

Waste management technologies

What waste management technologies are useful in Cambridge Bay?

Key messages

- Residents of Canada's remote northern communities want to improve waste management practices and decrease reliance on fossil-fuel-based energy sources.
- Greenhouse gas emissions, black carbon from fossil fuel use, and environmental contamination from overburdened landfills with open incineration negatively impact public health and contaminate land and food chains.
- POLAR has explored several waste management and waste-to-energy solutions. The knowledge gained is helpful to other northern communities considering clean energy alternatives.



Automated Communities System (ACS150)

ACS150 was a collection of technologies, within two sea cans, aimed at meeting the utility needs of a 150-person community. The technologies were grouped so that waste products went in at one end and potable water, heat, and electricity were produced as outputs. This technology demonstration was hosted by Cambridge Bay in 2014, in collaboration with Sustainable Development Technology Canada.

Waste stream analysis

A waste audit of the Cambridge Bay landfill was completed to choose the right waste-to-energy technology for the community. This work was completed in partnership with Concordia University's Institute for Water, Energy and Sustainable Systems. In 2016, workers from the Hamlet, along with PhD student Nathan Curry, spent two weeks sorting 725 kilograms (1,600 pounds) of trash. They held a community meeting at the Elder's Palace and completed formal interviews about waste management. The results showed that the community could benefit from a composting program for food waste and a recycling program for cardboard, plastics, and soda cans.

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Burning garbage at the Cambridge Bay landfill. Incineration is a common waste management practice in many remote communities: POLAR.



Micro Automated Gasification System

With results of the waste stream analysis in hand, POLAR partnered with a Canadian waste-to-energy technology provider, Terragon Environmental Technologies Inc., to test and demonstrate its Micro Automated Gasification System (MAGS) within the community of Cambridge Bay. Terragon commissioned and started up the system and provided preliminary training to two operators from the community.

The system operates by batch loading waste products into two chambers. The waste is heated and breaks down to biochar and a gas consisting mostly of hydrogen and carbon monoxide (synthetic gas: syngas). The syngas is used as the fuel for maintaining the process. The overall objective of the project was to assess the MAGS technology in terms of performance, economic feasibility, and operability within a remote northern community.

Technology assessment

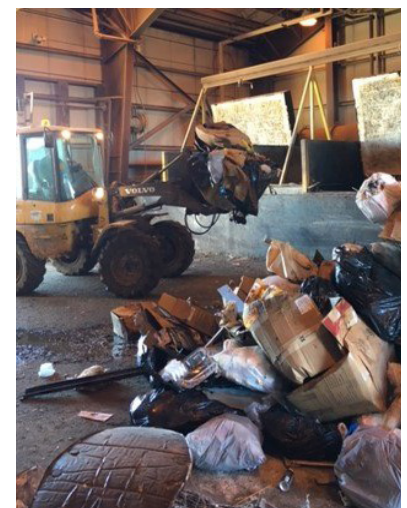
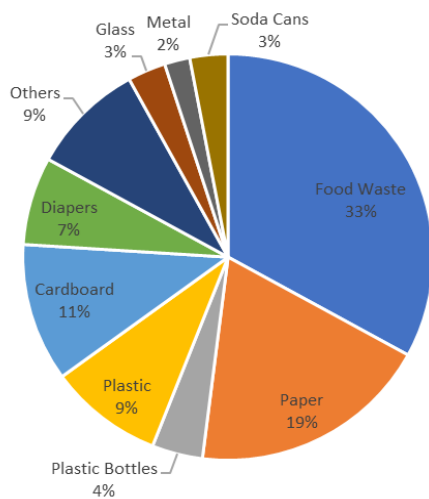
While the MAGS demonstration was running in Cambridge Bay, POLAR engineer Matt Wallace assessed a range of commercially available waste-to-energy technologies. This included heat-recovery technologies, as well as novel solutions to transform waste products into badly needed construction materials or road surface coatings—products that have intrinsic value in remote northern communities. After detailed research, Wallace recommended pursuing a simple incineration system with heat recovery as a starting point for a remote community waste-to-energy system.

Incineration system with heat recovery

Produced by Dynamis Energy, a Thermal Oxidation System (TOS) is successfully operated by the North Slope Borough in Utqiagvik, Alaska. POLAR and Hamlet personnel travelled to Alaska to view the TOS and meet with company and borough representatives. They concluded that this system would meet the waste management requirements of Cambridge Bay.

Although the population of Utqiagvik is double that of Cambridge Bay, similarities between the two communities support the use of a TOS in Nunavut. Utqiagvik is located north of the Arctic Circle and has a predominantly Indigenous population (i.e., over 60% of residents are Iñupiat). Like Cambridge Bay, Utqiagvik has a polar climate, is supplied mainly by sealift, and maintains strong traditions of harvesting country foods. This comparison helped with assessing whether the system would meet the needs of Cambridge Bay because Utqiagvik and Cambridge Bay, have similar waste profiles.

The TOS in Utqiagvik has significantly reduced waste going into the landfill. It produces clean emissions and inert ash. It is not, however, making full use of the heat or syngas produced, which reduces the overall economic viability of the system. The Hamlet of Cambridge Bay is now actively seeking funding to install a TOS and intends to use the waste heat either for district heating or greenhouse. POLAR and the Hamlet are both interested in the potential to use syngas for energy generation.



(left) According to a waste stream analysis, a third of Cambridge Bay's trash is food waste. Cardboard and paper make up another third. Data from Nathan Curry, PhD. (middle and right) Utqiagvik TOS in Operation: Matt Wallace.