

# ECDM Measure Summary Report 2020





### Measure Details Summary

|  |          | Hydro   | Gas     | Hydro     | o k\\/ / k\\/h   | Gas               | Litility  | Ons      |                  |   |                       | Grants                                  | Pavback              |                               |  |                           |
|--|----------|---------|---------|-----------|------------------|-------------------|-----------|----------|------------------|---|-----------------------|---|----------------------|-------------------------------|--|---------------------------|
|  | kW       | kWh     | m3      | \$        | \$               | \$                | \$        | \$       | Total<br>Savings | Total Sale<br>Price                     | Simple<br>Paybac<br>k | &<br>Incentiv<br>es                     | w/<br>Incentiv<br>es | Life<br>Expectancy<br>(years) | Implementation<br>Duration<br>(months) | GHG Avoided<br>CO2 Tonnes |
| Buildings A to D   |          |         |         |           |                  |                   |           |          |                  |   |                       |   |                      |                               |  |                           |
| ECM-01: LED Lighting Retrofit                            | 82       | 222,930 | (5,429) | \$0       | \$27,287         | -\$2 <i>,</i> 380 | \$24,907  | \$1,591  | \$26,498         | \$194,020                               | 7.32                  | \$13,930                                | 6.80                 | Fixtures 20                   | 10                                     | -1.1                      |
| ECM-02: Convert AHUs to VAV                              | 0        | 135,575 | 4,239   | \$0       | \$16,595         | \$1,858           | \$18,453  | \$0      | \$18,453         | \$300,667                               | 16.29                 | \$11,016                                | 15.70                | 20                            | 6                                      | 13.5                      |
| ECM-03: Control outdoor air w/CO2 sensor                 | 0        | (161)   | 3,284   | \$0       | -\$20            | \$1,440           | \$1,420   | \$0      | \$1,420          | \$5,333                                 | 3.76                  | \$645                                   | 3.30                 | 15                            | 3                                      | 6.2                       |
| ECM-04: Replace DHW heater                               | 0        | 0       | 2,149   | \$0       | \$0              | \$942             | \$942     | \$0      | \$942            | \$53,333                                | 56.61                 | \$430                                   | 56.15                | 25                            | 6                                      | 4.0                       |
| ECM-05: Weather stripping and caulking building envelope | 0        | 0       | 5,099   | \$0       | \$0              | \$2,236           | \$2,236   | \$0      | \$2,236          | \$16,133                                | 7.22                  | \$1,020                                 | 6.76                 | 8                             | 3                                      | 9.6                       |
| FIM-01: Convert RTUs to VAV                              | 0        | 157,426 | 23,578  | \$0       | \$19,269         | \$10,337          | \$29,606  | \$0      | \$29,606         | \$756,667                               | 25.56                 | \$16,523                                | 25.00                | 15                            | 10                                     | 50.8                      |
| FIM-02: Replace aged R22 condensing<br>units             | 0        | 6,806   | 0       | \$0       | \$833            | \$0               | \$833     | \$0      | \$833            | \$21,333                                | 25.61                 | \$510                                   | 25.00                | 15                            | 3                                      | 0.3                       |
| Building E   |          |         | _       |           |                  |                   |           |          |                  | _                                       |                       |   |                      |                               | _                                      |                           |
| ECM-01: LED Lighting Retrofit                            | 4        | 12,258  | (299)   | \$0       | \$1,504          | -\$131            | \$1,373   | \$114    | \$1,487          | \$13,347                                | 8.97                  | \$792                                   | 8.44                 | 8                             | 3                                      | -0.1                      |
| ECM-06: Integrate lighting and FCU                       | 0        | 45.619  | 7.516   | \$0       | \$5.598          | \$3.295           | \$8.892   | \$0      | \$8.892          | \$20.000                                | 2.25                  | \$0                                     | 2.25                 | 8                             | 8                                      | 16.0                      |
| occupancy control  |          | - ,     | ,       |           | 1 - 7            | 1-7               | · · · ·   | , -      | 1 - 7            | , ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |                       | , -                                     | _                    |                               |  |                           |
| Building F to J  | 70       | 101.050 |         | 40        | da4 433          | 64.070            | 420.054   | <u> </u> | 624 470          | 4222.272                                | 44.45                 | 40.000                                  | 40.00                | 5: 1 20                       | 10                                     | 0.4                       |
| ECM-01: LED Lighting Retrofit                            | /0       | 181,656 | (4,157) | \$0<br>¢0 | \$21,423         | -\$1,372          | \$20,051  | \$1,419  | \$21,470         | \$239,373                               | 11.15                 | \$9,908                                 | 10.69                | Fixtures 20                   | 10                                     | -0.4                      |
