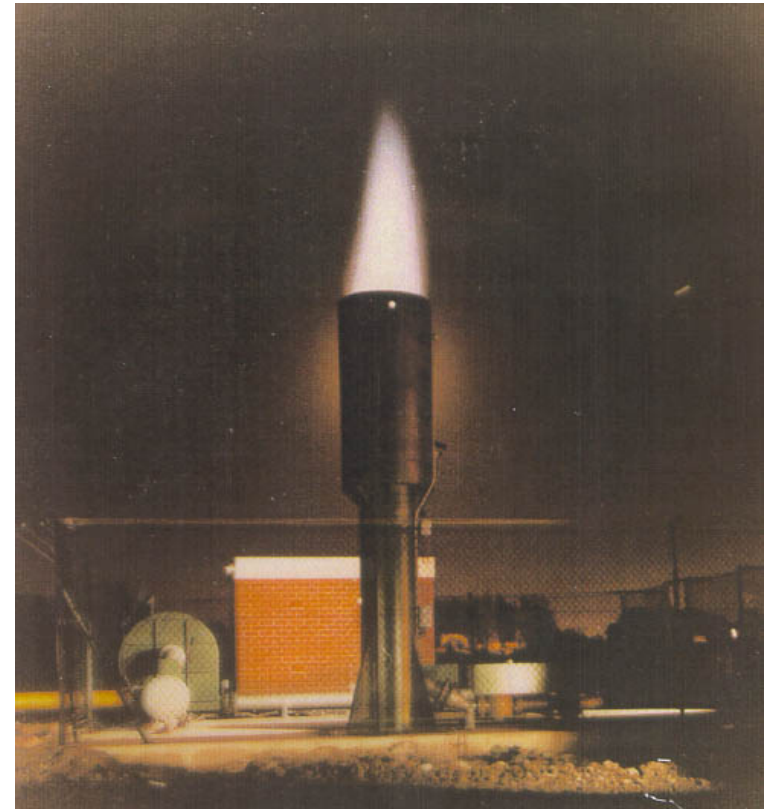


**METHANE TO MARKETS
MINISTERIAL MEETING**

**NOVEMBER 15, 2004
WASHINGTON D.C.**

BARRIERS AND OPPORTUNITIES FOR
LANDFILL GAS CAPTURE AND USE

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Project Director



Introduction

- Introduction
- UK/EU requirements landfill gas (LFG) management
- UK financial opportunities
- Overseas financial opportunities

Introduction

- Methane, 21 x GWP (Global Warming Potential) than carbon dioxide.
- GHG (Greenhouse Gases) absorb infra-red radiation from Earth's surface and radiate heat.
- Lead to climate change.



Introduction

Kyoto Protocol Commitments (1997)

- Kyoto - 5.2% reduction below 1990 levels by 2008-12
- EU - 8% reduction below 1990 levels by 2008-12
- UK - 12.5% reduction below 1990 levels by 2008-12
- 15.4% reduction below 1990 levels by 2015
- UK goals - 20% reduction below 1990 levels by 2010
- 60% reduction below 1990 levels by 2050

Introduction

UK Government Facts and Predictions

1960 – 7M affected by world flooding

2003 – 150M affected by world flooding

\$55Bn damage extreme weather events 2002

6°C global warming 21 century, 88cm sea level rise, threaten 100M people

GHG increase, 10% since 1990

UK, 5% GHG reduction since 1997, 17% economic growth

UK, 27% of GHG from methane emissions

EU, UK Regulatory Requirements Landfill Directive

Legislation	Implications
Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste	Seeks to harmonise landfill standards across the EU, and reduce the amount of biodegradable municipal waste (BMW) landfilled for reasons of sustainability
Condition	Aim
6	“Landfill should be adequately monitored and managed to prevent or reduce potential adverse effects on the environment and risks to human health”

EU, UK Regulatory Requirements Landfill Directive

Condition	Aim
11	“to lay down technical standards for landfill of waste at Community level”
16	“to reduce the product of methane gas from landfills, <i>inter alia</i> , in order to reduce global warming, through the reduction of the landfill of biodegradable waste and the requirements to introduce landfill gas control

Landfill Gas Management

Hierarchy	Systems
Utilise	Contain
Flare	Collect
Oxidise	Extract
Vent	Combust

Financial Opportunities, UK/EU

- 1989, UK Electricity Act – Non-Fossil Fuel Obligation (NFFO) Orders
- 2000, UK Utilities Act, Renewables Obligation (RO) Order 2002 and Climate Change Levy (CCL), managed by OFGEM (Office for Gas & Electricity Markets)
- Jan 2005, EU Emissions Trading Scheme (ETS), 'cap and trade' through 'National Allocation Plans' (NAP)

