SHALL INCLUDE CERTIFICATE NUMBER FOR NSF61 CERTIFICATION, UL508A AND QCZJ 3RD PARTY COMPLIANCE.
3. SYSTEM CONTROLS MUST COMPLY WITH AND PROVIDE FOR EITHER CONTROL LOGIC OR REMOTE SENSOR IN ACCORDANCE WITH ANSI/ASHRAE/IES STANDARD 90.1 ENERGY STANDARD
4. PROVIDE 5-YEAR WARRANTY ON COMPLETE SYSTEM AND INCLUDE WARRANTY CERTIFICATE WITH DETAILS IN SUBMITTALS
5. SYSTEM SHALL BE PRE-SET TO SYSTEM SITE CONDITIONS BY SIMULATING SUCTION PRESSURE. HYDROSTATIC-ONLY TESTING IS NOT ACCEPTABLE.
6. THE INDUSTRIAL CONTROLLER SHALL BE IN COMPLIANCE WITH CURRENT NEC, SECTION 409.110 HAVING A MAXIMUM 100K AVAILABLE FAULT CURRENT.
7. SCCR RATINGS MUST BE INCLUSIVE OF ALL COMPONENTS WITHIN THE ENCLOSURE WITHOUT THE NEED TO PROVIDE ADDITIONAL UPSTREAM PROTECTION.
8. EQUAL SYSTEMS MUST SHOW MATHEMATICAL ANALYSIS PROVING THAT THE ALTERNATE SUPPLIER MEETS OR EXCEEDS THE KW CAPACITY LISTED.
9. PROVIDE THE FOLLOWING OPTIONS: GENERAL ALARM DRY CONTACT RELAY; MONITORS: SENSOR FAIL, LOW SUCTION/LEVEL & HIGH SYSTEM AND VFD FAULTS, PERMISSIVE RUN INPUT. REQUIRES BMS DRY CONTACT RELAY. ALLOWS THE SYST
10. REPRESENTATIVE: ENVIROAIR INDUSTRIES, INC.. PHONE: (514) 738-9865
11. BASED ON PROJECT: 1470 SUMMER STREET (035205)

## BASE CASE Energy Use

**Based on Sample Airflow Tests:** 15,940
**Design Supply Airflow Rate:** 20,200
**Design Exhaust Airflow Rate:** 21,500

| Hrs per Day |
|---|
| 24.0 |

Fresh-Air Replacement - Sensible Heating Load

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 1,118,964.60 | 15,940 | 66 | 1 | 327.94 |

Sensible Heating Load — 118.1

| Q (Btu/hr) | Operating Hours |
|---|---|
| 1,118,964.60 | 24.0 |

Annual Cost for Electric

| Efficiency | HDD (66F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 7,274 | 66 | 1 | 880,754.00 |

Annual Cost for Heat Pump

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 17.07 | -17 | 19 | 4,041 | 176,047.23 |

**Total Annual Heating kWh's:** 880,754.00

**ERV Effectiveness:** 64%
**Total Annual Heating kWh's:** 317,071.44

**AIR HP Total Annual Heating kWh's:** 176,047.23

## Proposed Energy Use - Daytime Hours

**Based on Sample Airflow Tests:** 15,940 15,940
**Design Supply Airflow Rate:** 20,200
**Design Exhaust Airflow Rate:** 21,500

| Hrs per Day |
|---|
| 15.0 |

Fresh-Air Replacement - Sensible Heating Capacity

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 1,118,988.00 | 15,940 | 66 | 1 | 327.94 |

Sensible Heating Load

| Q (Btu/hr) | Operating Hours |
|---|---|
| 1,118,988.00 | 15.0 |

Annual Cost for Electric

| Efficiency | HDD (66F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 7,274 | 66 | 1 | 550,482.76 |

Annual Cost for Heat Pump

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 17.07 | -17 | 19 | 4,041 | 110,034.26 |

