Developing Landfill Gas to Energy and CDM Projects Internationally

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Presentation Topics

- Introduction - Veolia Environmental Services
- Landfill gas capture and utilisation technologies
- A CDM project example
- CDM project development - Observations / recommendations
- Conclusions
Waste Management Division of Veolia Environnement

- Annual Revenue: €7.5 Billion
- Operating in 33 Countries
- 82,700 employees worldwide
- Collected 35 million tonnes of waste
- Treated 58 million tonnes of waste in 698 treatment facilities
- Recovered 7 million tonnes of waste
- 4.2 Million MWh of electricity and 2.5 Million MWh of thermal energy sold
- 2 registered CDM projects; others in the «pipeline»
Veolia Environmental Services' landfills

Veolia Environmental Services manages 146 non-hazardous waste landfills world-wide.
Landfill Gas Utilisation Technologies

The figure presents the various applications for the three grades of fuel that can be produced from raw LFG. It also illustrates the increasing degree of processing that is required to transform the LFG from a low-grade fuel into a more refined fuel source.

Increasing degree of processing:
- Moisture removal
- Particulate removal
- \( \text{CO}_2 \) separation
- Removal of impurities
Landfill Gas Utilisation projects

**VES Examples:**

- **US:** Cranberry Creek Landfill
- **US:** Greentree Landfill
- **France:** REP Energie
- **China:** Xingfeng Landfill
- **Brazil:** SASA Landfill
Landfill Gas Utilisation projects

Site: CRANBERRY CREEK LANDFILL, USA

Technology: Direct Use

- Partnership between Veolia ES Cranberry Creek Landfill and a nearby Ocean Spray plant
- LFG is compressed, filtered and dried at an onsite compressor station and conveyed from the landfill to the plant through a 2.4 km pipeline.
- Methane gas from this pipeline powers the Ocean Spray’s steam boilers, that energise the cranberry concentrator.

Benefits:

- Greenhouse gas emissions reductions: 6,300 tonnes a year (comparable to the elimination of the CO2 emissions produced from 12,000 automobiles)
- Ocean Spray cut fuel costs by 25%.

→ In 2006, the site received the « GOLD STAR AWARD » from SWANA (Solid Waste Association of North America)
Landfill Gas Utilisation projects

Site: XINGFENG LANDFILL, China

- Ownership: Guangzhou Government
- Contracts to VES: Landfill design, design coordination and 8 years operation; Separate LFG design, build and operate contract

Technology: Reciprocating Engines

- Two 970 kW reciprocating engines / gensets for electricity production
- Additional modular units to be added as recovered landfill gas increases
- Reciprocating engines use medium grade LFG as fuel. It is necessary to condensate and remove particulates of the landfill gas.

Benefits:

- CDM project being developed for this site
- Reduced greenhouse gas emissions – expected 5 million tCO2e to the end of 2012
- Alleviate electricity shortages
Landfill Gas Utilization projects

Site: REP ENERGIE, France

Technology: Combined Cycle

- 11 MW
- 9300 Nm3 LFG / hr recovered
- 3 high pressure boilers (each with a steam capacity of 30 t/hr)
- 1 steam turbine

In 2005, selected under French Government tender for renewable energy project from Biomass / Biogas to meet EU 2010 target

Since 2006

- Total: 25 MW
- 17 000 Nm3 LFG / hr recovered
- 1 gas turbine
- 1 additional boiler
- 1 additional steam turbine

Benefits:
- Reduced GHG emissions: 74,000 tonnes CO2e avoided emissions
- Reduced fuel consumption: 16,400 toe saved
- The installed capacity of 25 MW is equivalent to the consumption of 80,000 inhabitants.
Landfill Gas Utilisation projects

Site: Greentree Landfill, USA

Technology: Pipeline Quality

- Conversion of landfill gas (17,000 m³/hr), which is otherwise burned in a flare, into pipeline quality methane gas.
- At the landfill, a processing facility processes and separates the natural gas from the remainder of the landfill gas. This natural gas is then transported by the project’s pipeline to an interstate natural gas pipeline located near the landfill site.

Benefits:

- Reduced greenhouse gas emissions
- "Green Energy" to be purchased by electricity producer
- The produced energy (the equivalent of 40 MW of electricity) is enough to satisfy the needs of 45,000 homes.

Reference

Greentree Landfill, Pennsylvania, USA
Site: SASA LANDFILL, Brazil

Technology: Leachate Evaporator

- Treats up to 19m³/day of leachate using LFG as fuel for evaporator

Benefits:

- Developed as a Clean Development Mechanism (CDM) project
- VES’ first registered project and carbon transaction!
- GhG emission reductions estimated at 700,000 tCO2e over 10 years
Various technologies exist for the utilisation of LFG. Selection of the best alternative for a specific site is dependent upon a number of factors including:

- projected recoverable LFG;
- presence and location of suitable markets;
- market price for end products;
- environmental and regulatory factors; and
- capital and operating costs of utilisation system options, including processing and transporting issues/costs.
Incentive for Landfill Gas Project development

- There has been increased development of landfill gas utilisation projects in a number of developed countries thanks to national incentive systems (Feed-in tariffs, green certificates, subsidies…)

- These types of national incentives are not yet available in most developing countries.

