Project Idea Note or PIN

Description of size and quality expected of a PIN

Basically a PIN will consist of approximately 5 pages providing indicative information on:

- the type and size of the project
- its location
- the anticipated total amount of Greenhouse Gas (GHG) reduction compared to the "business-as-usual" scenario (which will be elaborated in the baseline later on at Project Design Document [PDD] level)
- the suggested crediting life time
- the suggested Certified Emission Reductions (CER) price in US$/ton CO_2eq reduced
- the financial structuring (indicating which parties are expected to provide the project's financing)
- the project's other socio-economic or environmental effects/benefits

While every effort should be made to provide as complete and extensive information as possible, it is recognised that full information on every item listed in the template will not be available at all times for every project.

Template for PINs

PROJECT IDEA NOTE

A. Project description, type, location and schedule

Name of Project: Montevideo Landfill Gas Collection and Upgrade to Pipeline Quality Natural Gas.

Technical summary of the project ***Date submitted: 4-08-2003***

Objective of the project	The objective of the project is to collect the Landfill Gas (LFG) from the Montevideo new landfill area, its processing to pipeline quality high-BTU gas, and its injection into the natural gas distribution network. This approach requires close co-operation with the private natural gas distributor, to whom the enriched LFG will be sold.
Project description and proposed activities (including a technical description of the project)	The Municipal Government of Montevideo (Intendencia Municipal de Montevideo - IMM), the capital city of the country, currently disposes in its own operated landfill an average of 1500 tons/day of municipal solid wastes (MSW) generated by its 1.4 millions inhabitants. The size of the landfill, the largest of the country, and type of refuse received makes this site a good candidate for a LFG recovery system. The IMM has already started disposing MSW in the new projected 40 hectares sanitary landfill. This new disposal area will have improved groundwater protection through leachate collection & treatment system and geo-membrane bottom liner, in which IMM has already invested US $ 3.5 millions. However, only passive venting rather than a LFG collection system has been projected. The proposed GHG emission reduction project includes the following stages: ▪ LFG extraction system, including wells, well heads, piping, condense collection and knockout, blowers and monitoring station. ▪ Flare stage in order to allow safe NMOCs thermal destruction and methane and combustion during emergency shut-downs ▪ Compression and gas enrichment stage ▪ Compression and pipeline to inject in natural gas network
Technology to be employed	Pipeline quality gas projects are generally in the 5 to 10 mmscfd (inlet flow) size range. This condition is met by the project, since the estimated average LFG flow during its life is 5.6 mmscfd. Another critical factor for the success of a LFG recovery system is the total amount of MSW in place at the beginning of the project. Since at least 2 million tons is required by LFG developers, project should start not before than 2004 to have enough refuse quantities in place and final cover to provide sufficient recoverable LFG. Actual IMM's landfill design is planned for a refuse depth of 100 ft, in compliance with the minimum 40 ft recommended for LFG recovery. Typical pipeline quality gas specifications require a minimum of 970 Btu/scf, to be free of environmental unacceptable substances,

	and must be pressurised to the pressure of the pipeline to which the gas production facility is interconnected. The following steps must be taken to convert LFG to pipeline quality gas: Prevention of air infiltration into the LFG well field; Moisture removal; Sulphur removal; NMOC removal; and Carbon dioxide removal. The removal of CO2 is the principal step taken to increase energy content. The prevention of air infiltration into the well field is also a critical step to satisfy tight gas specifications, since removing air from LFG is widely viewed as being prohibitively expensive. Carbon dioxide can be removed from LFG using three well-proven technologies: the membrane process, the molecular sieve or pressure swing adsorption (PSA), and solvent absorption. Even when all three are reliable, the latter requires a complex chemical plant and to purchase proprietary liquids, and membrane process is expensive. Therefore, PSA was the chosen technology. According to US EPA database, seven landfills in USA are operational producing High-Btu pipeline gas from LFG, while four are under construction. From all these landfills, at least one is using PSA technology[a]. Several biogas upgrading plants are operational in Europe, either in landfills or in sewage plants, and using the upgraded gas as vehicle fuel or as pipeline gas. Specifically, there are four locations in The Netherlands[b] and where LFG is upgraded with PSA and added to the natural gas grid. a. Rumpke SLF Inc., Cincinnati (OH): Input: 9 million scf/d LFG / output: 4.5 million scf/d pipeline gas b. Nuenen 3000 m³/h, Wijster 4000 m³/h, Vasse 300 m³/h and Wolvega 1800 m³/h