64.44 **Total Annual Heating kWh's:** 550,482.76

**Heat Coil Effectiveness:** 64%
**Total Annual Heating kWh's:** 198,173.79

**AIR HP Total Annual Heating kWh's:** 110,034.26

| | F - HDD | C - HDD |
|---|---|---|
| To convert °F HDD to °C HDD: °C HDD = (5/9) x (°F HDD | 7559.0 | 4199.4 |
| To convert °C HDD to °F HDD: °F HDD = (9/5) x (°C HDD | 5761.6 | 3200.9 |

## Proposed Energy Use - After Hours

**Based on Sample Airflow Tests:** 15,940 8,000
**Design Supply Airflow Rate:** 20,200
**Design Exhaust Airflow Rate:** 21,500

| Hrs per Day |
|---|
| 9.0 |

Fresh-Air Replacement - Sensible Heating Capacity

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 561,600.00 | 8,000 | 66 | 1 | 164.59 |

Sensible Heating Load

| Q (Btu/hr) | Operating Hours |
|---|---|
| 561,600.00 | 9.0 |

Annual Cost for Electric

| Efficiency | HDD (66F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 7,274 | 66 | 1 | 165,766.45 |

Annual Cost for Heat Pump

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 17.07 | -17 | 19 | 4,041 | 33,134.53 |

64.44 **Total Annual Heating kWh's:** 165,766.45

**Heat Coil Effectiveness:** 64%
**Total Annual Heating kWh's:** 59,675.92

**AIR HP Total Annual Heating kWh's:** 33,134.53

| | F - HDD | C - HDD |
|---|---|---|
| To convert °F HDD to °C HDD: °C HDD = (5/9) x (°F HDD | 7559.0 | 4199.4 |
| To convert °C HDD to °F HDD: °F HDD = (9/5) x (°C HDD | 7273.6 | 4040.9 |

# Ventilation Air AH-1

## BASE CASE Energy Use - Heating Only

AH-1 Flow (per dwg's) : 2,400
EF-5 Flow (per dwg's): 2,100

| Hrs per Day |
|---|
| 24.0 |

**Fresh-Air Replacement - Sensible Heating Load**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 168,480.00 | 2,400 | 66 | 1 | 49.38 |

**Sensible Heating Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 168,480.00 | 24.0 |

**Annual Cost for Electric**

| Efficiency | HDD (66F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 7,274 | 66 | 1 | 132,613.16 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 8.19 | -17.2 | 19 | 4,041 | 55,247.61 |

**Fresh-Air Replacement - Latent Load - Dehumidication**

| Q (Btu/hr) | Total cfm | H1 | H2 | Q (kW) |
|---|---|---|---|---|
| | 2,400 | 0.0138 | 0.0085 | 0.00 |

**Latent Load - Dehumidication**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 0.00 | 24.0 |

**Annual Cost for Chiller**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 0.00 |

**Fresh-Air Replacement**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| | 2,400 | 72 | 83 | 0.00 |

**Cooling Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 0.00 | 24.0 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 0.00 |

**Total Annual Cooling kWh:** 0.00
**Total Annual Heating kWh's:** 132,613.16

## Proposed Energy Use - Replace Unit with VRV HP & ERV

AH-1 Flow (per dwg's) : 2,400 2,400
EF-5 Flow (per dwg's): 2,100

| Hrs per Day |
|---|
| 24.0 |

**Fresh-Air Replacement - Sensible Heating Capacity**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 168,480.00 | 2,400 | 66 | 1 | 49.38 |

**Sensible Heating Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 168,480.00 | 24.0 |

**Annual Cost for Electric**

| Efficiency | HDD (7F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 22 | 7 | -1 | 395.64 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 8.19 | -17.2 | 19 | 4,041 | 55,248.83 |

9.257142857 kW of HP

**Fresh-Air Replacement - Latent Load - Dehumidication**

| Q (Btu/hr) | Total cfm | H1 | H2 | Q (kW) |
|---|---|---|---|---|
| 61,564.80 | 2,400 | 0.0138 | 0.0085 | 18.04 |