| ECM-02: Convert AHU to VAV                               | 0        | 103,171 | 10,415  | ŞU        | \$12,167         | \$3,436           | \$15,603  | ŞU       | \$15,603         | \$249,333                               | 15.98                 | \$9,821                                 | 15.35                | 20                            | 10                                     | 23.8                      |
| building envelope  | 0        | 0       | 3,319   | \$0       | \$0              | \$1,095           | \$1,095   | \$0      | \$1,095          | \$10,000                                | 9.13                  | \$664                                   | 8.53                 | 8                             | 3                                      | 6.2                       |
| FIM-03: Replace aged R22 RTUs                            | 0        | 4,833   | 0       | \$0       | \$570            | \$0               | \$570     | \$0      | \$570            | \$75,333                                | 132.16                | \$363                                   | 131.53               | 15                            | 6                                      | 0.2                       |
| Building K   | 1        |         |         |           | · · · · · ·      |                   |           |          |                  | 1                                       |                       |   |                      | -                             | 1                                      |                           |
| ECM-01: LED Lighting Retrofit                            | 10       | 19,351  | (471)   | \$0       | \$2,452          | \$0               | \$2,452   | \$152    | \$2,604          | \$32,953                                | 12.65                 | \$1,556                                 | 12.06                | Fixtures 20                   | 4                                      | -0.1                      |
| ECM-09: Recirculate air Welding Shop                     | 0        | 0       | 0       | \$0       | \$0              | \$0               | \$O       | \$0      | \$0              | \$0                                     |                       | \$0                                     |                      | 8                             | -                                      | 0.0                       |
| Building L   | <b>I</b> |         | ()      | 4.5       | 4                | 4000              | 4.00-     | 4000     | 4                |   |                       | 4                                       |                      |                               | -                                      |                           |
| ECIVI-01: LED Lighting Retrofit                          | 11       | 34,419  | (838)   | Ş0        | \$4,482          | -\$385            | \$4,097   | \$206    | \$4,303          | \$21,787                                | 5.06                  | \$1,544                                 | 4.70                 | Fixtures 20                   | 4                                      | -0.2                      |
| building envelope  | 0        | 0       | 3,583   | \$0       | \$0              | \$1,647           | \$1,647   | \$0      | \$1,647          | \$13,333                                | 8.09                  | \$717                                   | 7.66                 | 8                             | 3                                      | 6.7                       |
| ECM-08: Kitchen Demand Control<br>Ventilation            | 0.0      | 28,780  | 10,001  | \$0       | \$3,748          | \$4,598           | \$8,346   | \$0      | \$8,346          | \$160,000                               | 19.17                 | \$4,159                                 | 18.67                | 15                            | 6                                      | 20.0                      |
| Building M   |          |         |         |           |                  |                   |           |          |                  |   |                       |   |                      |                               |  |                           |
| ECM-01: LED Lighting Retrofit                            | 33       | 91,342  | (2,090) | \$0       | \$11,419         | -\$518            | \$10,901  | \$1,213  | \$12,114         | \$93,727                                | 7.74                  | \$6,984                                 | 7.16                 | Fixtures 20                   | 6                                      | -0.2                      |
| ECM-06: Integrate lighting and FCU                       | 0        | 95,152  | 7,780   | \$0       | \$11.896         | \$1.929           | \$13.824  | \$0      | \$13.824         | \$101.143                               | 7.32                  | \$7,563                                 | 6.77                 | 15                            | 8                                      | 18.5                      |
| occupancy control  |          |         | .,      |           | +,000            | + =,5 =5          | +===,02 : | + •      | + == ,02 +       | + = = = + = + = + = =                   |                       | + , , , , , , , , , , , , , , , , , , , |                      |                               |  |                           |
| Students Residence                                       |          | 70.015  | 14 25 - | 40        | 40.000           | Ac                | 40.01=    | 4-0-5    | 40 700           | A418 155                                | 12.55                 | 40.715                                  | 40.65                |                               |  |                           |
| ECM-01: LED Lighting Retrofit                            | 19       | 70,219  | (1,356) | Ş0        | \$8 <i>,</i> 662 | -\$615            | \$8,047   | Ş736     | \$8,783          | \$115,100                               | 13.11                 | \$3,712                                 | 12.68                | Fixtures 20                   | 6                                      | 0.3                       |
| building envelope  | 0        | 0       | 4,895   | \$0       | \$0              | \$2,220           | \$2,220   | \$0      | \$2,220          | \$16,667                                | 7.51                  | \$979                                   | 7.07                 | -                             | -                                      | 9.2                       |