- However, a different form of incentive that helps the transfer of landfill gas recovery technology into developing countries is the Clean Development Mechanism (CDM).
Onyx Alexandria (VES Egypt) –
A CDM Project Example
Onyx Alexandria (VES Egypt)

Landfills operated as part of global waste management contract

CDM Project – consists of :

• Upgrade of the landfill gas collection system
• Commissioning of a leachate evaporator (Borg El Arab)
• Potential GhG emission reductions of approx. 3,700,000 t CO₂eq.

Sale of CERs

2005 : Signed ERPA with World Bank for first tranche of CERs (30%)
CDM Project - Alexandria, Egypt

CDM Project Cycle

Project design Documents

Host Country Approval

Validation

Registration

Completed Steps

✓ 2005 - Prepared Project Design Documents; EIA completed by Consultant

✓ December 2005 - Conducted Stakeholder meetings

✓ January 2006 - Letter of No Objection received from the Egyptian DNA

✓ April 2006 - Validation Completed

✓ June / July 2006 - Received Egyptian / Spanish / French DNA LOA

✓ August 2006 - Submitted PDD for Registration to the CDM Executive Board

✓ 15 December 2006 - project registered!
CDM Project - Alexandria, Egypt

CDM Project Cycle

- Implementation
- Monitoring
- Verification
- Issue CERs

- Leachate evaporator installed at the Borg El Arab landfill; flares and initial phase of collection system have been installed on both sites
- Landfill gas monitoring is on-going
  - October, 2007 - Additional monitoring equipment being installed
  - October, 2007 - Verification process by external Verifier was launched.
  - First Quarter, 2008 - Issue first CERs for payment.
Veolia Environmental Services’ experience in the Kyoto project mechanisms

Veolia Environmental Services has two registered projects.

The group has other on-going projects, under preparation or being evaluated:
- Projects in South America, in partnership with VE subsidiary Proactiva.
- In Asia and in Africa / Middle East for the CDM
- In Eastern Europe for the Joint Implementation.

The benefits of CDM projects in terms of Sustainable Development:
- Continuous improvement - environmental controls
- Transfer of technology
- Reinforced local participation
- Technical training of on-site staff
CDM Project Development - Observations / recommendations
CDM Project Development - Observations / recommendations

**Project design Documents**

Future emission reductions from LFG projects are based on first order mathematical models; existing registered projects are producing less CERs than forecasted in PDDs.

Models used in PDD should be:
- prepared by experienced modellers
- adapted to site-specific conditions and parameters

CDM EB Rules / Methodologies / tools are evolving:

Project developers must keep abreast of CDM EB Methodologies / Decisions / Clarifications
CDM Project Development - Observations / recommendations

Validation

Delays experienced in the Validation step.

- Ensure project design documents are complete:
  - Clearly explain compliance with the applied baseline and monitoring methodology
  - Ensure justification of “additionality” is provided
- Selection of an available DOE with sector experience
- Follow-up on the established schedule
Each host country establishes their own CDM approval process

- Develop understanding of country requirements early-on in the project development process
- Interface with the Designated National Authority
- Ensure approval letters include the 3 points required by the CDM Guidelines:
  - The Party has ratified the Kyoto Protocol
  - The approval of voluntary participation in the project activity
  - Host Country: the project contributes to sustainable development
Early landfill gas projects showing shortfall in delivered CERs compared to amount forecasted in the PDDs

Proper landfill gas collection system design, construction and operation required to maximise CER production.
Monitoring requirements specified in CDM methodologies for LFG projects have become more and more complex
- Continuous monitoring of LFG flow, quality, T, P, …
- Flaring unit – combustion efficiency in addition to the temperature of combustion, hours of operation…

- Need to ensure proper instrumentation (flowmeters, gauges, emission monitoring) installed and calibrated according to manufacturer’s specifications
- Install secure data storage system and conduct routine QA / QC
Measuring Performance

One measure of performance for CDM projects is the “CER issuance success rate”:

\[
\text{CERs Issued} = \frac{\text{CERs Issued}}{\text{CERs estimated in PDD for the same period}}
\]

As of 2\textsuperscript{nd} October 2007, registered landfill gas projects having reached the issuance step had a “CER issuance success rate” of 35%.

This under-delivery can be attributed to several possible reasons:

- an over-estimation of emission reductions by the FOD model because of:
  - lack of available site specific data (waste quantity and composition, moisture content…)
  - Operational constraints not considered
- technical issues, especially when projects are based on old sites (leachate levels, poor containment systems, inadequate compaction / cover…)
- delays in the installation of required equipment
- Insufficient monitoring data

→ Still in the early phases of project implementation
→ Need to take into account the level of uncertainty of future CER estimation when entering into negotiation for sales
From uncontrolled dump sites to environmentally sound landfills

Uncontrolled Dumpsites

Modern Sanitary Landfills
Conclusion

- Landfill gas recovery and utilisation technologies are proven and reliable.

- There is a significant potential to transfer these technologies into developing countries under the CDM.

- The supplemental revenue generated by the sale of energy from landfill gas or emission credits can contribute to the development of environmentally sound waste treatment facilities in developing countries and other sustainable development benefits.

- VES supports efforts to promote these projects and to remove development barriers.
Thank you for your attention!

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