



Green Energy Complex Barbados

CDM Opportunities in
Latin America
March 18, 2003

Presentation Program

- Introduction of the Green Energy Complex Team
- What is a Green Energy Complex
- Design
- Opportunities and Deliverables

R. J. Burnside International Limited

R.J. Burnside International

Environmental Engineering Services

- Established in 1992 to deliver core services of R. J. Burnside & Associates Limited (Burnside) to an international market
- Over 30 years corporate experience as Burnside
- Specialized Experience in Solid Waste Management and Climate Change Initiatives
- Additional service areas include
 - water and wastewater treatment and supply
 - satellite remote sensing
 - site assessment and remediation
 - golf course development

Burnside

Recent Solid Waste and Climate Change Project Experience

- Landfill Evaluation and Design, Barbados
- Landfill Bio-gas Demonstration Project, Egypt
- In-situ Bioreactor Design, Brazil
- Methane Capture Baseline Studies for the Solid Waste Sector

Biothermica International Inc.

Biothermica

Technology Leader in Thermal Treatment of Biomass & Gases

- Founded in 1987
- Technology-construction firm
- Leader in pollution control and landfill gas
- Canadian Leader in landfill gas collection & utilization
- R&D in landfill gas, particulate filtration, biomass gasification and VOC oxidation
- Finance and structure private power plant projects on a BOO/BOOT basis around the world

Helimax Energy Inc.

Helimax

Leader in Technologies and Power Projects for Sustainable
Development

- New market strategies, studies, and prospecting
- Energy project development
- Energy project construction and operation

Burnside-Biothermica-Helimax

Geographic Focus

- Caribbean
- North America
- Central America
- South America
- Egypt / Middle East
- India
- Europe
- Africa
- Asia

Green Energy Complex

- **What is the Green Energy Complex?**
 - Landfill Gas-to-Energy project including additional green energy generation capabilities through the provision of wind turbines
 - Project to be developed as a CDM Project

Green Energy Complex

- **Proposed Project Stages**
 - Landfill Gas (LFG) Collection and Flaring System
 - Landfill Gas-to-Energy including LFG storage and energy generation
 - Wind farm to be constructed to increase total energy generation capacity

Baseline Study

Objectives

- Estimate potential carbon credits that may be generated through using:
 - Landfill gas (LFG) captured for energy
 - Reduction in GHGs released to the environment
 - Create clean energy from captured landfill gas
 - Wind Energy potential

Green Energy Complex Baseline Study Approach

- Environmental Impact Assessment (EIA)
- Selected the historical operational procedures assuming no LFG collection system as the baseline scenario
- Estimated GHG emissions that are reasonably expected under:
 - The reference scenario
 - The proposed scenario
- Assessed potential power generation rates from both wind and LFG extraction system

Small Scale CDM Project

- **Small Scale Project Definitions**
- UNFCCC has published a reference document entitled “Further Clarifications on Definitions of Eligible Activities” (2002)
- Describes three project categories including:
 - Type 1: Renewable Energy Projects ←
 - Type 2: Energy Efficiency Improvement Projects
 - Type 3: Projects that Reduce Anthropogenic Emissions ←

Small Scale CDM Project

- **Renewable Energy Projects (Type I)**
- Maximum output capacity equal to 15 megawatts or equivalent
 - Includes LFG-to-Energy and Wind Power Components
 - Maximum expected energy generation rate is 5-8 MW

Small Scale CDM Project

- **Projects Reducing Anthropogenic Emissions (Type III)**
- Project activity directly emits less than 15,000 T CO₂e annually
 - Controlled by Project Boundary Definition
 - Project boundary was defined as the methane gas collection system