| Others                                |     |           |        |     |           |  |               |                  |  |                      |       |          |       |             |    |       |
|---------------------------------------|-----|-----------|--------|-----|-----------|--|---------------|------------------|--|----------------------|-------|----------|-------|-------------|----|-------|
| ECM-10: LED Outdoor Lighting Retrofit | 14  | 55,700    | 0      | \$0 | \$6,834   | \$0                                    | \$6,834       | \$2 <i>,</i> 898 | \$9,732                                | \$169,392            | 17.40 | \$6,915  | 16.69 | Fixtures 20 | 4  | 2.3   |
| ECM-07a: Recommissioning Building A   | 0   | 20,908    | 2,625  | \$0 | \$2,559   | \$1,151                                | \$3,710       | \$0              | \$3,710                                | \$25,000             | 6.74  | \$0      | 6.74  | 10          | 1  | 5.8   |
| ECM-07b: Recommissioning Building B   | 0   | 21,748    | 1,351  | \$0 | \$2,662   | \$592                                  | \$3,254       | \$0              | \$3,254                                | \$22,000             | 6.76  | \$0      | 6.76  | 10          | 1  | 3.4   |
| ECM-07b: Recommissioning Building F   | 0   | 27,198    | 3,014  | \$0 | \$3,207   | \$995                                  | \$4,202       | \$0              | \$4,202                                | \$28,000             | 6.66  | \$0      | 6.66  | 10          | 2  | 6.8   |
| ECM-07b: Recommissioning Building H   | 0   | 15,766    | 1,420  | \$0 | \$1,859   | \$469                                  | \$2,328       | \$0              | \$2,328                                | \$15,500             | 6.66  | \$0      | 6.66  | 10          | 1  | 3.3   |
| ECM-07b: Recommissioning Student      | 0   | 0         | 8 230  | ¢Ο  | ŚŊ        | \$3 733                                | \$3 733       | ŚŊ               | \$3 733                                | \$24,833             | 6 65  | ŚŊ       | 6 65  | 10          | 1  | 15 5  |
| Residence                             | 0   | 0         | 0,230  | Ų   | Ψ         | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | <i>43,733</i> | ΨŪ               | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | ŞZ <del>4</del> ,033 | 0.05  | ΨŪ       | 0.05  | 10          | L  | 15.5  |
| OG-01: Carport Solar PV               | 200 | 1,008,950 | 0      | \$0 | \$126,119 | \$0                                    | \$126,119     | \$0              | \$126,119                              | \$2,345,000          | 18.59 | \$0      | 18.59 | 25          | 12 | 41.4  |
| Totals                                | 443 | 2,359,646 | 87,855 | \$0 | \$291,126 | \$36,571                               | \$327,697     | \$8,329          | \$336,026                              | \$5,139,308          | 15.29 | \$99,749 | 15.00 | -           | -  | 261.8 |





### Measure Summary Table

|   |   |   |   |   |   |   |   | Build | ings |   |   |   |           |        |
|---|---|---|---|---|---|---|---|-------|------|---|---|---|-----------|--------|
| Measures  | А | В | С | D | E | F | G | н     | J    | К | L | м | Residence | Others |
| ECM-01: LED Lighting Retrofit                               | х | х | х | х | x | х | х | х     | х    | х | х | х | х         |        |
| ECM-02: Convert AHUs to VAV                                 | х | х |   |   |   |   |   | Х     |      |   |   |   |           |        |
| ECM-03: Control Outdoor Air w/CO2<br>Sensor                 | х |   |   |   |   |   |   |       |      |   |   |   |           |        |
| ECM-04: Replace DHW Heater                                  |   |   | х |   |   |   |   |       |      |   |   |   |           |        |
| ECM-05: Weather Stripping and<br>Caulking Building Envelope | x | x | x | x |   |   | х | x     | х    | x | x |   | х         |        |
| ECM-06: Integrate Lighting and FCU<br>Control               |   |   |   |   | x |   |   |       |      |   |   | x |           |        |
| ECM-07: Recommissioning                                     | х | x |   |   |   | x |   | х     |      |   |   |   | x         |        |
| ECM-08: Kitchen Demand Control<br>Ventilation               |   |   |   |   |   |   |   |       |      |   | x |   |           |        |
| ECM-09: Recirculate Air Welding Shop                        |   |   |   |   |   |   |   |       |      | х |   |   |           |        |
| ECM-10: LEED Outdoor Lighting<br>Retrofit                   |   |   |   |   |   |   |   |       |      |   |   |   |           | х      |
| FIM-01: Convert RTUs to VAV                                 | х | x |   |   |   |   |   |       |      |   |   |   |           |        |
| FIM-02: Replace Aged R22<br>Condensing Units                |   | x |   |   |   |   |   |       |      |   |   |   |           |        |
| FIM-03: Replace Aged R22 RTUs                               |   |   |   |   |   |   | х |       | х    |   |   |   |           |        |
| OG-01: Carport Solar PV                                     |   |   |   |   |   |   |   |       |      |   |   |   |           | х      |



