



## **Sewage Effluent Energy Recovery/Storage by Renewable Resource Recovery Corp. (R3C)**

R3C's *@Source*-Energy Pipe™ is an innovative precast concrete sewage pipe incorporating an integrated heat recovery system embedded within the concrete pipe wall. Designed to extract and store thermal energy from sewage effluent and the surrounding ground, the *@Source* Energy™ system upgrades low-grade heat through heat pumps connected to buildings, providing sustainable heating and cooling solutions.

This implementation occurred at a newly constructed 55-unit senior residence in Coniston (Sudbury), Ontario, where a 72-foot 12-inch diameter sewer line, composed of nine interconnected *@Source*-Energy™ pipes, was installed. The system provides heating and cooling Energy to a 1,000 sq. ft. mechanical room in the building. Data was collected and analyzed<sup>1</sup> over a one-year period from July 2024 to June 2025.

This system extracts heat from sewage effluent and the surrounding ground, which is then upgraded by heat pumps connected to buildings. The heat pumps boost the low-grade heat collected by the *@Source*-Energy™ System and distribute it to heat the building; in warmer weather, the process reverses to cool the building by transferring excess heat to the pipe, where it is stored in the ground for recovery during colder periods.

This system leverages Sudbury's typical meteorological year weather conditions, where winter temperatures reach lows of -28°F (-33°C) and summer highs of 84°F (29°C). A 3-ton heat pump (HP) controls the energy recovery and distribution fluid flow to the *@Source*-Energy™ pipes, enabling efficient energy management and contributing to sustainable building operations.

A data logger recorded the temperature of sewer water in/out of the building and the air temperature distributed in the building from the HP. The monthly heating and cooling loads vary significantly throughout the year, reflecting the building's seasonal energy demand. The heating load peaked during the winter months, reaching its maximum in April 2025 at 4,479 kBTU, while the cooling load was highest in July 2024 at 776 kBTU. Notably, the building experienced negligible cooling demand from November to February. The peak hourly heating and cooling loads occurred in March (9.76 kBTU/hr)

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<sup>1</sup> By Ph.D. students Saeed Ranjbar and Abolfazl Rezaei from Concordia University in partnership with Renewable Resource Recovery Corp.

and July (11.53 kBTU/hr), respectively, indicating the most energy-intensive hours for both modes.

As shown in Table 1, the monthly heating and cooling loads vary significantly throughout the year, reflecting the building's seasonal energy demand.

*Table 1 Monthly Cooling Loads and Cooling Peak Loads*

| MONTH        | Total Heating (kBTU) | Peak Heating (kBTU/hr) | Total Cooling (kBTU) | Peak Cooling (kBTU/hr) |
|--------------|----------------------|------------------------|----------------------|------------------------|
| JULY 24      | 693                  | 3.08                   | 776                  | 11.53                  |
| AUGUST 24    | 663                  | 2.50                   | 586                  | 5.53                   |
| SEPTEMBER 24 | 366                  | 2.09                   | 415                  | 1.91                   |
| OCTOBER 24   | 1308                 | 5.96                   | 304                  | 3.03                   |
| NOVEMBER 24  | 2822                 | 7.15                   | 29                   | 3.12                   |
| DECEMBER 24  | 3539                 | 7.76                   | 3                    | 1.48                   |
| JANUARY 25   | 2737                 | 8.14                   | 1371                 | 7.46                   |
| FEBRUARY 25  | 3912                 | 7.92                   | 47                   | 8.52                   |
| MARCH 25     | 4293                 | 9.76                   | 466                  | 10.82                  |
| APRIL 25     | 4479                 | 8.68                   | 77                   | 9.26                   |
| MAY 25       | 3239                 | 7.38                   | 105                  | 3.46                   |
| JUNE 25      | 977                  | 5.56                   | 497                  | 3.01                   |
| TOTAL        | 29027                | -                      | 4676                 | -                      |

The system effectively maintained indoor comfort while adapting to rapid outdoor temperature variations.

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