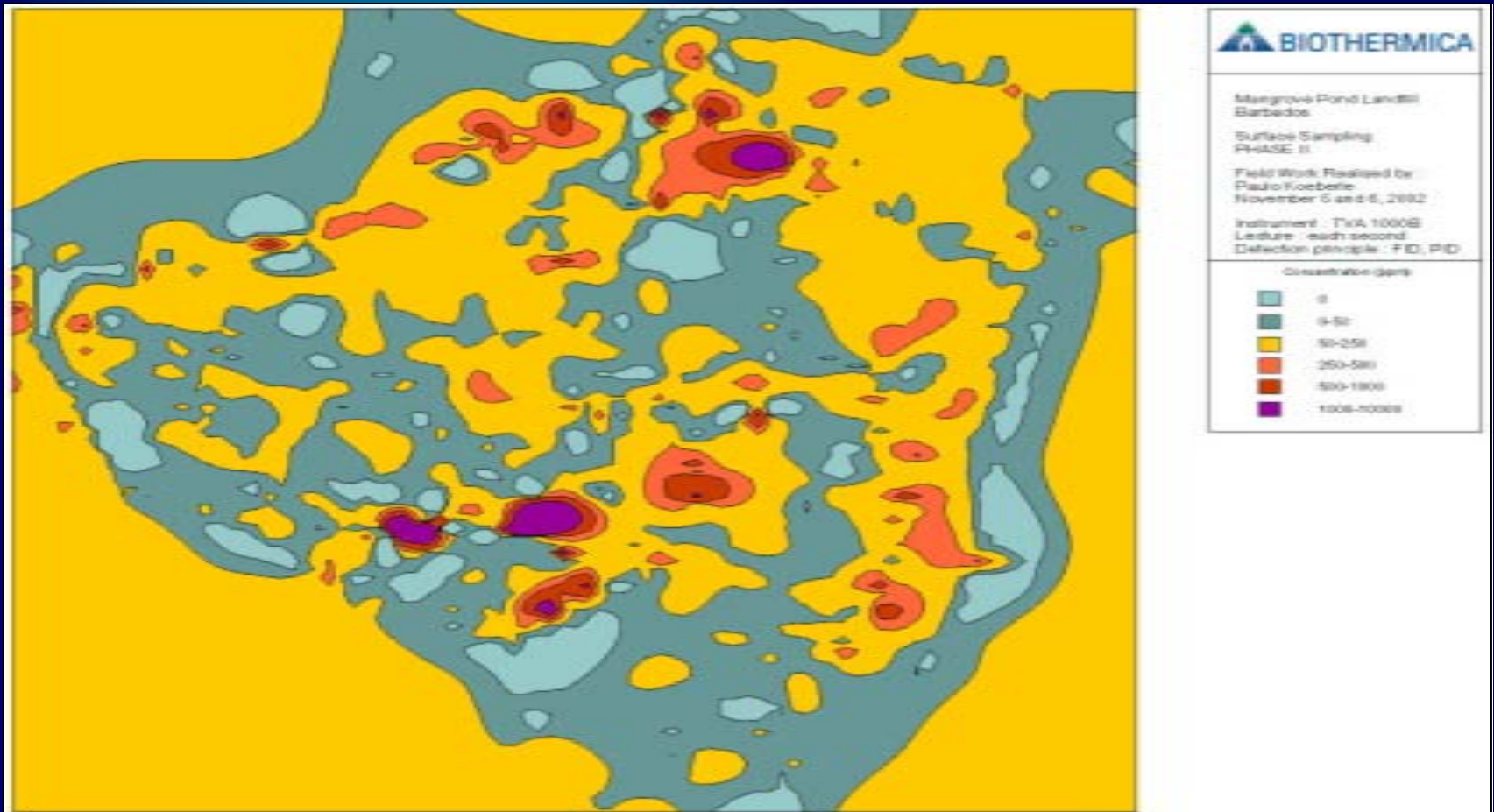
Assessment of LFG Generation

Major Factors Affecting Landfill Gas Generation

- Waste input from site opening to closure
- Waste composition (organic matter and humidity content)
- Climate