#### Measure Descriptions

The sections below provide a more detailed description for each measure proposed in the Energy Conservation & Demand Management Plan (ECDM).

#### 1.1 ECM-01: LED Lighting Upgrade

Generally, educational facilities benefit greatly from a lighting system upgrade utilizing the most energy efficient lighting models available. Blackstone recommends implementing a variety of energy efficient lighting solutions that impact the energy utilization from the facilities lighting system.

By switching the existing interior and exterior lighting to LED, the facility will save a significant portion of their energy consumption while maintaining or exceeding existing lighting levels. LED lamps and LED fixtures also have a longer lifetime than currently installed fluorescent and compact fluorescent models which will reduce the maintenance costs and time associated with replacement. Incentives are offered through the program by the IESO which will assist project finances.

The proposed upgrades will reduce the facility operating costs associated with maintaining lighting systems due to longer life expectancy. Additional material cost savings will result from premature burnouts during the warranty period. Please see table below for summary of measures per site.

|                   | ECM-01: Lighting Upgra | ade Summary |        |
|-------------------|------------------------|-------------|--------|
| Building          | ECM-01a                | ECM-01b     | ECM-10 |
| А                 | Х                      | Х           |        |
| В                 |                        | Х           |        |
| С                 |                        | Х           |        |
| D                 |                        | Х           |        |
| E                 |                        | Х           |        |
| F                 | Х                      | Х           |        |
| G                 |                        | Х           |        |
| Н                 |                        | Х           |        |
| J                 |                        | Х           |        |
| К                 | Х                      | Х           |        |
| L                 |                        | Х           |        |
| М                 |                        | X           |        |
| STUDENT RESIDENCE | Х                      | X           |        |
| EXTERIOR          |                        |             | Х      |



#### 1.1.1 ECM-01a: New LED Interior Fixtures

The intent of this measure is to replace the existing lighting systems with new, more efficient luminaires with LED and electronic driver technology. This measure is proposed for existing fixtures that are in poor condition and where a new system will improve both illumination and efficiency. Most replacements are installed on a one-for-one basis. Typically, new LED luminaires replace a wide variety of existing incandescent, compact fluorescent and older fluorescent fixtures.

Older red exit signs will be updated to code and replaced with new LED green running man exit signs. The exit signs are illuminated with LED panels. The exit signs will be replaced on a one-for-one replacement basis.

All lamps, ballasts, and fixtures will be disposed of in an environmentally friendly manner. All fluorescent lamps and non-PCB ballasts will be recycled.

#### 1.1.2 ECM-01b: Re-lamp & Re-ballast

The intent of this measure is to replace the existing fluorescent lighting systems with new, more efficient T8-LED, T5HO-LED, T5-LED, and PL-LED lamps and electronic ballasts. This measure is proposed for luminaires that are generally in good condition, and where better performance can be achieved through a cost-effective solution. This lighting measure will be installed on a one-for-one basis.

Re-lamp and re-ballast measures can be implemented on a wide variety of luminaire types and lamp/ballast combinations. Typical lamp lengths of 2', 3' and 4' are replaced with corresponding lower wattage T8, T5HO, and T5 LED lamps and high efficiency electronic ballasts. Likewise, recessed downlights throughout the facilities with existing compact fluorescent pin-type lamps will be replaced with corresponding lower wattage PL-LED lamps and electronic ballasts. Typically, existing fluorescent systems that are five years or older benefit greatly from this upgrade.