Financial Opportunities, UK

NFFO	DATE	CONTRACTS	MW	PRICE
1	1990 – 98	-	35Mw	5.7 – 6.4p/Kwh(10.3 – 11.5cc/Kwh)
2	1991 – 98	-	48Mw	4.8 – 5.7p/Kwh (8.6 – 10.3cc/Kwh)
3	1994 (15 year)	177	389Mw	4.2 – 4.8p/Kwh (7.6 – 8.9cc/Kwh)
4	1997 (15 year)	60	148Mw	2.8 – 3.2p/Kwh (5.0 – 5.8cc/Kwh)
5	1998 (15 year)	75	159Mw	2.6 -2.9p/Kwh (4.7 – 5.2cc/Kwh)

UK electricity cost around 2.5p/kwh (4.5cc/kwh)

Financial Opportunities, UK

ROCs, Renewable Obligation Certificates

- ROCs came into force 1st April 2002, Government's mechanism for increasing electricity from renewable sources
- Regional Electricity Companies (RECs) have targets for non-fossil fuel electricity and have to pay any shortfall as a Fossil Fuel Levy (FFL)/ROC buy out price
- REC buy ROCs from OFGEM
- OFGEM buys ROCs under Replacement Fuel Purchase Agreements from Registered contractors, and is the wholesaler for ROCs
- There are regular auctions for ROCs

Financial Opportunities, UK

ROCs

Each bid; irreversible offer

0.1p to 20p/Kwh

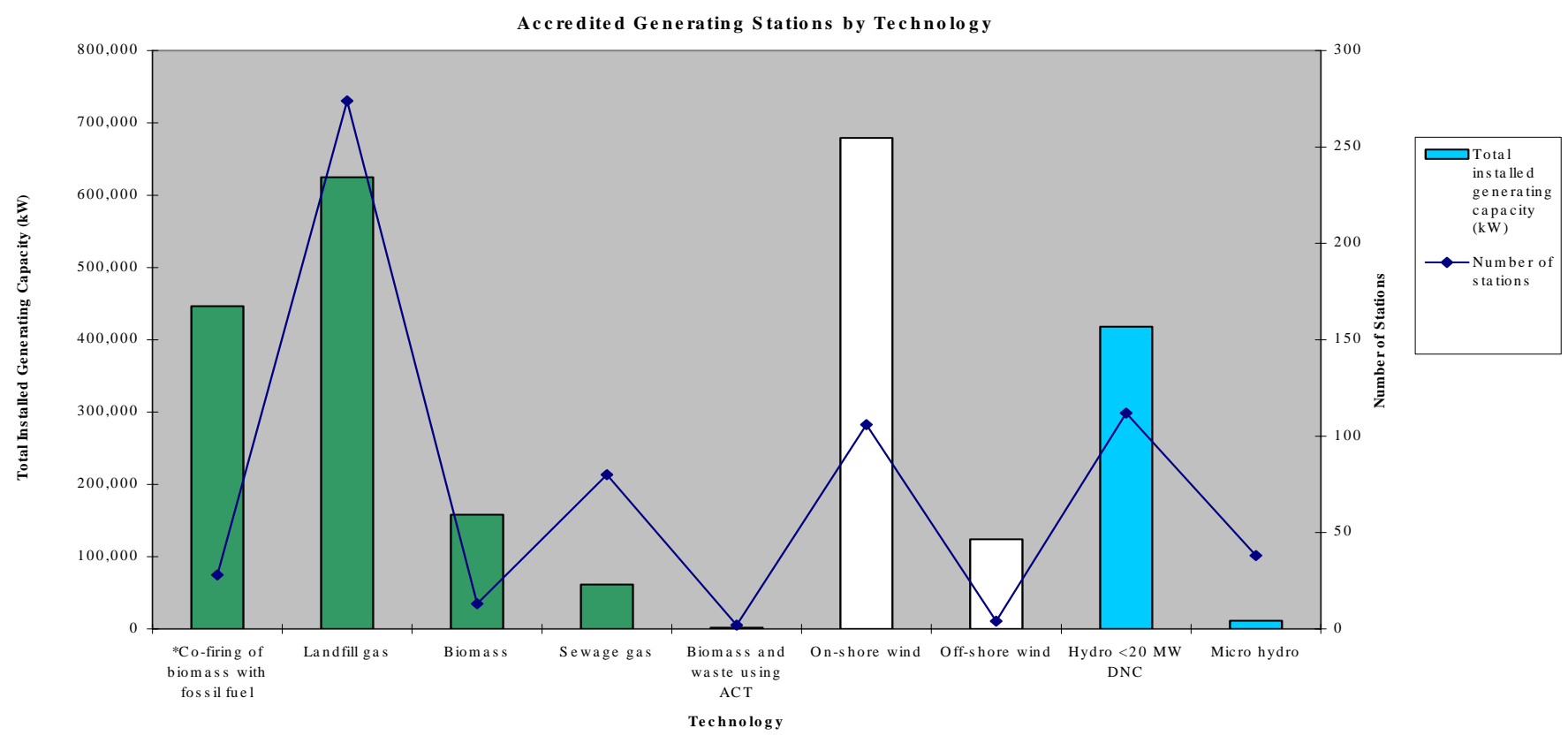
(0.18cc to 36cc/Kwh)