Landfill Surface Sampling

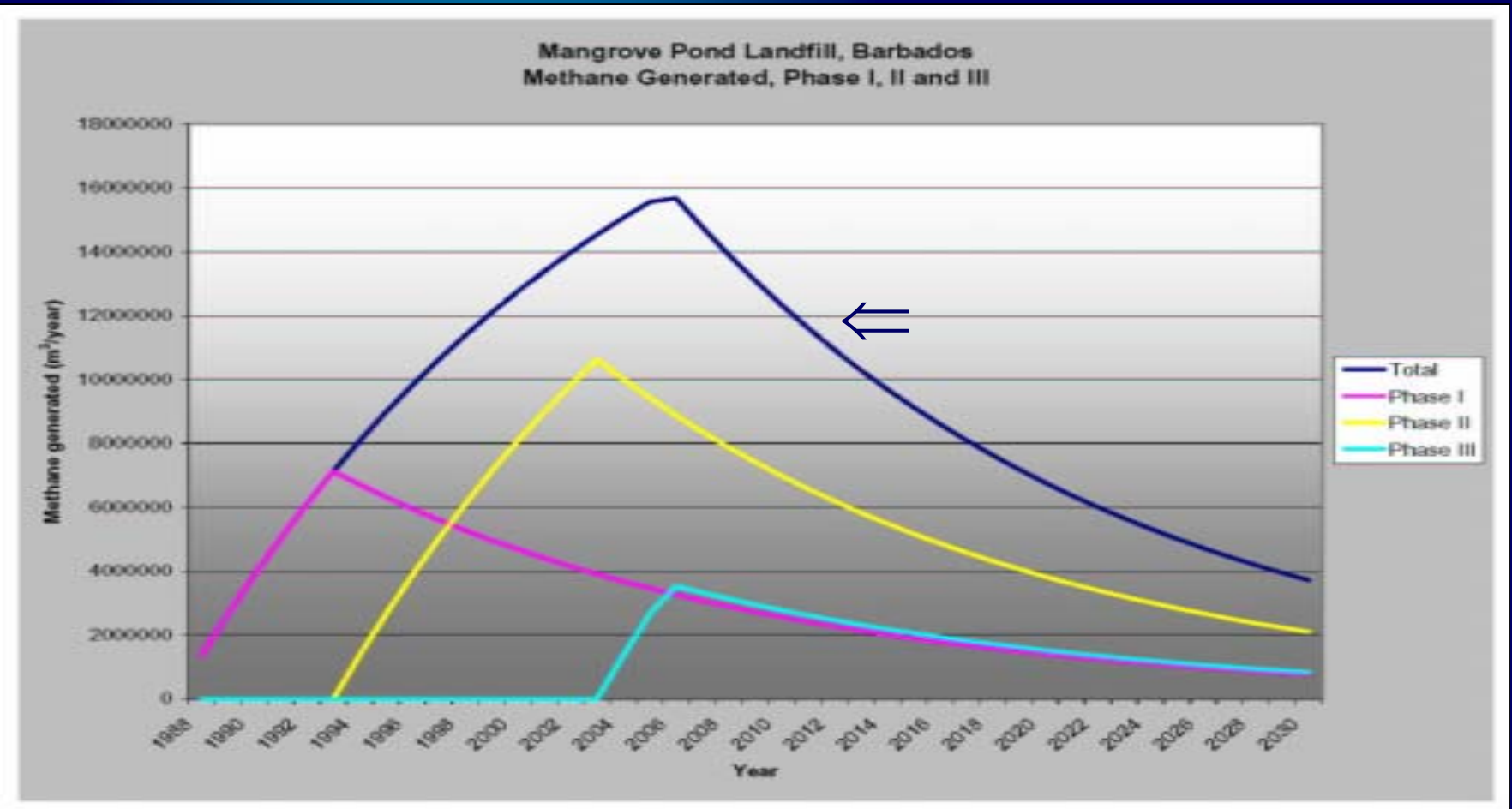
Phase 2



Results

- Modeling efforts: estimated current LFG production rates at 14,000,000 m³ per year, while peak rates estimated to reach 15,700,000 m³ in 2006
- Observed conditions: estimated vertical migration of LFG at the landfill surface was limited to 3,700,000 m³ per year

Estimation of methane generation



Wind Characterization

Wind Characterization

- Wind energy has potential to offset GHG emissions through adding clean energy to the power grid
- Wind speed at 50 m elevation above ground expected to average 7.6 m/s
- Wind expected to provide approximately 16.5 GWh as annual net electrical output
- Energy produced from wind is expected to reduce GHG emissions by 13,000 tonnes CO₂ per year as compared to existing energy generation methods