Project developer	
Name of the project developer	The project developer will be designated through an international open tender bidding process.
Organizational category	
Other function(s) of the project developer in the project	
Summary of the relevant experience of the project developer	
Address	
Contact person	
Telephone / fax	
E-mail and web address, if any	
Project sponsors	
(List and provide the following information for all project sponsors)	
Name of the project sponsor	Intendencia Municipal de Montevideo
Organizational category	Municipality
Address (include web address, if any)	Avda. 18 de Julio 1360 – Piso 3 – Palacio Municipal / Sectores Ejido y Soriano. C.P. 11200. Montevideo – Uruguay Contact: Eng. Esteban Garino – Environmental Development Dept.

	Tel.: (598 2) 1950 2060 / (598 2) 1950 2050 desarrolloambiental@piso3.imm.gub.uy www.imm.gub.uy
Main activities	Since 1989, domestic solid wastes, street sweepings, park wastes, demolition debris and some industrial wastes have been landfilled here in a controlled way by the IMM. This should be understood as a landfill with frequent capping of the wastes, compacted low permeability clay as bottom, and groundwater monitoring wells. The controlled landfill area of 29.5 hectares and 30+ meters high is about to be closed. Therefore, the IMM has already started disposing MSW in the new projected 40 hectares sanitary landfill. This new disposal area will have improved groundwater protection through leachate collection & treatment system and geo-membrane bottom liner.
Summary of the financials	The total investment for the project is about US $ 5,8 millions, which includes the LFG collection, cleanup and enrichment systems, as well as connection to the network. Downpayment covered by the Municipality will be US $ 1,2 millions, while the remaining US $ 4,6 millions will be provided by a private equity financing, through an international open tender bidding process. The projected net revenues amounts US $ 3.4 millions with an Internal Rate of Return of 21% yearly. The marginal cost of this project reaches US $2,14 for ton of equivalent CO2.
Type of the project	
Greenhouse gases targeted	CH_4
Type of activities	Abatement
Field of activities	
a. Energy supply	Renewable energy, excluding biomass
b. Energy demand	
c. Transport	
d. Waste management	Capture of landfill methane emissions
e. Land Use Change and Forestry	
Location of the project	
Region	South America
Country	Uruguay
City	Montevideo
Brief description of the location of the plant	The plant would be next to the landfill.
Expected schedule	
Earliest project start date	Year in which the plant will be operational: 2005
Estimate of time required before becoming operational after approval of the PIN	Time required for financial commitments: 06 months Time required for legal matters: 06 months Time required for negotiations: 06 months Time required for construction: 12 months
Expected first year of CER delivery	Year 2
Project lifetime	Number of years: 21
Current status or phase of the project	Opportunity study finished. Available documentation: the application of the US EPA E-Plus (Energy Project Landfill Gas Utilization Software
Current status of the acceptance of the Host Country	Memorandum of Understanding on co-operation in the field of CDM between the Netherlands Ministry of Housing, Spatial

	Planning and the Environment and the Uruguayan Ministry of Housing, Territorial Regulation and Environment signed on October 2002
The position of the Host Country with regard to the Kyoto Protocol	The Host Country signed and ratified the Kyoto Protocol

