

## **1. What is being considered at the Saskatoon Landfill?**

The City of Saskatoon, through its electric utility (Saskatoon Light & Power) and the Environmental Services Branch, is developing a Landfill Gas Collection System at the City Landfill Site. Over 500 landfills throughout North America have similar systems installed in order to reduce environmental impacts associated with the operations of landfills, mainly gas production from organic material decomposition.

It is proposed that collected landfill gas (LFG) will be piped to a Power Generation Facility adjacent to and west of the landfill. The LFG will then be used to fuel internal combustion engines. The engines are coupled to electrical generators to produce power that will be fed to the electrical grid.

Additionally, the heat generated by the internal combustion engines will be used in a Turboexpander Power Generation Facility at SaskEnergy's Natural Gas Regulating Station west of the landfill, to produce even more power that will be fed to the electrical grid.

The estimated capital cost of the Landfill Gas Project is \$10 million, with annual revenue projections estimated at \$1.3 million beginning in year 2012. The project is partially funded (50%) by the Governments of Canada and Saskatchewan through the Canada-Saskatchewan Provincial-Territorial Base Funding.

The estimated capital cost of the Turboexpander Project is \$3 million, with annual revenue projections estimated at \$300,000 beginning in year 2012. The project is proposed as a joint venture between the City of Saskatoon and SaskEnergy Incorporated. The annual revenue projection above is the City of Saskatoon's share of the revenue.

## **2. What other options are being considered for alternative energy sources in Saskatoon?**

The LFG Power Generation Facility is one of several renewable electrical generation facilities being proposed as part of a Green Energy Park at the Landfill.

Saskatoon's Green Energy Park at the landfill site is proposed to include a number of renewable and/or low impact electrical generation facilities, including a Tall Wind Turbine, Landfill Gas Power Generation Facility, Turboexpander Power Generation Facility (in conjunction with SaskEnergy) and potential to add fuel cells and heat recovery generation in the future. The projects approved or being considered have a combined capacity of 8.6 megawatts. The Green Energy Park will produce enough power for 5,550 homes and provide an annual reduction of greenhouse gas (GHG) emissions of 117,000 tonnes (equivalent to removing over 21,000 vehicles from our roadways).

Saskatoon Light & Power is also exploring the viability of hydropower generation at the Saskatoon Weir.

### **3. What is Landfill Gas, and how is it collected?**

Landfill gas (LFG) is produced naturally by the decomposition of organic material, such as food and yard waste, in municipal solid waste. LFG contains approximately 50% methane and 50% carbon dioxide. Methane is a greenhouse gas and is over 20 times more potent than carbon dioxide. Landfills emit LFG into the atmosphere throughout the operation of the landfill and for many decades after site closure. LFG is one of the highest human-caused sources of methane emissions.

Installing a LFG collection system involves drilling vertical wells into the waste, and connecting the wells to piping that collects LFG using a vacuum induction system. By installing a LFG Collection System, a majority of the LFG can be captured and either flared (burned), which will reduce its negative impact on the environment, or used in an energy recovery system to combust the methane and any trace constituents. This system also helps to reduce odours from the landfill and improve local air quality.

### **4. What options are there for using LFG?**

Many landfills install a LFG collection system because of regulatory requirements. LFG can simply be flared (burned) to thermally destruct the LFG and thereby reduce greenhouse gas emissions and odours. If an economical use for the LFG can be found there is potential for significant revenue opportunities.

Approximately two-thirds of projects use the LFG to generate electricity, and one-third sell the LFG to be used as boiler fuel. The LFG can also be processed to produce a pipeline quality gas similar to natural gas, and delivered into natural gas distribution systems.

Based on an economical analysis, the best use for the LFG from the Saskatoon Landfill is to use the LFG to generate electricity.

### **5. How much Landfill Gas could be produced, and how long will it last?**

Generally, the older and larger the landfill is, the greater the gas potential. Landfill Gas production will last for many years, with some landfills reporting steady production for greater than 30 years after placement.