0.05p (0.09cc) rate of bidding

Auctions, £50MWh average

Technology	August 2004
Biomass	5.79p/Kwh(10.4cc)
Hydro	7.66p/Kwh(13.8cc)
LFG	7.80p/Kwh(14.1cc)
MIW	3.03p/Kwh (5.5cc)
Wind	7.31p/Kwh(13.2cc)

Financial Opportunities, UK



Financial Opportunities, UK

ROC Issue from April 2002 to August 2004 by Technology and Country

	England	Wales	Scotland	TOTAL
Co-firing of biomass with fossil fuel	1,216,200		134,447	1,350,647
Landfill gas	5,996,243	131,194	243,748	6,371,185
Biomass	1,497,705		55,205	1,552,910
Sewage gas	404,238			404,238
Biomass and waste using ACT	8,491			8,491
On-shore wind	657,863	768,677	1,041,277	2,467,817
Off-shore wind	6,449	60,709		67,158
Hydro <20 MW DNC	50,950	236,782	1,678,377	1,966,109
Micro hydro	1,400	815	78,292	80,507
TOTAL	9,839,539	1,198,177	3,231,346	14,269,062

Financial Opportunities, Overseas

- CDM – Countries, no legislation to combust LFG, qualify for Emission Reductions (ERs)
- PCF – Prototype Carbon Fund, purchase ERs through World Bank
- ERs – Paid for LFG combustion and fossil fuel saving
- EU – Feed-in tariffs

Case Study, eThekiwi Municipality, Durban Solid Waste, South Africa

- Bisasar Road, 21Mm³ by 2016, 3,500tp day.
- Mariannahill, 4.4Mm³ by 2024, 700tp day.
- La Mercy, 1.3Mm³ by 2006, 300tp day.
- Sites historically dilute and disperse.
- New phases now lined.
- Restored with natural soil materials

