DURBAN'S GAS-TO-ELECTRICITY PROJECT

MITIGATING METHANE EMISSIONS

PARIS, FRANCE

9 NOVEMBER 2015

John Parkin
Deputy Head: Plant & Engineering
eThekwini Municipality

SOUTH AFRICA

DURBAN (ETHEKWINI)

- Area : 2297 sq kms
- Coast Line: 98 kms
- Rural: 55% by Area
  15% by Pop.
- Population : 3,5m
- Households: 925 000
- Unemployment: 32%

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SUNSET OVER DURBAN

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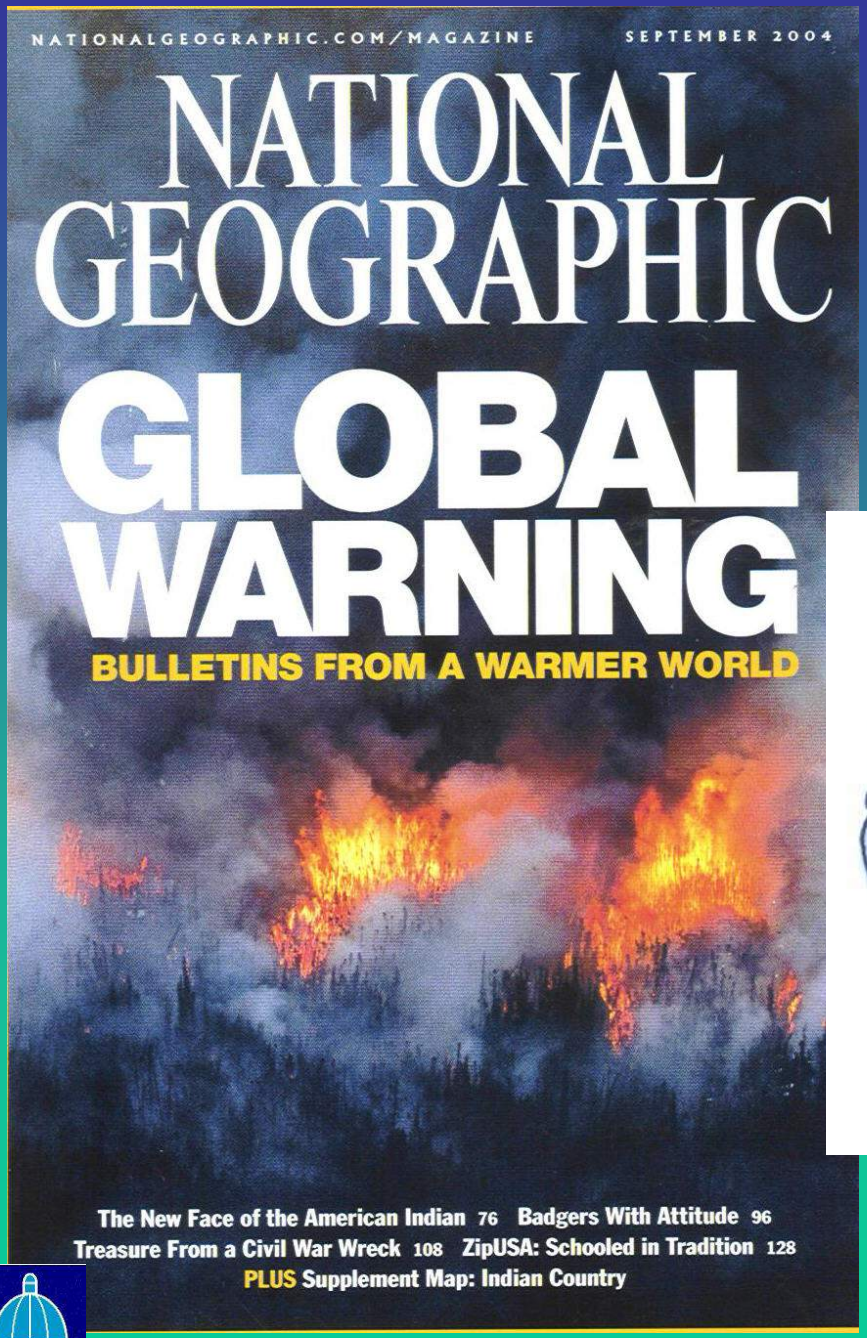