**Latent Load - Dehumidication**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 61,564.80 | 24.0 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 1,776.77 |

5.261948718 kW of Heat Pump

**Fresh-Air Replacement**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 29,040.00 | 2,400 | 72 | 83 | 8.51 |

**Cooling Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 29,040.00 | 24.0 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 838.10 |

**Total Annual Cooling kWh:** 2,614.87
**$134.31013431** **Total Annual Heating kWh's:** 55,248.83

**Heat Coil Effectiveness:** 68%
**Total Annual Cooling kWh:** 836.76
**Total Annual Heating kWh's:** 18,075.26

# Ventilation Air AH-2

## BASE CASE Energy Use - Heating Only

AH-2 Flow (per dwg's) : 3,500

Hrs per Day: 0.0

**Fresh-Air Replacement - Sensible Heating Load**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 245,700.00 | 3,500 | 66 | 1 | 72.01 |

**Sensible Heating Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 245,700.00 | 0.0 |

**Annual Cost for Electric**

| Efficiency | HDD (66F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 7,274 | 66 | 1 | 0.00 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 8.19 | -17.2 | 19 | 4,041 | 0.00 |

**Fresh-Air Replacement - Latent Load - Dehumidication**

| Q (Btu/hr) | Total cfm | H1 | H2 | Q (kW) |
|---|---|---|---|---|
| | 3,500 | 0.0138 | 0.0085 | 0.00 |

**Latent Load - Dehumidication**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 0.00 | 0.0 |

**Annual Cost for Chiller**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 0.00 |

**Fresh-Air Replacement**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| | 3,500 | 72 | 83 | 0.00 |

**Cooling Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 0.00 | 0.0 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 0.00 |

**Total Annual Cooling kWh:** 0.00
**Total Annual Heating kWh's:** 0.00

## Proposed Energy Use - Replace Unit with VRV HP & ERV

New OA Flow Rate: 200 200

Hrs per Day: 24.0

**Fresh-Air Replacement - Sensible Heating Capacity**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 14,040.00 | 200 | 66 | 1 | 4.11 |

**Sensible Heating Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 14,040.00 | 24.0 |

**Annual Cost for Electric**

| Efficiency | HDD (66F) | Temp In. (F) | Temp Out (F) | Annual kWh's |
|---|---|---|---|---|
| 100.0% | 7,274 | 66 | 1 | 11,051.10 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | HDD (≤18.9C) | Annual kWh |
|---|---|---|---|---|
| 8.19 | -17.2 | 19 | 4,041 | 4,604.07 |

0.771428571 kW of HP

**Fresh-Air Replacement - Latent Load - Dehumidication**

| Q (Btu/hr) | Total cfm | H1 | H2 | Q (kW) |
|---|---|---|---|---|
| 52,535.30 | 2,048 | 0.0138 | 0.0085 | 15.40 |

**Latent Load - Dehumidication**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 52,535.30 | 24.0 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 1,516.18 |

4.490196239 kW of Heat Pump

**Fresh-Air Replacement**

| Q (Btu/hr) | Total cfm | Temp In. (F) | Temp Out. (F) | Q (kW) |
|---|---|---|---|---|
| 24,780.80 | 2,048 | 72 | 83 | 7.26 |

**Cooling Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 24,780.80 | 24.0 |

**Annual Cost for Heat Pump**

| EER | Temp In. (C) | Temp Out (C) | CDD | Annual kWh |
|---|---|---|---|---|
| 18.60 | 22 | 28 | 134 | 715.18 |

**Total Annual Cooling kWh:** 2,231.36
**$134.31013431** **Total Annual Heating kWh's:** 4,604.07

**Heat Coil Effectiveness:** 0%
**Total Annual Cooling kWh:** 2,231.36
**Total Annual Heating kWh's:** 4,604.07

## BEFORE Annual Heating Cost - HUH's, CUH's Misc BB

*Note: Yellow fields are editable…do not touch any blue fields.*

| | | |
|---|---|---|
| Heater Size (Btu/hr) | 204,911 | *Note: This represents the heat loss or heat requirements of the building. This calculation tool will be inaccurate if the system was initially oversized.* |
| Heater Size (kW) | 60.00 | |
| Indoor Design Temp (°F) | 72 | *72°F is the Standard ASHRAE Design Condition* |
| Outdoor Design Temp (°F) | 1 | *1°F is the Standard ASHRAE Design Condition for Halifax* |
| Heating Degree Days | 5762 | *Must be degree F HDD's* |
| Operating Hours per Day | 18 | |