Bisasar Road Landfill



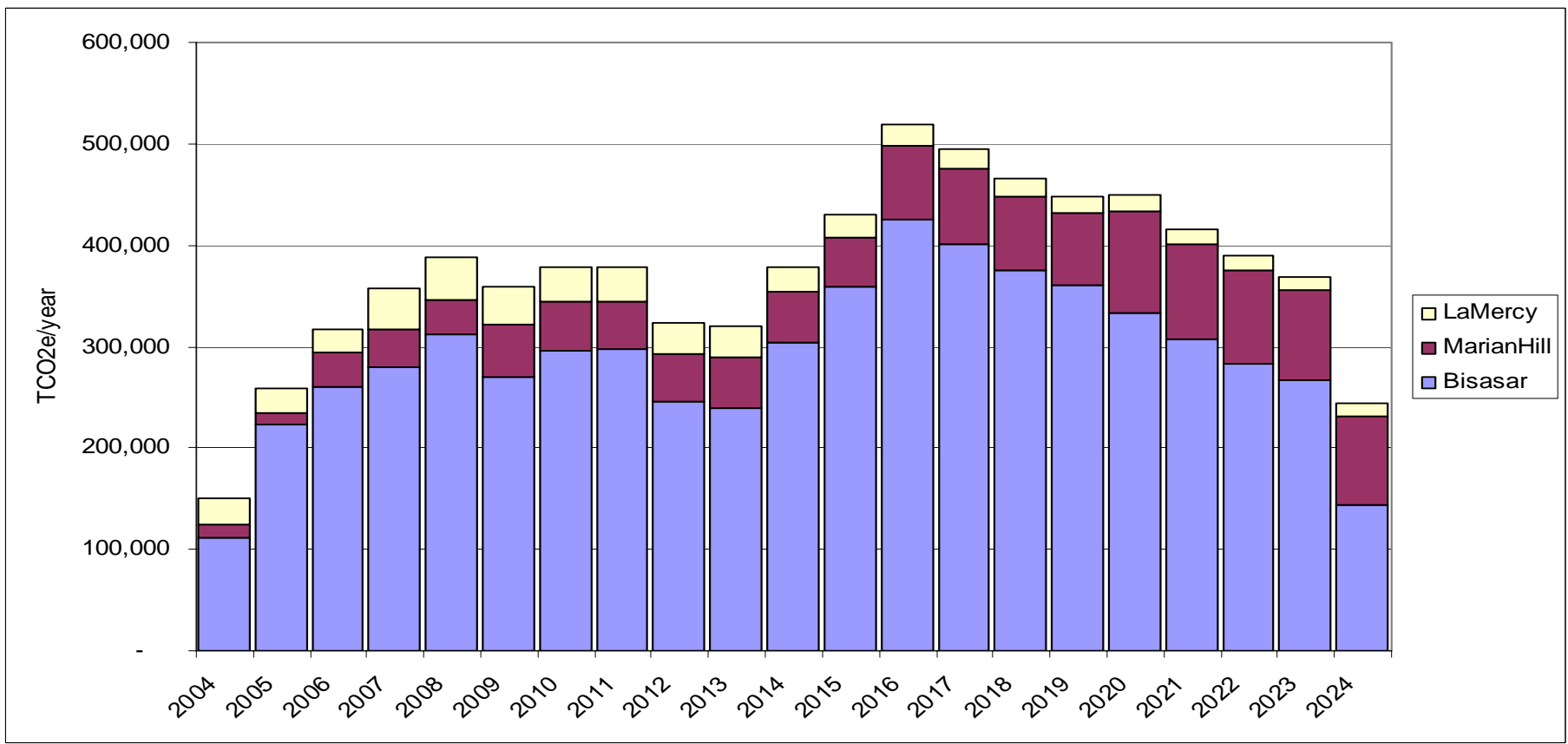
Mariannahill Landfill



CDM PCF Process

- PIN
- PCN
- Baseline Study
- Methodology Approval
- Term Sheet
- ERPA
- EIA
- ERPA Final signing.

EMISSION REDUCTIONS



7.75 MILLION TONNES, 21 YEARS

Emission Reductions

- $ER_y = (MD_{project_y} - MD_{baseline_y}) \times GWP_{CH_4} + ES_y \times Elgrid_y$

ER – emission reduction (tCO_{2e})

MD = methane destroyed (t)

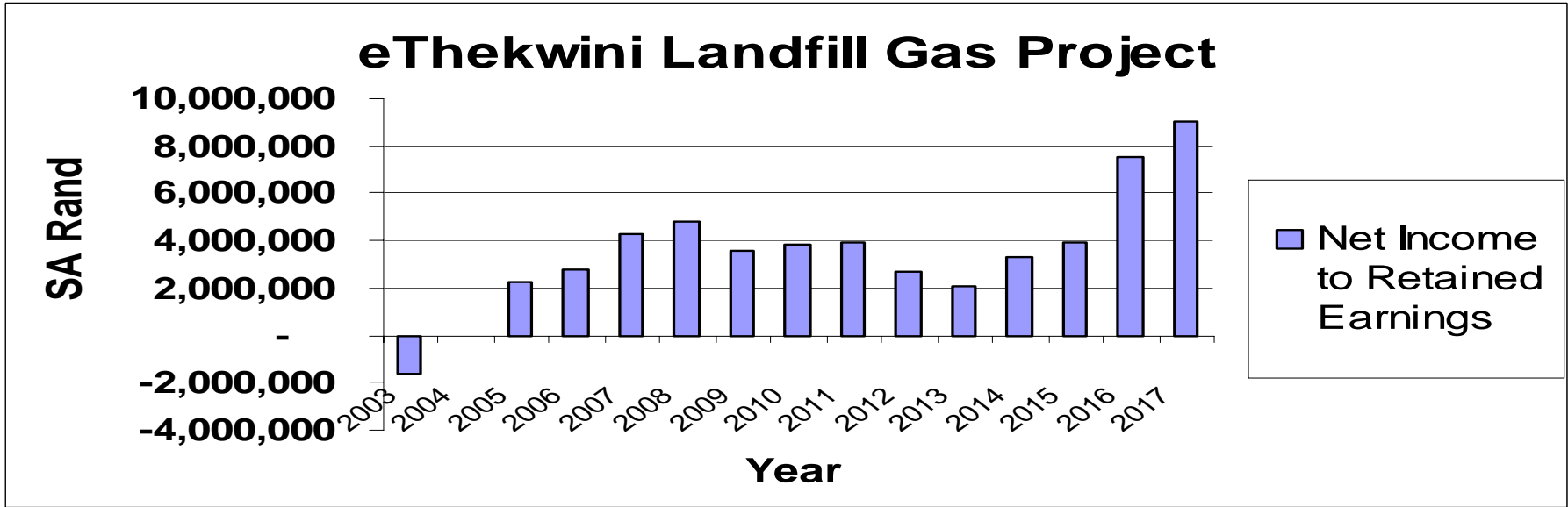
GWP_{CH₄} = global warming potential of methane (CO_{2e})

ES = electricity generated, (MWh)

Elgrid = EO₂ equivalent per MWh (tCO_{2e}/MWh)

Finance

- \$3.75/t CO₂eq (per tonne carbon dioxide equivalent).
- \$0.20/t CO₂eq social benefit fund (advance payment).



Thank you



Questions