B. Expected environmental and social benefits

Estimate of Greenhouse Gases abated / CO_2 Sequestered (in metric tons of CO_2-equivalent)	Up to and including 2012: 3.1 millions tCO_2-equivalent Up to a period of 10 years: 3.8 millions tCO_2-equivalent Up to a period of 7 years: 2.4 millions tCO_2-equivalent Up to a period of 14 years: 4.8 millions tCO_2-equivalent Total emission reduction: 6.7 millions tCO_2-equivalent Please see Annex 1
Baseline scenario	The baseline scenario is configured by legal constraints and current IMM's landfill management practices. Since no national nor local regulations regarding mandatory LFG capture are expected in the near future, sanitary landfilling with methane venting will be applied in a "bussiness-as-usual" scenario. In order to estimate the methane emissions from solid wastes disposal sites, the IPCC Guidelines for National GHG Inventories Reference Manual encourages to apply the more complex derivative of the first order decay model rather than the default method, if there is sufficient data to do so. Therefore, the US EPA's Landfill Gas Emissions Model software, which employs a first-order equation, was used for both baseline and project conditions. Sources of uncertainty are those considered in § 6.2.5 of the above mentioned manual. Main assumptions for the input data were the following: **MSW composition**: domestic solid wastes (DSW) composition based on IMM's latest survey (1996); other fractions weights (street sweepings, demolition debris, garden and park wastes) based on IMM's 2001 data. **MSW quantity**: based on IMM latest months average data. A conservative approach was taken, since projected annual MSW generation is considered constant and set in the low present value. Due to the recent country's strong economic recession, in few months the MSW generation dropped about 20%. Even when this may be a reversible process, this possiblity was not considered. In the same way, the local population growth incidence (2.4‰/year) was discarded, as it is not significant compared with economic factors. **First order decay model parameters**: methane generation rate constant was based on results from local University (UdelaR) small-scale and field tests in the IMM landfill, supported by a pumping trial in another municipal landfill with similar MSW. The methane generation potential was estimated using the assumed MSW composition and the IPCC default method, with the Bingemer & Crutzen degradable organic carbon fractions (DOCs) values. **LFG composition**: typical LFG composition with 50% of CH4 and 40% of CO2 was assumed. Limited data from the IMM landfill proves this estimation to be reasonable.

Specific global & local environmental benefits	
Which guidelines will be applied?	An environmental management system, compatible with ISO 14,000 standards, will be implemented. This implies monitoring and keeping a record of all possible activities and processes with potential environmental and socioeconomic impacts.
Local benefits	The project will also have a positive local environmental impact through the control of flammable gas migration and NMOCs emissions, which can cause other local and global environmental effects such as odor nuisances, stratospheric ozone layer depletion, and ground-level ozone creation. Other main landfill environmental aspects (i.e.: groundwater contamination) are already considered in the baseline scenario.
Global benefits	Besides CO2 equivalent emissions reduction through methane combustion, the substitution of a fossil fuel by a renewable one contributes to the reduction of GHG emissions.
Socio-economic aspects What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	
Which guidelines will be applied?	
What are the possible direct effects (e.g., employment creation, capital required, foreign exchange effects)?	Foreign investment of 4.5 US$ millions. Saving of natural gas imports. Jobs will be created on the landfill site to operate the LFG collection and proccessing units, and will be covered by local staff.
What are the possible other effects? For example: • training/education associated with the introduction of new processes, technologies and products and/or • the effects of a project on other industries	Local staff will be trained on various fields to guarantee proper operation of the system.
Environmental strategy/ priorities of the Host Country	Project is consistent with current development policies in Uruguay. Sustainable development criteria are being developed by national CDM authorities.