*Electric*

| | | |
|---|---|---|
| Energy Content (Btu per kW-hr) | 3,412 | |
| Heat Efficiency (%) | 100% | *Electric Efficiency is always 100%* |
| Annual Fuel Use (kWh) | 87,722.88 | |
| Heat Set-Back | 0.00 | |
| REVISED Annual Fuel Use (kWh) | **87,722.88** | |

## AFTER Annual Heating Cost - HUH's, CUH's Misc BB

*Note: Yellow fields are editable…do not touch any blue fields.*

| | | |
|---|---|---|
| Heater Size (Btu/hr) | 204,911 | *Note: This represents the heat loss or heat requirements of the building. This calculation tool will be inaccurate if the system was initially oversized.* |
| Heater Size (kW) | 60.00 | |
| Indoor Design Temp (°F) | 72 | *72°F is the Standard ASHRAE Design Condition* |
| Outdoor Design Temp (°F) | 1 | *1°F is the Standard ASHRAE Design Condition for Halifax* |
| Heating Degree Days | 5762 | *Must be degree F HDD's* |
| Operating Hours per Day | 18 | |

*Electric*

| | | |
|---|---|---|
| Energy Content (Btu per kW-hr) | 3,412 | |
| Heat Efficiency (%) | 100% | *Electric Efficiency is always 100%* |
| Annual Fuel Use (kWh) | 87,722.88 | |
| Heat Set-Back | 4,443.39 | |
| REVISED Annual Fuel Use (kWh) | **83,279.49** | |

## BEFORE Annual Heating Cost - CUH- 6

*Note: Yellow fields are editable…do not touch any blue fields.*

| | | |
|---|---|---|
| Heater Size (Btu/hr) | 47,813 | *Note: This represents the heat loss or heat requirements of the building. This calculation tool will be inaccurate if the system was* |
| Heater Size (kW) | 14.00 | Just CUH-4, CUH-5, CUH-6 |
| Indoor Design Temp (°F) | 72 | *72°F is the Standard ASHRAE Design Condition* |
| Outdoor Design Temp (°F) | 1 | *1°F is the Standard ASHRAE Design Condition for Halifax* |
| Heating Degree Days | 5762 | *Must be degree F HDD's* |
| Operating Hours per Day | 18 | |

*Electric*

| | |
|---|---|
| Energy Content (Btu per kW-hr) | 3,412 |
| Heat Efficiency (%) | 100% |
| Annual Fuel Use (kWh) | 20,470.10 |
| Heat Set-Back | 0.00 |
| REVISED Annual Fuel Use (kWh) | **20,470.10** |

## AFTER Annual Heating Cost - CUH-6

*Note: Yellow fields are editable…do not touch any blue fields.*

| | | |
|---|---|---|
| Heater Size (Btu/hr) | 47,813 | *Note: This represents the heat loss or heat requirements of the building. This calculation tool will be inaccurate if the system was* |
| Heater Size (kW) | 14.00 | Just CUH-4, CUH-5, CUH-6 |
| Indoor Design Temp (°F) | 72 | *72°F is the Standard ASHRAE Design Condition* |
| Outdoor Design Temp (°F) | 1 | *1°F is the Standard ASHRAE Design Condition for Halifax* |
| Heating Degree Days | 5762 | *Must be degree F HDD's* |
| Operating Hours per Day | 18 | |

*Electric*

| | |
|---|---|
| Energy Content (Btu per kW-hr) | 3,412 |
| Heat Efficiency (%) | 240% |
| Annual Fuel Use (kWh) | 8,529.21 |
| Heat Set-Back | 0.00 |
| REVISED Annual Fuel Use (kWh) | **8,529.21** |