#### 1.2 ECM-02: Convert AHUs to VAV

Some AHUs serving Buildings A, B and H are constant volume and can be converted to variable volume.

This measure will include:

- 1. Installation of VAV boxes in ductwork
- 2. Installation of room temperature sensors to control VAV boxes
- 3. Installation of Variable Speed Drivers (VSDs) to control supply and return motor fans speed
- 4. Install static pressure sensor into main ductwork to control SF VSD
- 5. Incorporate all new boxes, room temperature sensors, static pressure sensor and VSD into BAS, including new graphics and sequence of operation

The table below shows AHUs included in this measure.

| Unit     | SF/RF     | Airflow (cfm) | Cooling  | Heating |
|----------|-----------|---------------|----------|---------|
| A-HRU-01 | 20/7.5 HP | 20,000        | DX 40ton | HW      |
| B-S-01   | 7.5/3 HP  | 8,000         | DX 40ton | HW      |
| H-HRU-01 | 20/7.5 HP | 20,000        | DX 40ton | HW      |



#### 1.3 ECM-03: Demand Ventilation

The Outdoor Air Damper of the A-HRU-02 that is serving the old gym can be controlled below minimum position by installing a CO<sub>2</sub> sensor in the return ductwork.

This measure would include:

- 1. Installation of CO<sub>2</sub> sensor in return ductwork
- 2. Incorporate CO<sub>2</sub> sensor into building automation system (BAS), including new graphics and sequence of operation
- 3. Verify operation of outdoor air damper and actuator and replace if needed

#### 1.4 ECM-04: Replace DHW Heater

This measure includes replacing a 610MBH DHW heater installed in building C with a new condensing boiler.

#### 1.5 ECM-05: Weather Stripping and Caulking Building Envelope

Air leakage is defined as the, "uncontrolled migration of conditioned air through the building envelope," caused by pressure differences due to wind, chimney (or stack) effect, and mechanical systems. It has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings.

Blackstone's inspection revealed that there are gaps, cracks and holes in the building envelope; air sealing, weather-stripping and compartmentalization is recommended to eliminate the infiltration and ex-filtration of air to reduce energy loss while improving occupant safety and comfort. This measure will result in fuel savings by lowering heat lost through the building envelope.

#### 1.6 ECM-06: Integrate Lighting and FCUs Occupancy Control

Many occupancy sensors exist within Sault College's newer facilities already and there is an opportunity to expand the controls in buildings E and M to integrate Fan Coil Units (FCUs), which would provide ventilation at each room based upon occupancy. Classrooms occupancy in the summer is well below the fall and winter periods and rooms are being maintained under occupied comfort conditions and most of the time lights are on during the day.

Building E contains nLight enabled devices and is networked accordingly. However, this is not the case for Building M, which will require additional scope of work to network the light fixtures and FCUs to new nLight Controls. The intent is to tie the nLight systems to the BAS via BACnet in order to control both the lighting and FCUs, based upon occupancy. Every room occupancy control will be incorporated into the BAS.



#### 1.7 ECM-07: Recommissioning and Adjust Schedule

The recommissioning effort will include:

- 1. Alarm detection and reporting functions of the BAS for units and areas included in the scope
- Verification checks of all of components of the DDC control system, such as sensors, safeties, time- of-day programs, reset programs and command points. All input/output devices will be verified for proper operation by performing point-to-point tests and will be calibrated where appropriate and documented as verified.
- 3. Verification of VAV boxes (F building) minimum/maximum airflow set points and by-pass damper
- 4. Functional test of the DDC control system operation to confirm all components work as described in the design documents and as-built control drawings.
- 5.

The cost of repairs of faulty sensors, controllers, actuators, etc. is not included in the project cost. Additionally, hours of operation at each AHU will be verified to see if it's matching occupancy of area served by the unit and modify accordingly. Table below shows equipment included in this measure.

| Item | Equipment            |
|------|----------------------|
| 1    | A-HRU-01 to A-HRU-03 |
| 2    | B-AHU-01 to B-AHU-04 |
| 3    | B-S-01 to B-S-03     |
| 4    | H-HRU-01             |
| 5    | F-RTU-O2 to F-RTU-07 |
| 6    | HW System Residence  |

#### 1.8 ECM-08: Kitchen Demand Ventilation system

The intent of this measure is to control the kitchen hood exhaust and ventilation based on kitchen usage. Measuring temperature, steam and smoke in the kitchen hood, the control adjusts the exhaust fan speed accordingly to save both fan energy and conditioned air. The three kitchen hoods at building L are included in this project. As part of this measure Blackstone proposes to:

- 1. Install a kitchen demand ventilation kit (Melink or similar) including:
  - ✓ Control cabinet with I/O processor and keypad
  - ✓ Optic sensor kit and temperature sensors in the kitchen hood
  - $\checkmark$  CAT 5 interconnection between VFD and the controller in the kitchen
- 2. Install VFD at EF and SF of MUA unit
- 3. Incorporate all new equipment into BAS.