C. Finance

Total project cost estimate	
Development costs	4.7 US$ million (discount rate: 12% yearly).
Installed costs	5.8 US$ million of the initial investment
Other costs	
Total project costs	10.5 US$ million
Sources of finance to be sought or already identified	
Equity	
Debt – Long-term	
Debt - Short term	
Not identified	4.6 US$ million of the initial investment
CDM contribution sought	7.5 US$ million (discount rate: 12% yearly)

CDM contribution in advance payments. (The quantum of upfront payment will depend on the assessed risk of the project by the World Bank, and will not exceed 25% of the total ER value purchased by the World Bank for the project. Any upfront payment will be discounted by a factor considered appropriate by the World Bank for the project.)	CDM contribution in advance payments will depend of the international open tender bidding process.
Sources of carbon finance	
Indicative CER Price (subject to negotiation and financial due diligence)	US$ 3 tCO2 equivalent
Total Emission Reduction Purchase Agreement (ERPA) Value	
A period until 2012 (end of the first budget period)	8 US$ millions
A period of 10 years	10.8 US$ millions
A period of 7 years	6.7 US$ millions
A period of 14 years (2 * 7 years)	7.4 US$ millions
If financial analysis is available for the proposed CDM activity, provide the forecast financial internal rate of return for the project with and without the CER revenues. Provide the financial rate of return at the expected CER price above and US$3/ tCO_2e. DO NOT assume any up-front payment from the PCF in the financial analysis that includes PCF revenue stream. Please provide a spreadsheet to support these calculations.	The forecast of Financial Internal Rate of Return with CER revenues is 21% yearly, and can not be calculated without CER revenues. Please see Annex 2: Financial Analysis.

Annex 1: i
GHG emissions calculations

US EPA E-PLUS (**E**nergy **P**roject **L**andfill **G**as **U**tilization **S**oftware) was used for the GHG emissions calculations. E-PLUS is a decision support system designed to analyze the opportunities for installation of a gas recovery system in landfills. The selected methane production estimate method in E-PLUS was the IPCC aproved[1] First Order Decay Model:

$$Q^{T} = \Sigma\, Q^{T,x} \quad \text{for } x = \text{initial year to } T$$

$$Q^{T,x} = L_O\, R_x\, e^{-k\,(T-x)}$$

where:

Q^T	=	total methane generated to the year (T) by the waste Rx
$Q^{T,x}$	=	methane generated in current year (T) by the waste Rx
L_O	=	methane generation potential (m³/Mg of refuse)
R_x	=	the amount of waste disposed in year x (Mg)
k	=	methane generation rate constant (1/yr)
x	=	the year of waste input
T	=	current year

Based on previous studies[2, 3] the adopted value for k was 0.20 1/yr. L_O was calculated with IMM's MSW composition data and IPCC's default degradable organic carbon (DOCs) factors for major waste streams, resulting in 1.310 cf/lb CH_4 or 82 m³/Mg CH_4. This is a conservative value, since L_O values may range from less than 100 to over 200 m³/Mg.

Modern LFG recovery systems can reach collection efficencies of more than 85%, so a 70% value was adopted as an achievable goal.

The amount of waste disposed by year was assumed to be fixed in 1500 Mg/day, wich is a conservative approach according to considerations discussed for baseline methodology.

1. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Reference Manual - Methodologies to estimate methane emissions from solid waste disposal sites

2. Borzacconi, L.; López, I.; Gazzola, A.; Anido, A. (1998). Estimación de la producción de biogás en un relleno sanitario.

3. Horta, M. (1999) Proyecto demostrativo de recuperación y aprovechamiento energético del biogás de un relleno sanitario. Descripción de las actividades de campo. Unidad de Cambio Climático

Annex 1: ii

Emission Reductions in 1000 Mg/year				
Year	**CH_4 reduction**	**CO_2 equivalent reduction**	**CO_2 avoided by gas sale**	**Total CO_2e Reduction**
2004	7,68	161,32	19,96	181,27
2005	10,28	215,86	27,22	243,08
2006	12,41	260,53	32,66	293,19
2007	14,15	297,10	37,19	334,30
2008	15,58	327,05	40,82	367,87
2009	16,74	351,56	43,54	395,11
2010	17,70	371,63	46,27	417,89
2011	18,48	388,06	48,08	436,14
2012	19,12	401,51	49,90	451,41
2013	19,64	412,52	51,71	464,23
2014	20,08	421,54	52,62	474,16
2015	20,42	428,93	53,52	482,45
2016	20,71	434,98	54,43	489,41
2017	16,96	356,12	44,45	400,58
2018	13,88	291,57	36,29	327,86
2019	11,37	238,72	29,94	268,65
2020	9,31	195,44	24,49	219,94
2021	7,62	160,02	19,96	179,98
2022	6,24	131,02	16,33	147,34
2023	5,11	107,27	13,61	120,87
TOTAL	**283**	**5953**	**743**	**6696**
Average	**14,2**	**297,6**	**37,1**	**334,8**