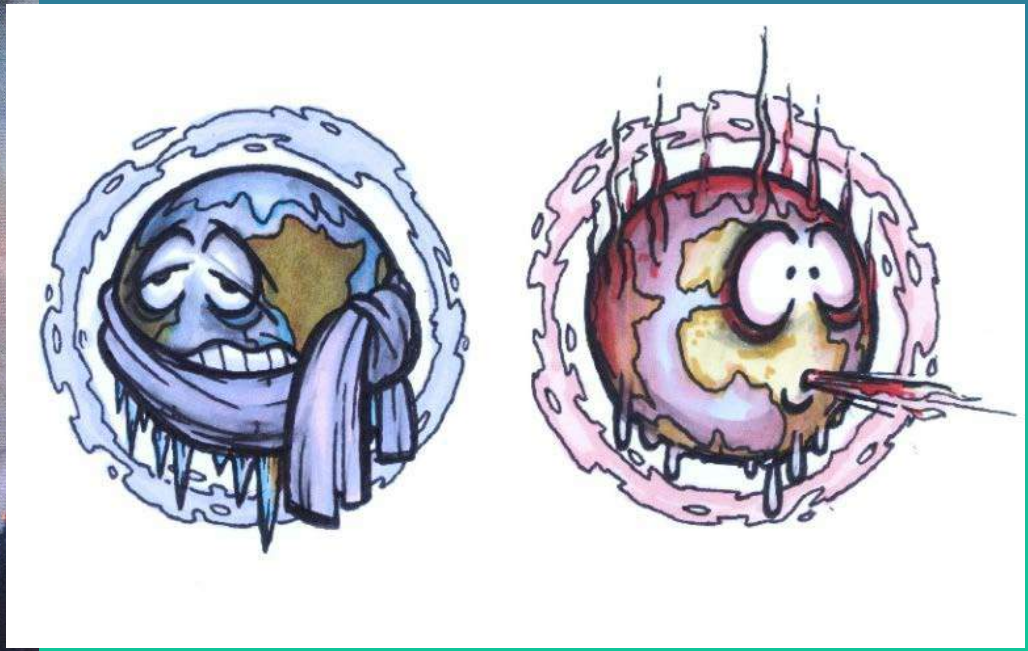

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PROOF OF GLOBAL WARMING

GAS PRODUCTION

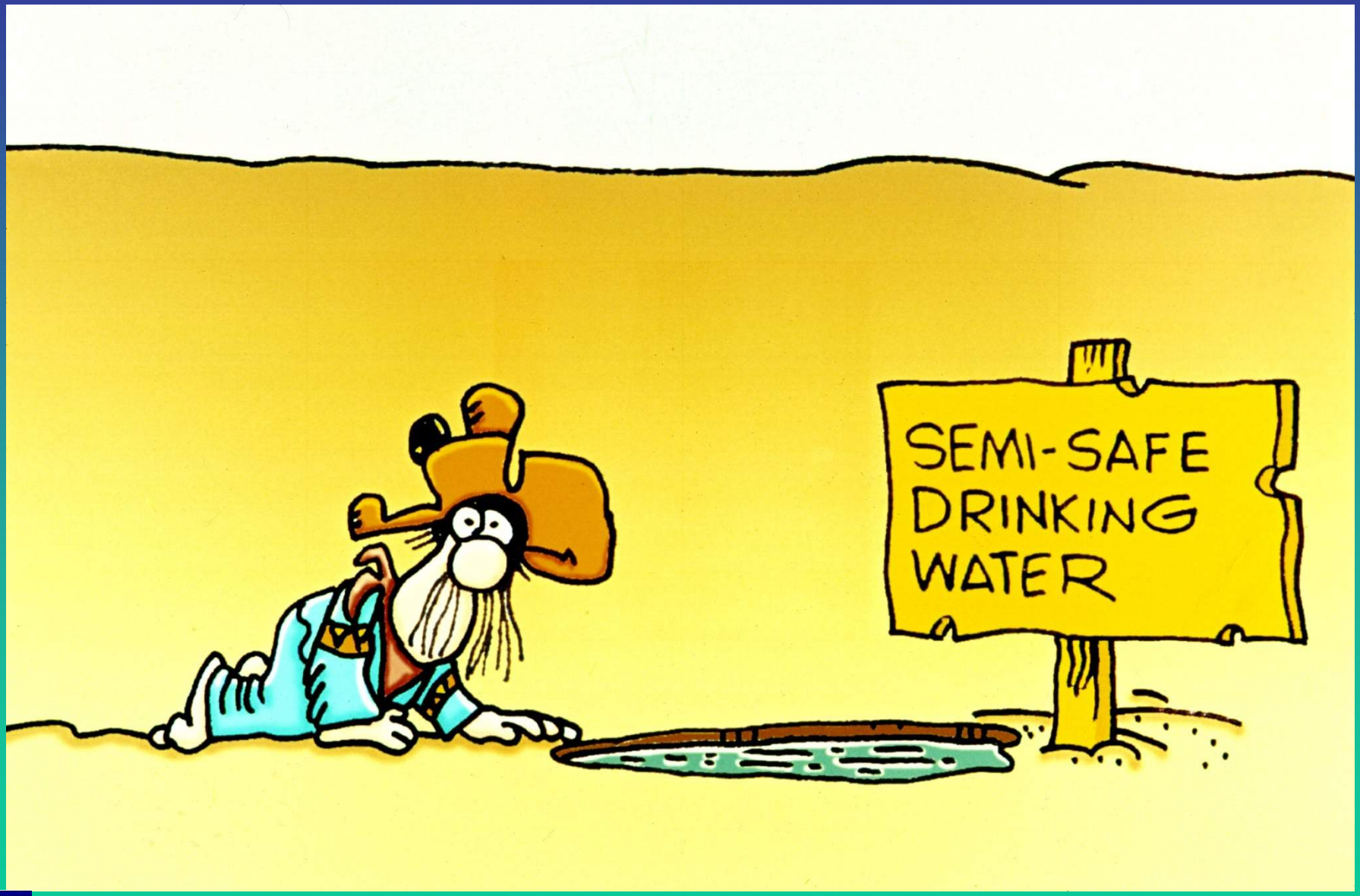
“A rule-of-thumb is that 6 – 10m^3 of landfill gas will be produced per ton of waste per year for 10 – 15 years from placement”

(Robert Eden, et al; 2002)

- Roughly 500Nm^3/hr from every 1m t of waste.

