Landfill Gas Project for the green society through Public-Private Partnership

Yoon, Jong-Seok
Director of Environmental Policy Division
Daegu Metropolitan City, Korea
E-mail : jong@korea.kr
Phon : +82-53-803-4170

Contents

Daegu, Open to World

Introduction to Daegu

- Population : 2.5 Million (3rd largest in Korea)
- Area : 884㎢ (212,160 acre)
- Major Industries : Textile and Fashion design, Machinery, Optical industry, High Quality Medical Service
- GRDP : 26.8 Million $/yr

Environmental Policies in Daegu

☐ Vision for Environment

" Healthy city where nature is alive and breathing"

☐ Environmental Policies

1. Solar City Projects

- The 1st International Solar City Congress 2004
  (2004.11, Daegu EXCO [Exhibition and Convention Center)
- Announcing Solar City Daegu, and enactment of ordinance for Solar City
- Holding annual international Green Energy EXPO's,
- Building 10,000 Solar Houses

Environmental Policies in Daegu

2. Exemplary City for Climate Change Diminution

- Reduction of Greenhouse gases of 5% by 2020, compared with 2005
- Green-life Campaign and Practice
- Management System for Greenhouse Gas Reduction

3. Air and Water Quality Control

- The Change to Natural Gas Buses from Diesel fueled Buses
- Adoption of Total Maximum Daily Load Management System to manage water basin

Background of LFG Project

☐ Project Definition

Energy generation project through active collection of LFG generated by biological decomposition of waste in large MSW (municipal solid waste) landfill site

☐ Background and Objectives

1. Control of malodorous and explosive compounds from landfill sites
2. Economical benefit by collected gas utilization
3. Contribution to greenhouse gas emission reduction (Clean Development Mechanism project)

State of Landfill Site

☐ State of Landfill Site

- Location : Dalsong District area
- Period of landfilling : since 1990
- Area : 435,000 m^2 (104.4 Acres)
- Capacity : 9,225,000 m^3
- Landfill completed : 8,815,000 m^3
- Type of Landfill : Facultative aerobic landfill for MSW (municipal solid waste)
- Now under expansion work to 23,154,000 m^3 of capacity (250% expansion in capacity)

☐ Waste generation and treatment in Daegu

- MSW generation : 2.6 thousands tons/day
- Treatment : Recycling and Reuse 56.8%, Landfill 30.5%, Incineration 12.7%

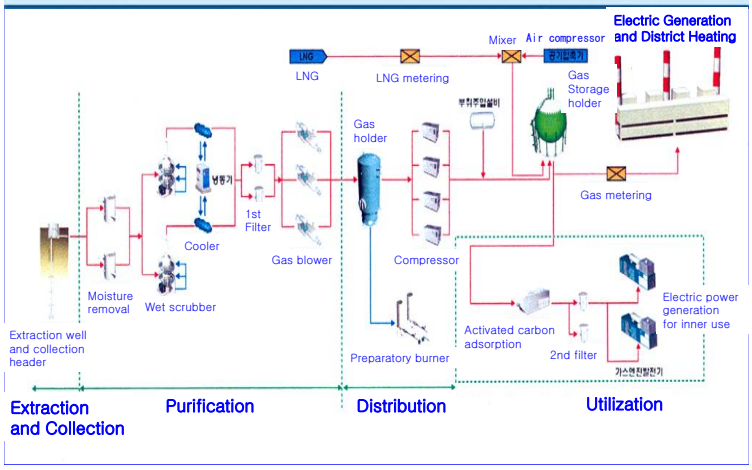
General Description for LFG Project

- ☐ Project type : Private Finance Initiative thru BTO (Build-Transfer-Operate)
  - Private operation for 20 years by Deagu Energy & Environment Co.
- ☐ Construction Period : May 2005 ~ September 2006 (for 17 months)
- ☐ Capital Cost : 19.6 Million USD (fully supplied by private sector)
- ☐ Gas Utilization : District Heating (10,000 households)
- ☐ Facilities
  - 105 gas extraction wells
  - Piping and Purifier : 130 m^3/min
  - Electric power generator (gas engine) 1.5MW (750KW x 2EA)
  - Gas storage (3,000 m^3, 3-6 atm.)