## Heat Set-Back - AFTER

**BB Heaters, CUH's and HUH's in Common Areas**

### Building Heat Loss Reduction by Lowering Space Temperature

| | | |
|---|---|---|
| Degree Days below 16°C (DDh) | 3200.89 | |
| No of Months with Monthly Mean Temperature below 15°C | 8 | |
| No. of Days in Heating Season | 243.2 | days |
| Fuel Type | Electric | |
| Recorded Annual Fuel Consumption | 87,723 | kWh |
| % of Annual Consumption for HVAC | 100% | |
| Annual Fuel Consumption for HVAC | 87,723 | kWh |
| Annual Fuel Consumption per DDh | 27 | kWh per DDh |
| Original Space Temperature (T1) | 22 | ºC |
| Reduced Space Temperature (T2) | 20 | ºC |
| Hour per Day at Reduced Temperatures | 8 | hrs |
| Reduction in Heating Degree Days | 162.1333333 | DDh |
| Annual kWh Savings | 4,443.39 | kWh |

# Mini-Split HP

## Current Energy Use

### MS-1 - Lounge Mini-Split

**Cooling Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 15,000.00 | 24.00 |

| Peak kW |
|---|
| 1.52 |

**Annual Cost**

| IEER | Temp In. (C) | Temp Out (C) | CDD (Above 16C) | Annual kWh | Set-Back Annual kWh |
|---|---|---|---|---|---|
| 18.60 | 20 | 28 | 400 | 967.74 | 0.00 |

| Revised Annual kWh |
|---|
| 967.74 |

**Heating Load - Heat Pump**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 18,000.00 | 18.00 |

**Annual Cost**

| EER | Temp Out. (C) | Temp In. (C) | HDD (Below 16C) | Annual kWh | Set-Back Annual kWh |
|---|---|---|---|---|---|
| 9.90 | -17.2 | 21 | 3,201 | 2,740.74 | 0.00 |

| Revised Annual kWh |
|---|
| 2,740.74 |

| | |
|---|---|
| Qty.2 - Total kWh | 7,416.96 |
| Qty.2 - Total Peak kW | 3.03 |

**Heating & Dehumidification Costs due to Evaporation from Swimming Pools**

INPUT
OUTPUT

Pass mouse over cells of base case to view comments
No password for protection

Yellow = input, Blue=results, Green = Info Only
Pass mouse over cells of base case to view comments

| | |
|---|---|
| Water Surface Area (ft2) | 415 |
| Cost of heating fuel ($/MMBtu) | $43.29 |
| Cost of dehumidification fuel ($/kWh) | $0.1477 |

Cost Conversion

| | |
|---|---|
| $0.1477 | $/kWh |
| $43.29 | $/MMBtu |

| | Base | ECM-1 | ECM-1b | ECM-2 | |
|---|---|---|---|---|---|
| Description | | | | | |
| Water temperature (oF) | 90 | 88 | 88 | 88 | |
| Room air temperature (oF) | 83 | 85 | 85 | 85 | |
| Room relative humidity (%) | 60% | 60% | 60% | 60% | (Will be rounded to nearest 10%) |
| Average number of people in pool | 4 | 4 | 4 | 4 | |
| Hours per year uncovered | 8760 | 8760 | 8760 | 8760 | |
| Cost of heating fuel ($/MMBtu) | 43.29 | 43.29 | 43.29 | 43.29 | |
| Cost of dehumidification fuel ($/kWh) | $0.1477 | $0.1477 | $0.1477 | $0.1477 | |
| Occupied Time (% of uncovered hours) | 20% | 20% | 20% | 20% | |
| Efficiency or COP of water heater | 1.00 | 1.00 | 1.00 | 1.00 | |
| Is there dehumidification? | Yes | Yes | Yes | Yes | |
| Efficiency or COP of dehumidification | 2.50 | 2.50 | 2.50 | 2.50 | 1.18 |
| % Latent Heat Recovery (ht pmp dehum) | 70% | 70% | 70% | 70% | |
| Other losses as a percent of total | 15% | 15% | 10% | 10% | |

