

City of Johannesburg

Robinson Deep Landfill Gas to Energy Project

Faced with the challenge of limited space for more landfill sites and associated GHG emissions, the City of Johannesburg explored possibilities of harvesting energy from existing landfills. Robinson Deep site identification took place in 2005. This identification also included other landfill sites like Marie Lousie, Linbro Park, Goudkoppies and Ennerdale. In May 2009, the City entered into agreement with EnerG Systems to develop, construct and operate the landfill gas to energy projects over a 20 year period.

Objective

The objective of the project is to collect and destruct/utilise the landfill gas (LFG) generated at the site. The project consists of two distinct stages. In the first stage LFG will be captured and flared. In the second stage the captured LFG will be fed into a generator set at site for electricity generation. Landfill gas consist of around 60-80% CH₄ (methane), a very potent greenhouse gas, which upon release contributes more than 20 times more to the greenhouse gas effect than the same amount of CO₂ (carbon dioxide). Hence, the collection and destruction of CH₄ is an important activity in the City's quest to combat climate change

The City of Johannesburg is currently implementing the landfill gas to energy clean development mechanism project aimed at extracting and combustion of landfill gas and generates green electricity as well as removing greenhouse gas emission caused by the landfill site emission in the atmosphere. The landfill gas is mainly made up of methane, carbon dioxide and oxygen and methane gas is the most harmful gas on the ozone layer. Methane is sucked through the combination of vertical and horizontal pipes to the flare system where it is burnt and released as carbon dioxide. Methane is 21 times more harmful as compared to carbon dioxide. When electricity generators have been installed the gas will be used to turn the generators and produce electricity. It is critical to note that electricity to be generated from the 5 sites does not pollute the environment; instead it uses the pollutants to power electricity generators.

Today two sites have been developed where in landfill gas is being extracted and combusted and flared as carbon dioxide as it is less harmful to the atmosphere as compared to methane gas. Construction of the Robinson Deep landfill started on 21 February 2011 and was completed in May 2011 where the site was commissioned to commence with flaring of gas. 68 gas wells were installed and will be increased during the second phase of the project to cover the entire site. The daily pumping rate of landfill gas at Robinson Deep is at 1400 cubic meters per hour and this will be increased over time. The plant can reach optimum pumping rate of 2000 cubic meters per hour when it is operated at full capacity.

There are positive signs of improvement of air quality at Robinson Deep and Marie Louise sites which might have negative impacts on human health. There is reduced bad odour experienced and few complaints of bad smell received from the surrounding landowners since the commissioning of the two sites. The project is minimizing environmental damaged through reduced methane emissions.

Climate Change Response Impacts

Robinson Deep landfill gas is currently producing around 1,400 m³ per day which is destroyed by means of a flare. When operating at full capacity, the capped landfill will produce around 3,000 m³ per day. This amount of landfill gas can be converted to 5 MW of renewable electricity when in the second phase the generators are installed providing renewable electricity for around 4,000 to 5,000 households. When operating at full capacity, the reduction of greenhouse gasses is equivalent to approximately 149,000 tonnes of CO₂-equivalents per annum. When completed, the five landfill-gas-to-energy projects will together comprise the largest landfill gas-to-energy programme in South-Africa. For this first phase, An estimated 19 MW of power would be generated from the completed projects, comparable to electricity usage by about 12,500 middle-income households.

Innovative financing

From the start of development, it was envisaged that the landfill gas-to-energy projects would be registered under to Clean Development Mechanism (CDM) of the UNFCCC allowing the projects to generate carbon credits or so called Certified Emissions Reduction units (CERs) under the CDM. Through the implementation of the projects as a CDM activity, the City will contribute to the country's achievement of the Kyoto

Protocol commitments and simultaneously generate revenue through the sale of Certified Emission Reductions (CERs) and sale of electricity generated. The City of Johannesburg Environment Infrastructure and Services department formally initiated the landfill gas to energy CDM project in 2007. The main aim of CDM project is to mitigate the harmful greenhouse gases (GHG) emitted, in this case methane from the landfills whilst earning carbon credits.

The Robinson Deep site has produced 137 888 Certified Emission Reductions (CER's) and destructed 18,288,457Nm³ of landfill gas which would have been released to the atmosphere from May 2011 till end of October 2013. Construction of the Marie Louise project commenced in February 2012 where 28 wells were installed and the site was commissioned in May 2012. The daily pumping of landfill gas at Marie Louise is at 500 cubic meters per hour and will also be increased when electricity is generated. A total 19,042 VER's were amassed and 3,157,656Nm³ of landfill gas was destructed at Marie Louise landfill sites since May 2012. The five projects have been combined into a CDM Programme of Activities (PoA). The registration process of the five landfill-gas-to-energy projects under the CDM of the UNFCCC was finalised in November 2012. During the 2012/2013 financial year, before registration under the CDM, the Robinson Deep site had already produced excess of 71,000 Verified Emission Reductions (VERs) under the voluntary carbon standard.

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