- 1MW electricity from every 700Nm^3/hr of gas

AFRICA'S FIRST LANDFILL GAS CDM PROJECT



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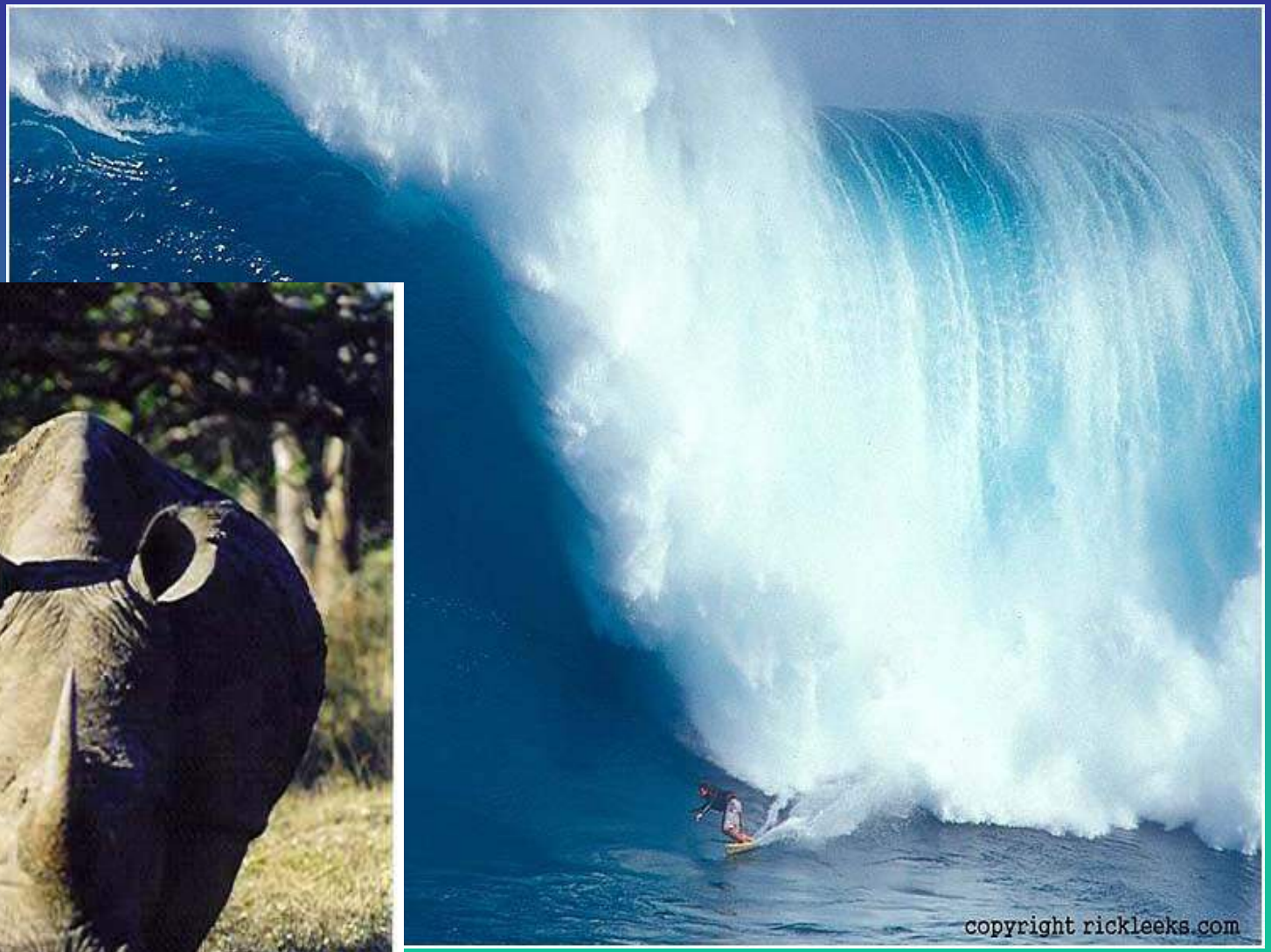