**CASE 1:**

| | |
|---|---|
| Water temperature (oF) | 88 |
| Room air temperature (oF) | 85 |
| Room relative humidity (%) | 0.6 |
| Average number of people in pool | 4 |
| Hours per year uncovered | 8760 |
| Cost of heating fuel ($/MMBtu) | 43.29 |
| Cost of dehumidification fuel ($/kWh) | 0.1477 |
| Occupied Time (% of uncovered hours) | 0.2 |
| Efficiency or COP of water heater | 1 |
| Is there dehumidification? | Yes |
| Efficiency or COP of dehumidification | 2.5 |
| % Latent Heat Recovery (ht pmp dehum) | 0.7 |
| Other losses as a percent of total | 0.15 |

**HEATING AND DEHUMIDIFICATION DUE TO EVAPORATION FROM POOL SURFACE**

| Case | Indoor Temp oF | Indoor RH % | Water Temp oF | Heating Use MMBtu/yr | Heating Use $/yr | Dehumidification Use kWh/yr | Dehumidification Use $/yr | Heating Savings MMBtu/yr | Heating Savings $/yr | Dehumidification Savings kWh/yr | Dehumidification Savings $/yr | Total Savings $/yr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Base** | **83** | **60%** | **90** | **95** | **$4,116** | **17,273** | **$2,551** | -- | -- | -- | -- | | |
| ECM-1 - New Setpoints | 85 | 60% | 88 | 69 | $2,983 | 12,518 | $1,849 | 26 | $1,133 | 4755 | $702 | $1,835 | 28% |
| ECM-1b - Better Control by BAS (Purge with OA) | 85 | 60% | 88 | 63 | $2,725 | 13,254 | $1,958 | 32 | $1,391 | 4019 | $594 | $1,985 | 23% |

If you get a divide by zero error for dehumidification, enter a non-zero efficiency.

| | | | | | |
|---|---|---|---|---|---|
| **MMBtu/yr** | 95 | **MMBtu/yr** | 69 | **MMBtu/yr** | 63 |
| **eGJ** | 100 | **eGJ** | 73 | **eGJ** | 66 |
| kWh | 27867 | kWh | 20195 | kWh | 18450 |
| $ | **$4,115.90** | $ | **$2,982.83** | $ | **$2,725.06** |

# VRV Cooling IDU's

**NEW Current Energy Use for ECM-4 (CU**

**Cooling Load**

| Q (Btu/hr) | Operating Hours |
|---|---|
| 40,084.00 | 24.00 |

| Peak kW |
|---|
| 2.17 |

**Annual Cost**

| IEER | Temp In. (C) | Temp Out (C) | CDD (Above 16C) | Annual kWh | Set-Back Annual kWh |
|---|---|---|---|---|---|
| 18.50 | 22 | 28 | 400 | 3,466.72 | 0.00 |

| Revised Annual kWh |
|---|
| 3,466.72 |

## Portable Dehum Unit

**Motor** *Single-Phase*

| % EF | PF | Volts | Amps | hp | kW | Run Hours | kWh |
|---|---|---|---|---|---|---|---|
| 100% | 0.87 | 115 | 5.10 | 0.684 | 0.510 | **1,500** | **1,026** |

| | |
|---|---|
| **QTY.:** | **3** |
| **Total kWh:** | **3,077.95** |
| **Total Peak kW:** | **1.53** |

## Elevator

**Qty.2 - 31.3-hp Motors** ***3-Phase***

| % EF | PF | Volts | Amps | hp | kW | Run Hours | kWh |
|---|---|---|---|---|---|---|---|
| 90% | 0.85 | 575 | 31.00 | 31.623 | 26.212 | **1,460** | **46,169** |

**NOTE:** Assume 4-hrs per day total run time (not per motor)