Experience at other landfills of similar size suggests that a collection efficiency of 70% may be attainable. This would result in a peak LFG recovery rate of approximately 2,100 m<sup>3</sup>/hr approximately one year after projected closure of the Saskatoon Landfill in 2061 (assuming a 50 year life remaining at the current landfill site). This amount of LFG

could produce approximately 3 to 4 megawatts of electricity or enough to power over 2,600 homes (equivalent to the size of the city of Humboldt, SK).

## **6. What is a Turboexpander?**

A turboexpander is a *turbine* through which a high pressure gas is *expanded* (i.e. its pressure is reduced). Energy is produced in this process. That energy, which will otherwise be lost (as high pressure gas lines must be de-pressured before the gas is delivered to residential homes) can be captured and used to drive a generator which in turn produces electricity.

When the pressure of the natural gas is reduced, it is accompanied by a drop in temperature. If the natural gas cools below a certain point, the moisture in the gas can freeze up and cause problems in transportation. To deal with this, heat by-product from the adjacent Landfill Gas Power Generation Facility will be used to pre-heat the natural gas before the pressure and temperature reduction through the turboexpander.

The Turboexpander Power Generation Facility will produce power with zero emissions, by recovering pressure energy and heat energy that would otherwise go un-used. It is estimated that the Turboexpander will produce approximately 1 megawatt of electricity, or enough to power 600 homes (equivalent to the size of the town of Davidson, SK).

## **7. Why aren't Turboexpanders used everywhere?**

Using a turboexpander to produce electricity in this pressure reduction application has always been possible, but to be economically viable, a low-cost source of heat is required. In other words, the turboexpander project is now possible because the LFG project is possible. Both projects work together to produce economical and environmentally-friendly electricity.

## **8. What are the expected benefits of the proposed Landfill Gas and Turboexpander Projects?**

The expected benefits of the proposed projects are:

- Provide Green Power for the City of Saskatoon, enough to power over 3,200 homes
- Provide a significant revenue source for the City of Saskatoon
- Promote the City of Saskatoon as an environmentally conscious and responsible community
- Reduce odours associated with the Landfill
- Improve local air quality in areas surrounding the Landfill
- Prevent the migration of LFG outside the limits of the Landfill

**9. Are there any health or safety concerns with the projects?**

Exhaust emissions from the proposed Landfill Gas Power Generation Facility must comply with Clean Air Act Legislation in the province of Saskatchewan, which regulates emissions from fuel burning equipment. Air dispersion modeling will also be completed as part of the Environmental Assessment for the project. In general, local air quality will improve as a result of the project through capture and thermal destruction of methane emissions that are already occurring from the Landfill.

Noise from the facility will be controlled using exhaust silencers, and through design of the buildings enclosing the equipment. It is a requirement of the projects that the noise level at the nearest residence is not to exceed 40 decibels (similar to the noise level in a quiet library).

Similar to any industrial facility that processes or uses a combustible gas, the facilities would be designed to include combustible gas detection instruments that would shut down equipment in the event that elevated concentrations of combustible gas are detected. All equipment must also be designed for installation in a hazardous location, as required under the Canadian Electrical Code.

**10. What are the next steps?**

Feedback from the Public Information Meeting will be communicated in a report to City Council. The next steps, pending City Council approval, would be to complete detailed design of the facilities, and issue equipment and construction tenders. The earliest that the facilities could be operational would be the summer of 2012.

**Contact Information**

**Web Site:** [www.saskatoon.ca](http://www.saskatoon.ca) (search under 'L' for Landfill Gas)

**For information or to comment:**

Kevin Hudson, P. Eng., Alternative Energy Engineer  
Saskatoon Light & Power, City of Saskatoon

- phone 975-3045
- fax 975-3057
- email [kevin.hudson@saskatoon.ca](mailto:kevin.hudson@saskatoon.ca)