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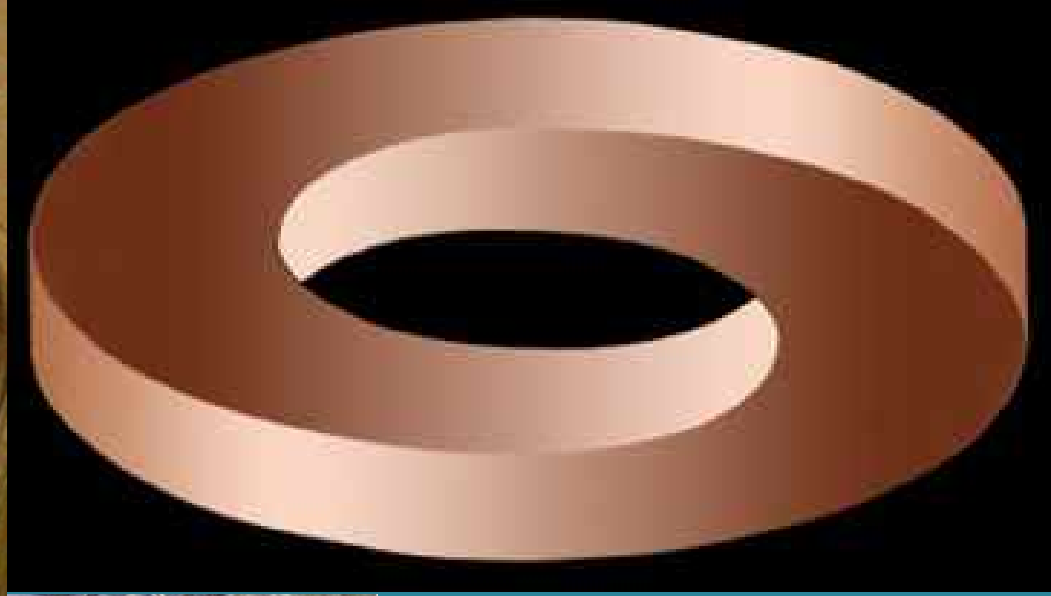
UNSUSPECTING & NAIVE



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CHAMPION

PASSIONATE

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BITTEN OFF MORE THAN WE COULD HANDLE

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MARIANNHILL LANDFILL

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1 MW ENGINE

BISASAR ROAD LANDFILL

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COMMISSIONED 6,5 MW JULY 2009

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The CDM Project Process

- PIN
- PCN
- Conditional Approval from DNA (DoE)
- Base-Line Study
- Validation Report
- MP (Monitoring Plan)
- PDD (Project Design Document)
- Comment from Public and Stakeholders
- EIA Process and obtain ROD for Project
- Verification of Project
- Final DNA Approval
- Project Registration with CDM Exec Board

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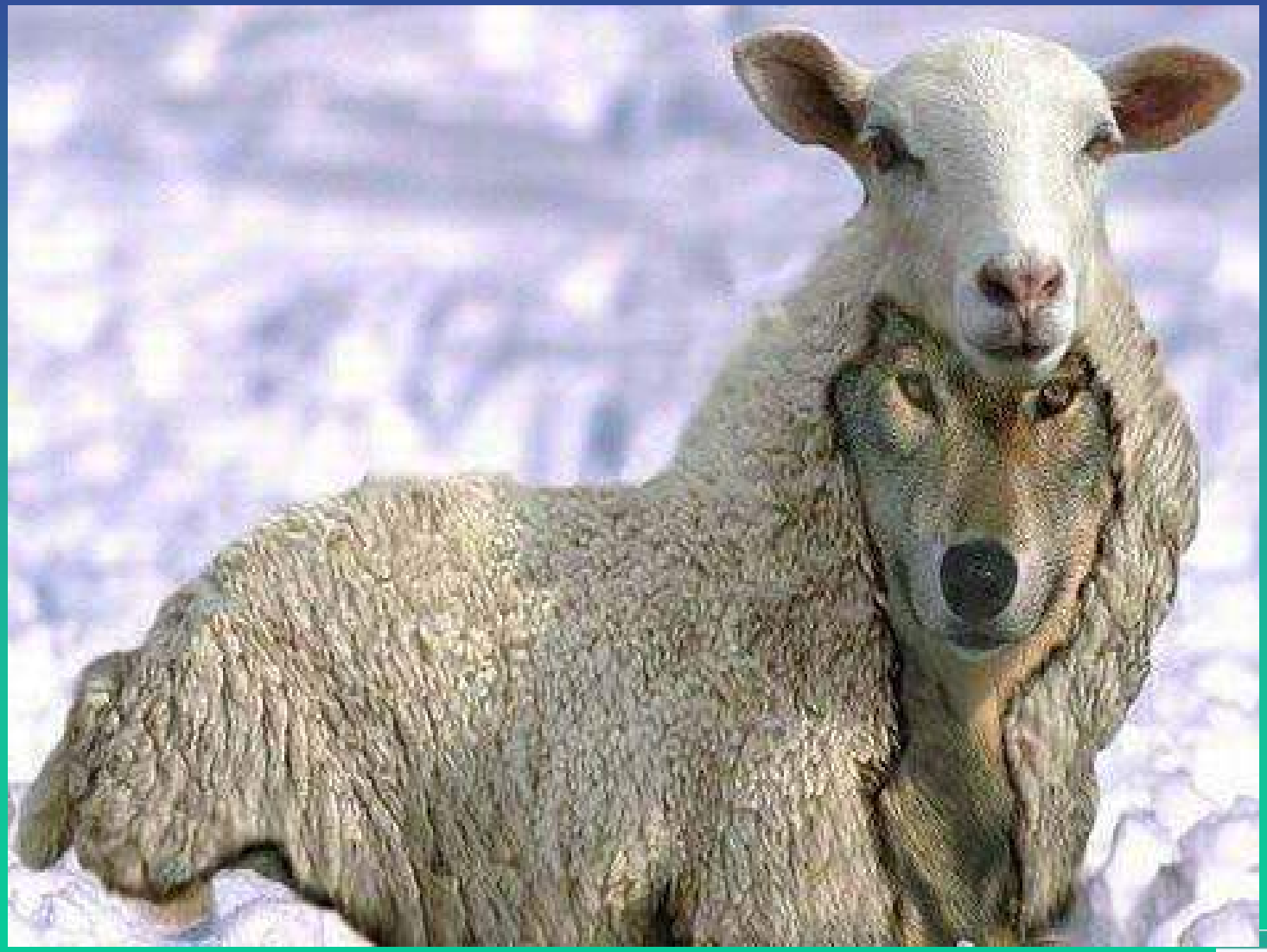
PROCESS LIKE A WOLF IN SHEEP'S CLOTHING