#### 1.9 ECM-09: Recirculate Air in Welding Shop

This measure was previously being considered by Sault College prior to Blackstone's ECDM Audit. Please refer to the College for measure details.

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#### 1.10 ECM-10: LED Outdoor Lighting Retrofit

Dark Sky compliance has played a significant role in how designers specifies outdoor lighting. There is a growing body of evidence which links the brightening night sky directly to measurable negative impacts on human health and immune function and on adverse behavioral changes in insect and animal populations. Due to the inherent nature of existing HID technology, it is difficult to control the direction of their light output. The glow that HID lamps emit unfortunately is a large contributor to light pollution.

Blackstone is proposing to replace all remaining HID fixtures to new LED fixtures on a one-for-one replacement basis. New outdoor LED lighting technology can be selected to meet very specific requirements such as improving light levels, safety, and Dark Sky compliance. Another major benefit to LED technology is the economic impact; typically LED fixtures can outperform an equivalent HID while only using 50% of the energy.

#### 1.11 FIM-O1: Convert RTUs to VAV

Some of the RTUs serving Buildings A and B have Energy Recovery Ventilator (ERV), during the site visit Blackstone could verify that some of them were not working. The main idea of this measure is replacing existing Rooftop Units (RTUs) with new more efficient ones (IEER between 17 and 20) with VFD to control Supply Fan (SF) motor speed, modulating gas burner with high turndown ratio, DX cooling coil capable to work at reduced airflow and air economizer.

As part of this measure Blackstone proposes to:

- 1. Remove existing RTU
- 2. Install new RTU according to specifications above
- 3. Install VAV boxes into supply ductwork
- 4. Install room temperature sensors to control VAV boxes
- 5. Incorporate all new boxes, room temperature sensors and RTUs into BAS, including new graphics and sequence of operation

| Unit          | Brand | Model  | Colling (TR) | Heating (Btu/h) |
|---------------|-------|--------|--------------|-----------------|
| A-HVAC-ERV-01 | York  | DM090N | 7.5          | 180,000         |
| A-HVAC-ERV-02 | York  | DM090N | 7.5          | 180,000         |
| A-HVAC-ERV-03 | York  | DM078N | 6.5          | 120,000         |
| A-HVAC-ERV-04 | York  | DM078N | 6.5          | 120,000         |
| A-HVAC-ERV-05 | York  | DM120N | 8.5          | 180,000         |
| B-HVAC-ERV-01 | York  | DM120N | 10           | 240,000         |
| B-HVAC-ERV-02 | York  | DM120N | 10           | 240,000         |
| B-HVAC-ERV-03 | York  | DM120N | 10           | 240,000         |
| B-HVAC-ERV-04 | York  | DM090N | 7.5          | 180,000         |
| B-HVAC-ERV-05 | York  | DM120N | 10           | 240,000         |

Below is the table with RTUs included in the measure.



#### 1.12 FIM-O2: Replace Aged R22 Condensing Units

Replace a couple of aged R22 condensing units (7.5ton each) serving cooling coils AHUs B-S-02 and B-S-03.

#### 1.13 FIM-O3: Replace Aged R22 RTUs

Replace some of the aged R22 RTUs installed at Building G and J. In this measure Blackstone includes the replacement of 5 RTUs 3ton and 1 RTU 5ton.

#### 1.14 OG-O1: Install a Carport Solar PV

Blackstone conducted a simulation using the Helioscope software to gauge the potential for Solar PV at Sault College. Helioscope's design-integrated approach models an array based on its physical design. This along with the software's ability to integrate NSRDB & NREL Meteo data leads to advanced modelling of system effects and enables detailed design and scenario analysis.

Initial assessments of the roof-tops suggested limited space to accommodate Roof-top Solar PV Systems. However, the parking lots provided suitable conditions to accommodate Car-port Canopy Systems that could accommodate Solar PV Systems. The Helioscope model rendered a 1.07 MW car-port system at Sault College with a performance ratio of 84.8%. This car-port system has the potential to generate 1,187 MWh of electricity annually. The details of the Solar PV Systems can be found in the Helioscope reports provided in the following pages.