Process of LFG Project

- ☐ 2002. 08. 30 : Public notice of private finance initiative project scheme for LFG recovery
- ☐ 2004. 02. 27 : Private part selection, making an agreement and authorization
- ☐ 2005. 05. 10 : Construction started
- ☐ 2006. 09. 30 : Construction ended
- ☐ 2007. 8. 19 : Certified as a CDM Project by the UN (the first certified CDM project in Korea local government)
- ☐ 2009. 11. 2 : UN notified the CER (Certified Emission Reduction)
  - CER : 387,000 t CO_{2eq}/yr
  - It is worth 7,346,000 USD/yr (1 ton of CO_2 =13 Euro)

Schematic Diagram of LFG Recovery and Utilization Proces



View of Gas Storage and Electric Power Generator

Constructing the LFG Extraction Well

Inner View of LFG Extraction Well

Gas Purifier Facilities

LFG Utilization

☐ LFG Recovery

- Annual recovery : 52,7 Million Nm^3/yr
- Uses : 95% → District Heating (10,000 households)
  5% → Electric power generation for own use
- Economical Benefit : 12,531,000 USD/yr
  (CER : 7,346,000 USD/yr, Gas utilization : 5,185,000 USD/yr

☐ Composition of LFG

- CH_4 : 51.48%, CO_2 : 40.80%
- Others (moisture, nitrogen, ammonia, O_2 etc.) : 7.72%

CDM Project

☐ Background

-Contribution to greenhouse gas emission reduction and climate change diminution

-To create Economical benefit

-To Secure the operation of LFG recovery system through CER proceeds

☐ Project Process

- Investigation and Feasibility Study on the CDM Project of LFG recovery : Jan. 2006 ~ April (by Consulting Company)
- Approved by Korean Government : Jan. 2007
- Applied to the UN for a CDM project : Aug. 2007
- Monitoring greenhouse gas emission reduction : Aug. 2007 ~ July 2008
- UN certified 387,000 ton CER per year : Nov. 2. 2009

※ 387,000 tons/yr x 13 Euro/ton ⟹ 7,346,000 USD/yr

Results of LFG Project

1. Reduction of Malodor from Landfill Site

-The complaints of residents have been reduced

-Air quality has been upgraded through the LFG recovery and by preventing on-site incineration

2. Energy Generation from Released LFG

-LFG utilization as a district heating fuel : 52,739,000 Nm^3/yr

-Electric power generation for own usage

3. Greenhouse Gas Reduction and Economical Benefit

-Annual reduction of 387 thousands tons of greenhouse gases

-Economical benefit from CER trading : 7,346,000 USD/yr

-Gas utilization : 5,185,000 USD/yr

Obstacles to Progress

1. Strong fear of property price plummets and environmental deterioration
2. Enormous expense and technical insufficiency in LFG recovery and utilization
3. Distrust in LFG and its limited uses

Overcoming the Obstacles

1. Persuading people

- supporting projects for residents (19,129,000 USD, gymnasium and citizens hall, etc.)
- Trust recovery through employing residents as part time monitors observing landfill operations

2. Inviting Private Finance and Technology

- Selecting a high capable company through expert consulting and constructability evaluation
- Cooperation with national government and regional assembly for approving the private finance initiative project

3. Using the LFG as a District Heating Fuel by Korea District Heating Corporation.

- Securing the quality and safety of LFG through high technology
- Utilizing the landfill site as a green renewable energy complex

Future Projects for Green Renewable Energy

1. Addition of LFG recovery facilities to the expanded landfill site

2. Constructing a green renewable complex in landfill site with RDF (Refuse Derived Fuel) and CHP (Combined Heat and Power) generation system

3. Biogas recovery from food waste (under construction)

4. Maximizing energy generation through waste heat recovery from MSW incinerators

5. Energy recovery from biogas in sewage treatment facilities

Colorful DAEGU

Thank you for your a

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