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LFG-to-Elec CDM Project Time Frames

First contact with PCF/World Bank	November 2001
MOU between eThekwini and PCF –	February 2003
Commence EIA's –	July 2003
Adhoc Approval for funds –	October 2003
ROD's for Mariannhill and La Mercy ("Component One") –	July 2004
Appeal against "Component One"	August 2004
Appeal response to Minister of DAEA for "Component One" –	September 2004

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LFG-to-Elec CDM Project Time Frame Cont

ROD Bisasar (“Component Two”) –	October 2004
Started construction …. “Component One”	January 2006
Final Revised ROD for “Component Two” (Bisasar) –	August 2006
CDM Registration of Component 1 (Mariannhill & La Mercy) –	November 2006
Commissioning of Mariannhill & La Mercy Flares & Gens –	Nov~Dec 2006
Initial Verification of Mariannhill	January 2007

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LFG-to-Elec CDM Project Time Frame Cont

"Component Two" (Bisasar) Start Construction –	March 2007
Verification of "Component 1" Year 1	January 2008
Commissioning of Bisasar Rd Flare & Engines	March 2008
Registration of Component 2 (Bisasar Rd)-	March 2009
Commissioning of 6,5 MW Component 2 (Bisasar Rd)	July 2009
Initial Verification Bisasar	November 2009
2nd Verification Mariannhill	November 2009

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LFG-to-Elec CDM Project Time Frame Cont

3rd Verification Mariannhill	September 2011
First Issuance Bisasar (65 711)	30 December 2011
Sale of VCU's (124 884)	January 2012
Commission Gas Chiller	May 2012
First Issuance Mariannhill (39 472)	March 2013
4th & 2nd Verifications Mariannhill & Bisasar	March 2013
2nd , 3rd & 4th Issuance Mariannhill	May, June, Aug 2013

LFG-to-Elec CDM Project Time Frame Cont

Reregistration of Mariannhill Project (ACM 0001)	December 2013
2nd Issuance Bisasar (749 633)	February 2014
5th Verification Mariannhill	March 2014
5th Issuance Mariannhill (33 937)	June 2014
6th Verification Mariannhill, first under ACM 0001 No issuance to date	November 2014
Notification of reregistration for Bisasar	September 2015

Calculated Emission Reductions (in tons)

Site	Methane Destruction	Electricity Generation	TOTALS
Bisasar Road	5,295,296	800,704	6,096,000
Mariannhill	1,112,568	112,344	1,224,912
La Mercy	488,972	24,511	513,483
TOTALS	6,896,836	937,559	7,834,395

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THE PARTICIPANTS

- In House Project Management
- World Bank Prototype Carbon Fund
- Department of Trade & Industry
- Department of Energy
- French Development Bank
- EIA Felehetsa / WSP Environmental
- External Verifiers (was SGS then DNV, next?)
- CER Purchaser

THE TEAM

- Project Management: DSW
- Gas Specialist: SLR Consulting (Pty) Ltd
- Legal: Imbewu Environmental (Pty) Ltd.
- Civil Consultants: Wilson Pass Inc.
- Engine Maintenance: Spare Invest 28 cc.
- Air Quality Monitoring: SGS SA (Pty) Ltd.
- Data Collation & Gas Field : Contra Odour cc
- Data Collation & Gas Field: Envitech Solutions

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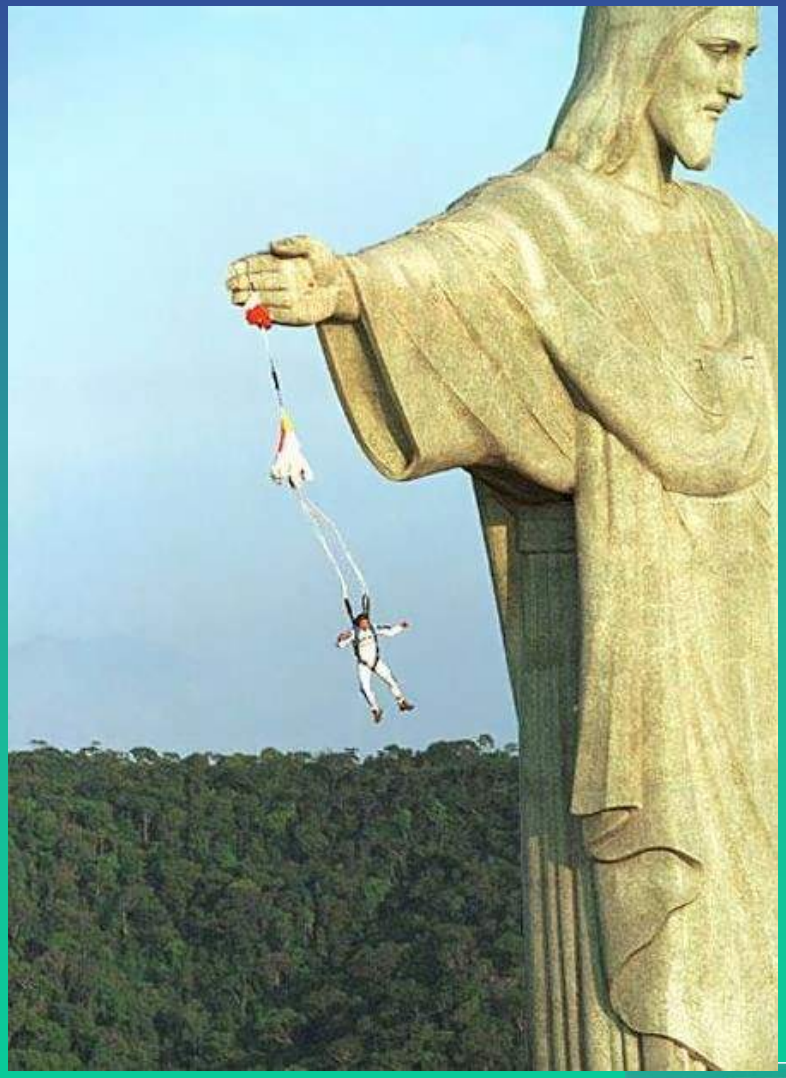
WHEN THINGS GO WRONG