# **U**HelioScope

### Design 1 Sault College, 443 Northern Ave E, Sault Ste. Marie, ON P6B 4J3

| 🖋 Report           |   |
|--------------------|---|
| Project Name       | Sault College                                       |
| Project<br>Address | 443 Northern Ave E, Sault Ste. Marie, ON P6B<br>4J3 |
| Prepared By        | lan Sinclair<br>isinclair@blackstoneenergv.com      |

| LIII System Met          | rics  |
|--------------------------|---|
| Design                   | Design 1  |
| Module DC<br>Nameplate   | 1.07 MW   |
| Inverter AC<br>Nameplate | 858.0 kW<br>Load Ratio: 1.24                        |
| Annual<br>Production     | 1.187 GWh   |
| Performance<br>Ratio     | 84.8%   |
| kWh/kWp                  | 1,112.6   |
| Weather Dataset          | TMY, 10km grid (46.55,-84.35), NREL<br>(prospector) |
| Simulator Version        | 71b60a7a24-64462d0407-0d9ed2e0c9-<br>2972c6c279     |





• Sources of System Loss



|               |                                     | <b>a</b>        |         |
|---------------|-------------------------------------|-----------------|---------|
|               | Description                         | Output          | % Delta |
|               | Annual Global Horizontal Irradiance | 1,316.0         |         |
|               | POA Irradiance                      | 1,312.4         | -0.3%   |
| Irradiance    | Shaded Irradiance                   | 1,312.0         | 0.0%    |
| (kWh/m²)      | Irradiance after Reflection         | 1,256.3         | -4.2%   |
|               | Irradiance after Soiling            | 1,209.0         | -3.8%   |
|               | Total Collector Irradiance          | 1,209.0         | 0.0%    |
|               | Nameplate                           | 1,290,361.0     |         |
|               | Output at Irradiance Levels         | 1,276,190.3     | -1.1%   |
|               | Output at Cell Temperature Derate   | 1,279,241.7     | 0.2%    |
| Energy        | Output After Mismatch               | 1,230,131.3     | -3.8%   |
| (kWh)         | Optimal DC Output                   | 1,226,542.2     | -0.3%   |
|               | Constrained DC Output               | 1,224,323.6     | -0.2%   |
|               | Inverter Output                     | 1,204,700.0     | -1.6%   |
|               | Energy to Grid                      | 1,186,630.0     | -1.5%   |
| Temperature N | Aetrics                             |                 |         |
|               | Avg. Operating Ambient Temp         |                 | 8.0 °C  |
|               | Avg. Operating Cell Temp            |                 | 13.9 °C |
| Simulation Me | trics                               |                 |         |
|               |                                     | Operating Hours | 4655    |
|               |                                     | Solved Hours    | 4655    |

# **U**HelioScope

| Annual Production Re | port | produced | by lar | n Sinclair |
|----------------------|------|----------|--------|------------|
|----------------------|------|----------|--------|------------|