Methane emission reduction (1000 tons/yr) = Methane generated (mmcf/yr) x Collection efficiency x 21.12 tons/mmcf x 21 ton CO_2/ton CH_4 x 1/1000

CO_2 equivalent of Methane emission reduction (1000 tons/yr) = methane emission reduction (mmcf/y) x 21.12 tons/mmcf x 21 ton CO_2/ton CH_4 x 1/1000

CO_2 equivalent avoided by gas sale (1000 tons/yr) = methane sold (mmcf/yr) x 21.12 tons/mmcf x 44/16 (CO_2/CH_4)

1 ton = 0.9072 Mg

1 mmcf = 28,32 1000 m³

Annex 2
Financial Analysis

Cash Flow

In US$ of the year 2003

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total costs	5.719.748	398.501	489.307	563.653	624.522	674.358	715.159	748.565	775.915	798.308
Investments	5.719.748	0	0	0	0	0	0	0	0	0
Operation and Maintenance	0	398.501	489.307	563.653	624.522	674.358	715.159	748.565	775.915	798.308
Residual value of the investments										
Benefits		1.115.135	1.493.771	1.802.301	2.055.132	2.261.896	2.430.415	2.569.861	2.682.787	2.776.237
Natural gas sales	0	571.314	764.530	922.722	1.052.239	1.158.279	1.245.096	1.316.177	1.374.372	1.422.019
Net CER sales	0	543.821	729.240	879.579	1.002.893	1.103.617	1.185.319	1.253.684	1.308.414	1.354.218
Net benefits	-5.719.748	716.634	1.004.463	1.238.649	1.430.610	1.587.539	1.715.255	1.821.296	1.906.871	1.977.929
Net benefits without sale of CERs	-5.719.748	172.813	275.223	359.069	427.717	483.921	529.937	567.612	598.457	623.711
Reduced emissions in tons of CO2		181.274	243.080	293.193	334.298	367.872	395.106	417.895	436.138	451.406

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total costs	816.641	6.551.399	843.941	854.002	722.763	615.313	527.341	455.315	396.346	348.065	308.537
Investments	0	5.719.748	0	0	0	0	0	0	0	0	0
Operation and Maintenance	816.641	831.652	843.941	854.002	722.763	615.313	527.341	455.315	396.346	348.065	308.537
Residual value of the investments											0
Benefits	2.853.730	2.915.442	2.966.466	3.008.749	2.463.005	2.016.215	1.651.419	1.352.016	1.106.657	906.032	742.509
Natural gas sales	1.461.029	1.492.967	1.519.116	1.540.525	1.261.275	1.032.645	845.458	692.203	566.728	463.997	379.889
Net CER sales	1.392.701	1.422.475	1.447.350	1.468.224	1.201.729	983.570	805.961	659.814	539.929	442.035	362.620
Net benefits	2.037.088	-3.635.957	2.122.525	2.154.747	1.740.242	1.400.901	1.124.078	896.701	710.311	557.967	433.972
Net benefits without sale of CERs	644.387	-5.058.432	675.175	686.523	538.512	417.332	318.117	236.887	170.382	115.932	71.352
Reduced emissions in tons of CO2	464.234	474.158	482.450	489.408	400.576	327.857	268.654	219.938	179.976	147.345	120.873

NPV (12%) of the net benefits without CERs US$	**-4.152.417**
NPV (12%) of the net benefits incl. CERs US$	**3.366.148**
FIRR of the net benefits included CERs	**21%**

Price of CER without transaction costs: 3 US$/T CO2eq