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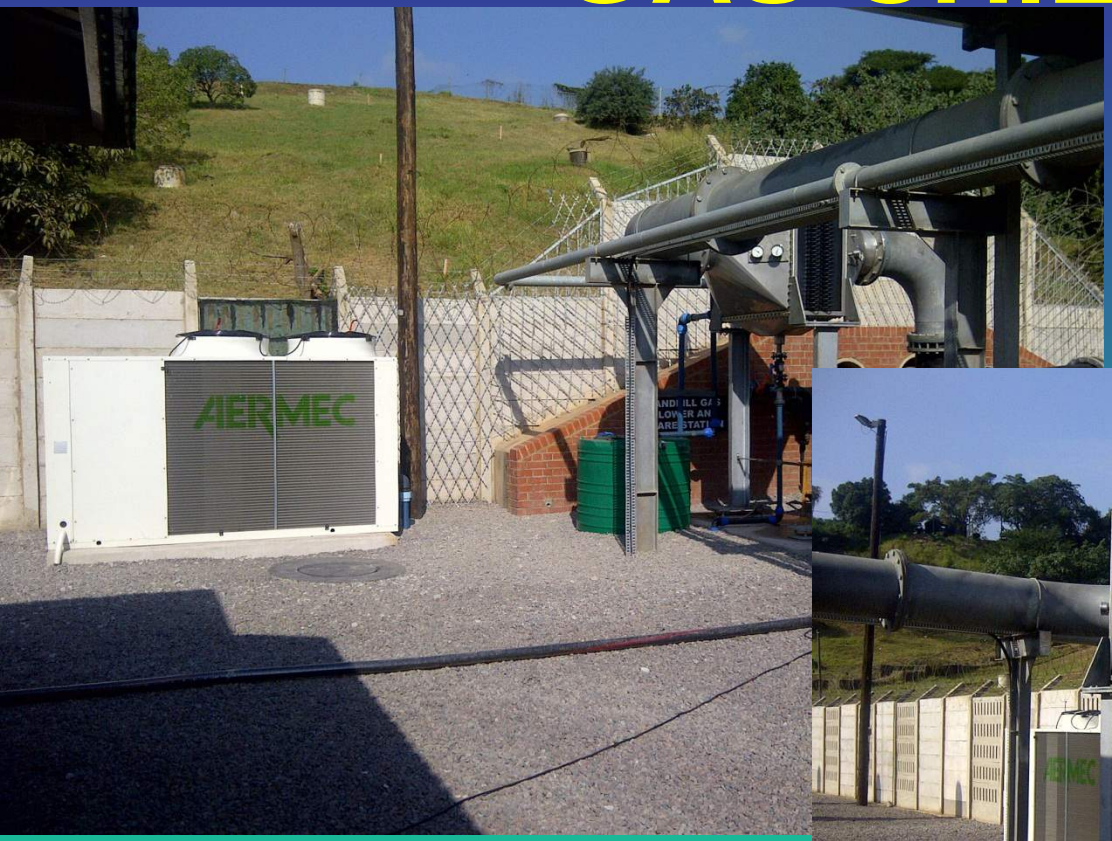
GAS CHILLER