| Condition Set                   |              |              |        |        |        |        |                |       |                |                                     |        |                  |      |   |
|---------------------------------|--------------|--------------|--------|--------|--------|--------|----------------|-------|----------------|-------------------------------------|--------|------------------|------|---|
| Description                     | Cond         | dition       | Set 1  |        |        |        |                |       |                |                                     |        |                  |      |   |
| Weather Dataset                 | TMY,         | , 10kr       | n grid | (46    | .55,-8 | 4.35   | 5), NRE        | EL (p | rosp           | ecto                                | r)     |                  |      |   |
| Solar Angle Location            | Mete         | eo Lat       | /Lng   |        |        |        |                |       |                |                                     |        |                  |      |   |
| Transposition Model             | Pere         | Perez Model  |        |        |        |        |                |       |                |                                     |        |                  |      |   |
| Temperature Model               | Sanc         | Sandia Model |        |        |        |        |                |       |                |                                     |        |                  |      |   |
|                                 | Rack         | с Туре       | :      |        | а      |        | b              |       |                | Tei                                 | mpera  | ature D          | elta |   |
| Temperature Model<br>Parameters | Fixe         | d Tilt       |        |        | -3.5   | 6      | -0.0           | )75   |                | 3°(                                 | 2      |                  |      |   |
|                                 | Flus         | h Mo         | unt    |        | -2.8   | 1      | -0.0           | 455   |                | 0°0                                 | 2      |                  |      |   |
|                                 | East         | -3.5         | 6      | -0.075 |        |        | 3°C            |       |                |                                     |        |                  |      |   |
|                                 | Carp         | oort         |        | -3.5   | 6      | -0.075 |                |       | 3°(            | 2                                   |        |                  |      |   |
| Soiling (%)                     | J            | F            | М      | A      | ľ      | N      | J              | I I   |                | A                                   | S      | 0                | Ν    | D |
| 50mmg (70)                      | 25 25 10 0.5 |              |        | 5 0    | .5     | 0.5    | 0.5            | 5 (   | 0.5            | 0.5                                 | 0.5    | 15               | 25   |   |
| Irradiation Variance            | 5%           |              |        |        |        |        |                |       |                |                                     |        |                  |      |   |
| Cell Temperature Spread         | 4° C         |              |        |        |        |        |                |       |                |                                     |        |                  |      |   |
| Module Binning Range            | -1.5%        | 6 to 1       | .5%    |        |        |        |                |       |                |                                     |        |                  |      |   |
| AC System Derate                | 1.50         | %            |        |        |        |        |                |       |                |                                     |        |                  |      |   |
| Module Characterizations        | Mod          | ule          |        |        |        |        | Uploa<br>By    | ded   | с              | hara                                | cteriz | ation            |      |   |
|                                 | CS3<br>Sola  | W-44(<br>r)  | OMS (0 | Cana   | adian  |        | Folsoi<br>Labs | m     | S<br>C         | Spec Sheet<br>Characterization, PAN |        |                  |      |   |
| Component<br>Characterizations  | Devi         | ce           |        |        |        |        |                |       | Uploaded<br>By |                                     |        | Characterization |      |   |
|                                 | CSI-<br>Sola | 66KTL<br>r)  | -GS 2  | 017    | -08 (C | ana    | idian          |       | Fols<br>Lab    | om<br>s                             |        | Spec Sheet       |      |   |

| 🖨 Components |  |                    |  |  |  |  |  |  |
|--------------|--|--------------------|--|--|--|--|--|--|
| Component    | Name                                     | Count              |  |  |  |  |  |  |
| Inverters    | CSI-66KTL-GS 2017-08 (Canadian<br>Solar) | 13 (858.0 kW)      |  |  |  |  |  |  |
| Strings      | 10 AWG (Copper)                          | 150 (9,720.5<br>m) |  |  |  |  |  |  |
| Module       | Canadian Solar, CS3W-440MS<br>(440W)     | 2,424 (1.07<br>MW) |  |  |  |  |  |  |

 Wiring Zones
 Combiner Poles
 String Size
 Stringing Strategy

 Wiring Zone
 12
 15-17
 Along Racking

 Image: Field Segments
 Employee
 12
 15-17

| Description         | Racking | Orientation            | Tilt | Azimuth             | Intrarow<br>Spacing | Frame<br>Size | Frames | Modules | Power      |  |  |  |
|---------------------|---------|------------------------|------|---------------------|---------------------|---------------|--------|---------|------------|--|--|--|
| Field Segment 1     | Carport | Portrait<br>(Vertical) | 8°   | 89.44909602078144°  | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 2     | Carport | Portrait<br>(Vertical) | 8°   | 269.44909602078144° | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 3     | Carport | Portrait<br>(Vertical) | 8°   | 89.4491°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 4     | Carport | Portrait<br>(Vertical) | 8°   | 269.449°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 6     | Carport | Portrait<br>(Vertical) | 8°   | 269.449°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 5     | Carport | Portrait<br>(Vertical) | 8°   | 89.4491°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 8     | Carport | Portrait<br>(Vertical) | 8°   | 269.449°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 7     | Carport | Portrait<br>(Vertical) | 8°   | 89.4491°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment 9     | Carport | Portrait<br>(Vertical) | 8°   | 89.4491°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment<br>10 | Carport | Portrait<br>(Vertical) | 8°   | 269.449°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment<br>12 | Carport | Portrait<br>(Vertical) | 8°   | 269.449°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
| Field Segment<br>11 | Carport | Portrait<br>(Vertical) | 8°   | 89.4491°            | 0.5 m               | 1x1           | 202    | 202     | 88.9<br>kW |  |  |  |
|                     |         |                        |      |                     |                     |               |        |         |            |  |  |  |

## **U**HelioScope

Oetailed Layout