Example of Wind Turbine

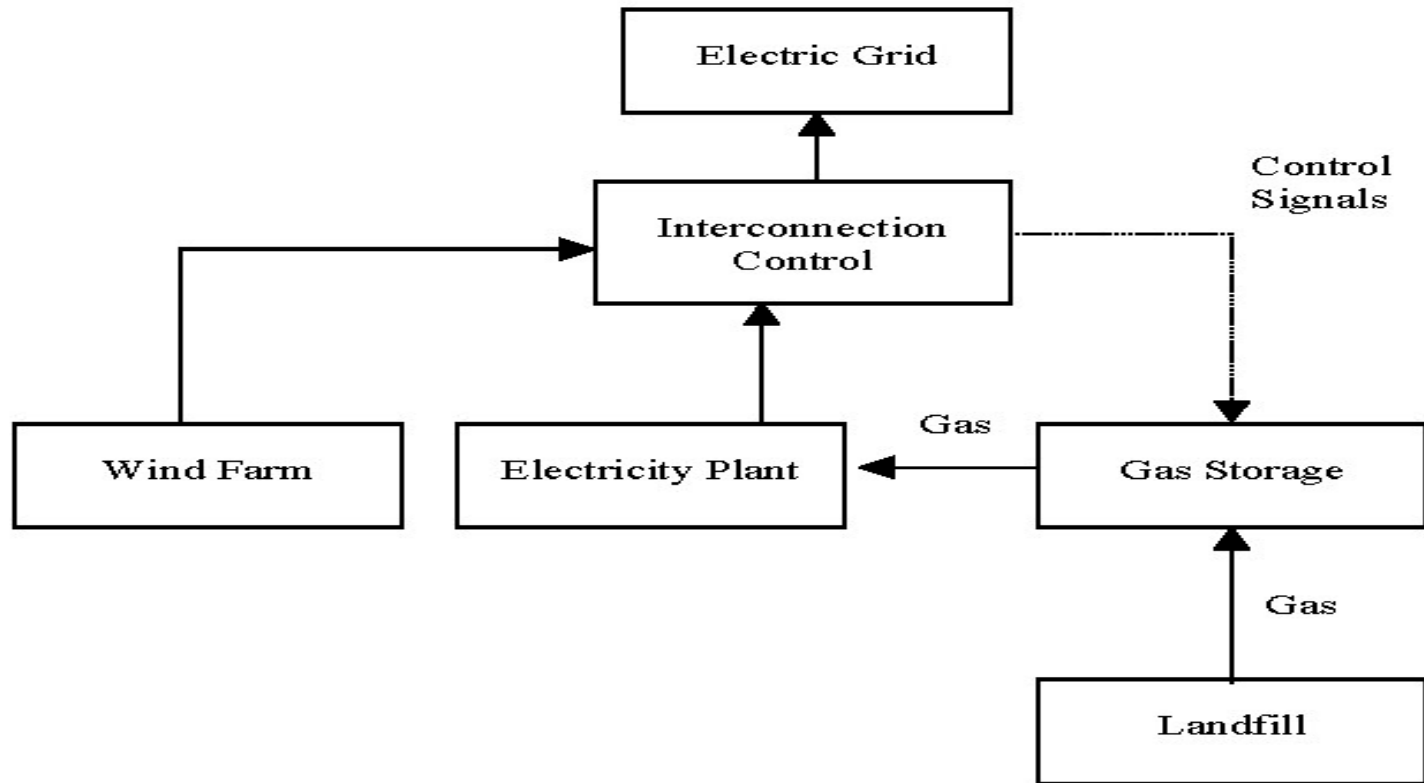


System Design

System Design

- On-site LFG collection and storage has been designed to provide for the option of variable demand rates
- Extraction of LFG from the landfill will be completed using a collection network consisting of a pipeline and recovery system
- On-site storage may be provided through liquefaction of methane or high-pressure methane storage
- LFG treatment will be provided in accordance with the desired end use
- The wind farm component will provide 2 to 3 MW of power