- DROPPING OUT 95 l/hr

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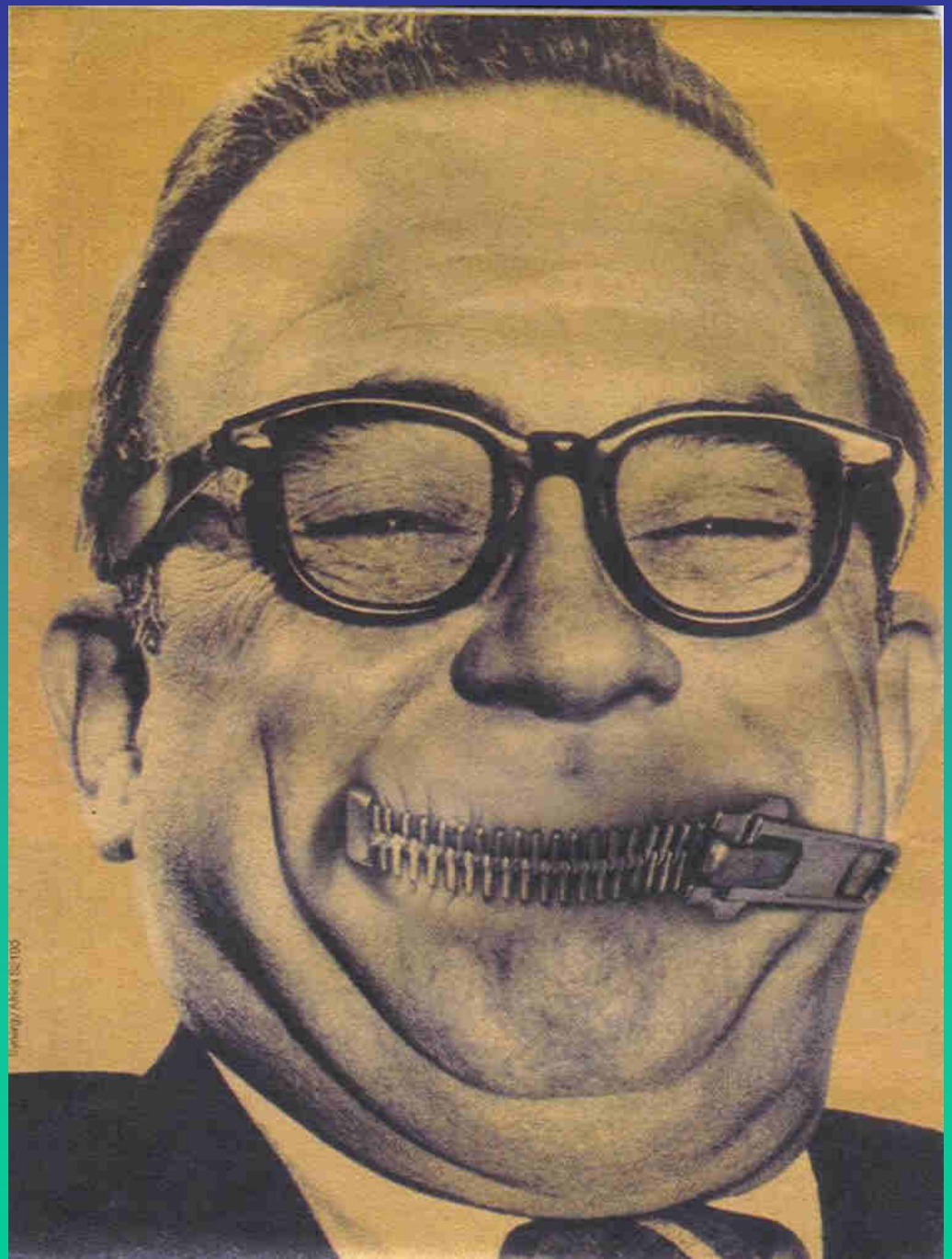

ADMINISTRATIVE CHALLENGES

- MFMA & SCM don't deal with out of ordinary processes
- EIA Process was problematic
- Registration by UNFCCC Ex Board long, tedious & pedantic
- Inconsistent decisions by Ex Board
- No direct access to Ex Board (recent change)
- Monitoring Onerous, Expensive
- Language is often a barrier
- Drawn out process
- Whole process is costly
- DOE accreditation

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TECHNICAL CHALLENGES

- Lack of Expertise & Resources
- Extreme weather conditions
- Excess leachate; poorly run site
- Manufacturers supplying incorrect equipment
- Lack of sharing information
- Lack of Experience / Technical Ability
- Understanding the Gas Field

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OPERATING CHALLENGES

- Service Suppliers lack of Expertise
- Cost of Spares & Oil
- Cost of Services
- Availability of Spares
- Need good Quality Assurance
- Monitoring: correct procedures
- Logging of raw data & interpretation
- Verification

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LEASONS LEARNED

- Be wary of “Experts”
- Easier to deal with Technical challenges than Political & Administrative issues
- Running of Landfill is as important as the Extraction Process
- Carry out a pre Verification Inspection, saves a lot of stress at verification but not time
- Add 12 months to any time frame given
- Cash flow is a major problem
- CER price has crashed (€15,07 vs €0,22/0,31)

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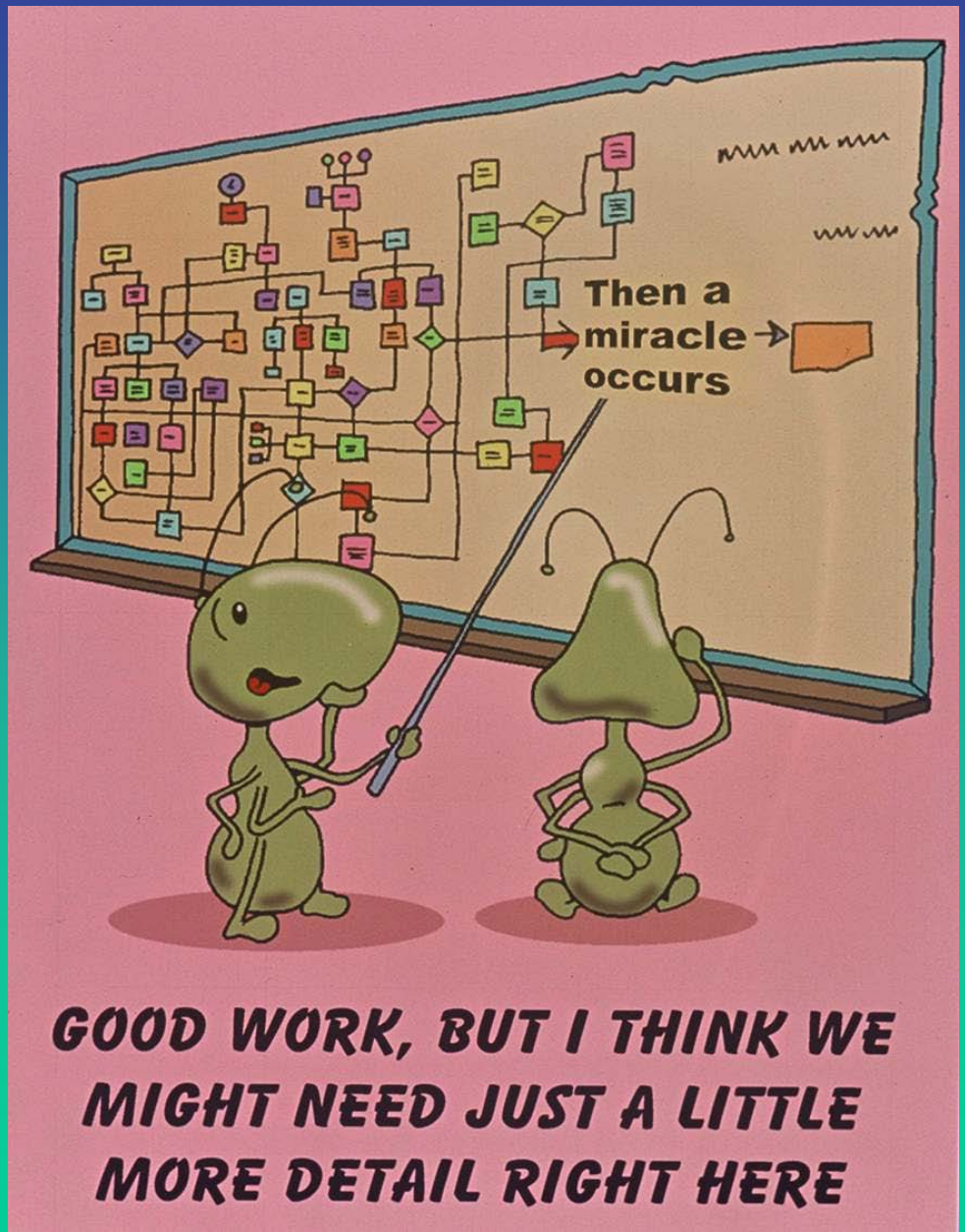
WE'RE STILL LEARNING



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SHOW ME THE MONEY

Project Review

- The capital and operating expenditures of the project are supported by two revenue streams:
  - **Sale of Carbon Credits**
  - **Sale of Electricity**
- **Without the sale of carbon credits, the project would not be financially viable.**

ELECTRICITY SALES BISASAR

	UNITS	HIGH RATE	AMOUNT	LOW RATE	AMOUNT
PEAK	599429	15,64	93 750,70	5,10	30 570,88
STAND-ARD	1456209	4,74	69 024,31	3,51	51 112,94
OFF PEAK	1739972	2,57	44 717,28	2,27	39 497,36
SUR-CHARGE		10,05%	20 852,98		12 178,71
RURAL LEVY		0,45	17 080,25		17 080,25
TOTAL			€ 245 425,52		€ 150 440,14

ORIGINAL REFIT (6,13) € 232 670,89

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CURRENT STATS

- 7.5 MW Generation of Electricity Capacity
- Electricity Supply to 3 750 small houses
- Total LFG Flow ~ 4 400 Nm^3/hr at 53% CH_4
- >20 000 Tons CO_2 equivalent destroyed /month
- 2,25m tons of CO_2 equivalent destroyed to date
- > € 9,3m worth of electricity generated to date
- > 315 000 MWh generated
- > € 280 000 electricity income in July 2015

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CASH FLOW

INCOME

- ELECTRICITY SALES
- € 167 000 / month

- CARBON CREDITS
- € 106 300 / month

  €5/CER

- TOTAL
  € 3 275 000 / annum

EXPENDITURE

- CAPITAL EXPENDITURE TO DATE € 8 700 000

- ANNUAL OPERATING
- € 870 000

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Concluding Comments

-Landfill gas offers a viable renewable energy source only when linked to Carbon Finance, CDM or ReBid (R0,079/kWh)

-VER's may be more viable than CER's due to over the top requirements of UNFCCC Process and price

-The EIA process has over-ripened this fruit – lost two years

- Lack of Technical Skills is restricting expansion in Africa

-Implementation of proven technologies is a must

-Distance from Europe is detrimental to fast reaction

-Exchange rate has a dramatic influence on cash flow

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Creamer Media's
ENGINEERING NEWS Online

Six African projects named among world's 100 most innovative

By: Irma Venter

Published: 27 Aug 12

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