System Design



GHG Emission Reduction Credits as an Additional Funding Mechanism

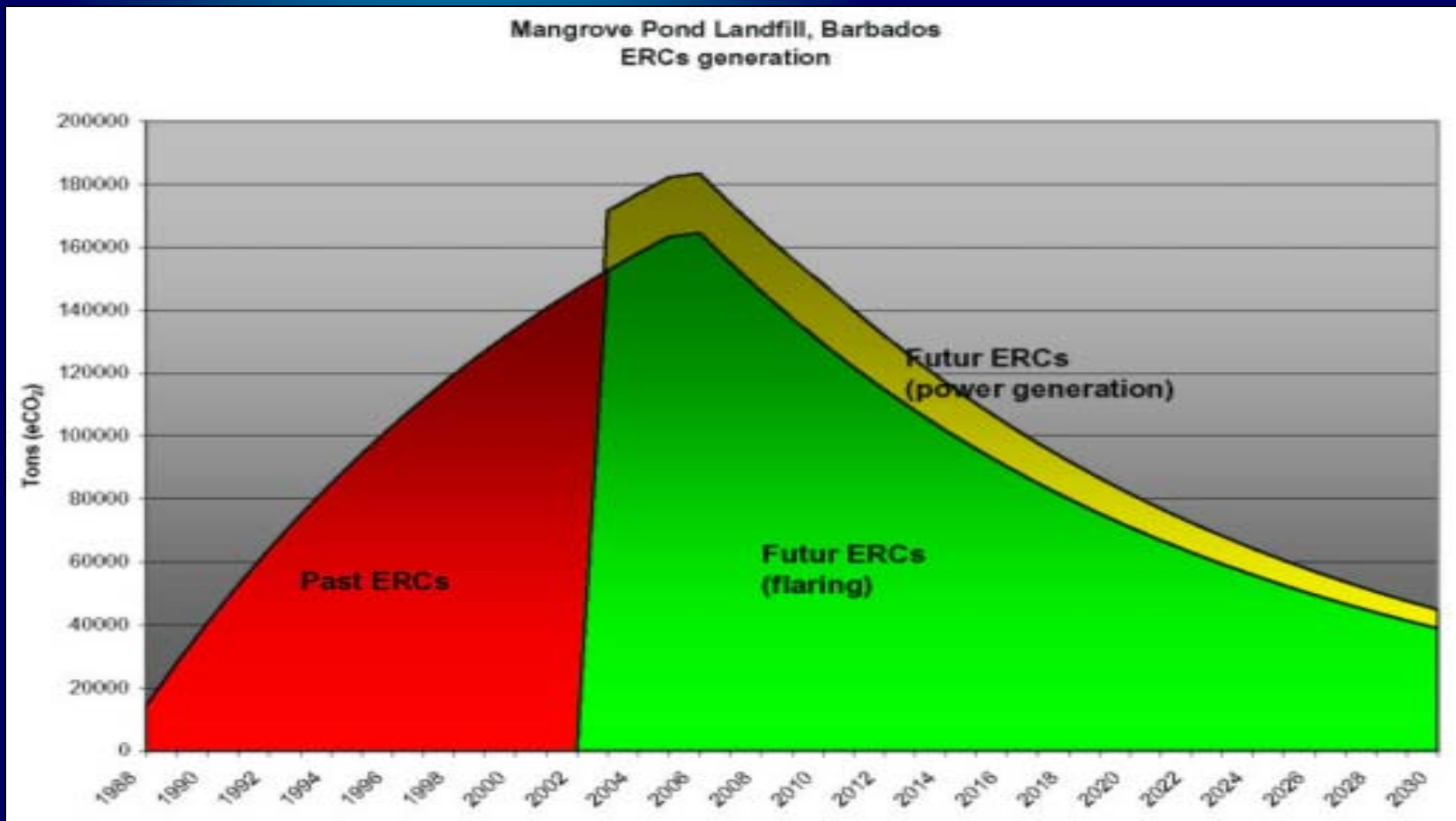
GHG Credits

- LFG emissions are expected to reduce total GHG emissions by:
 - 1.4 million tonnes CO₂e over 10 years through landfill gas collection, and
 - by an additional 190,000 tonnes CO₂e over 10 years through alternate fuel energy generation processes

GHG Credits

- Alternate fuel electrical generation in Barbados is assumed to offset 800 tonnes CO₂e / GWh
- Wind farm electricity generation is expected to offset 43,000 tonnes CO₂e over 10 years

GHG Credits



Opportunities and Deliverables

How to Proceed?

A phased approach

Phase 1 Landfill collection and flaring

Phase 2 Landfill gas energy utilization

Phase 3 Wind mill and energy integration

Feasibility Study &PDD

1. Detailed landfill gas recovery potential
 - Dynamic pumping tests (2-3 wells)
 - Subsurface integrated sampling
2. Construction costs of phase 1 of the project
3. Financial return for phase 1 of the project
4. Preliminary feasibility of phases 2 and 3
5. identify gains to host counties

Phase 1 – Landfill Gas Collection and Flaring

- Detailed feasibility study
- Biogas rights agreement
- Project implementation by Biothermica-Burnside on a Built-Finance-Operate basis
- Registration of CER's under CDM

Deliverables

CDM Baseline Study

Accepted in Final Form by the Canadian CDM/JI Office

Feasibility study

- Summary of Supplemental Landfill Gas Characterization Study
- Design of required technology to permit construction of landfill gas collection system

Deliverables

PDD:

- Project design document (PDD) to meet requirements of the UNFCCC Executive Board and to permit for the verification of Certified Emission Reduction Credits to be issued for this Small-Scale CDM Project

Implementation:

- Project implementation on a Built-Finance-Operate basis

Thank You