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%
PROOF OF GLOBAL WARMING

Positive 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$^3$ t of waste.

• 1MW electricity from every 700Nm$^3$/hr of gas
AFRICA’S FIRST LANDFILL GAS CDM PROJECT
UNSUSPECTING & NAIVE
CHAMPION

PASSIONATE
BITTEN OFF MORE THAN WE COULD HANDLE
1 MW ENGINE
COMMISSIONED 6,5 MW JULY 2009
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
PROCESS LIKE A WOLF IN SHEEP’S CLOTHING
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>First contact with PCF/World Bank</td>
<td>November 2001</td>
</tr>
<tr>
<td>MOU between eThekwini and PCF –</td>
<td>February 2003</td>
</tr>
<tr>
<td>Commence EIA’s –</td>
<td>July 2003</td>
</tr>
<tr>
<td>Adhoc Approval for funds –</td>
<td>October 2003</td>
</tr>
<tr>
<td>ROD’s for Mariannhill and La Mercy (“Component One”) –</td>
<td>July 2004</td>
</tr>
<tr>
<td>Appeal against “Component One”</td>
<td>August 2004</td>
</tr>
<tr>
<td>Appeal response to Minister of DAEA for “Component One” –</td>
<td>September 2004</td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>ROD Bisasar (“Component Two”) –</td>
<td>October 2004</td>
</tr>
<tr>
<td>Started construction …. “Component One”</td>
<td>January 2006</td>
</tr>
<tr>
<td>Final Revised ROD for “Component Two” (Bisasar) –</td>
<td>August 2006</td>
</tr>
<tr>
<td>CDM Registration of Component 1 (Mariannhill &amp; La Mercy) –</td>
<td>November 2006</td>
</tr>
<tr>
<td>Commissioning of Mariannhill &amp; La Mercy Flares &amp; Gens –</td>
<td>Nov~Dec 2006</td>
</tr>
<tr>
<td>Initial Verification of Mariannhill</td>
<td>January 2007</td>
</tr>
</tbody>
</table>
## LFG-to-Elec CDM Project Time Frame Cont

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Component Two” (Bisasar) Start Construction</td>
<td>March 2007</td>
</tr>
<tr>
<td>Verification of “Component 1” Year 1</td>
<td>January 2008</td>
</tr>
<tr>
<td>Commissioning of Bisasar Rd Flare &amp; Engines</td>
<td>March 2008</td>
</tr>
<tr>
<td>Registration of Component 2 (Bisasar Rd)</td>
<td>March 2009</td>
</tr>
<tr>
<td>Commissioning of 6,5 MW Component 2 (Bisasar Rd)</td>
<td>July 2009</td>
</tr>
<tr>
<td>Initial Verification Bisasar</td>
<td>November 2009</td>
</tr>
<tr>
<td>2nd Verification Mariannhill</td>
<td>November 2009</td>
</tr>
<tr>
<td>Event</td>
<td>Dates</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>3rd Verification Mariannhill</td>
<td>September 2011</td>
</tr>
<tr>
<td>First Issuance Bisasar (65 711)</td>
<td>30 December 2011</td>
</tr>
<tr>
<td>Sale of VCU’s (124 884)</td>
<td>January 2012</td>
</tr>
<tr>
<td>Commission Gas Chiller</td>
<td>May 2012</td>
</tr>
<tr>
<td>First Issuance Mariannhill (39 472)</td>
<td>March 2013</td>
</tr>
<tr>
<td>4th &amp; 2nd Verifications Mariannhill &amp; Bisasar</td>
<td>March 2013</td>
</tr>
<tr>
<td>2nd, 3rd &amp; 4th Issuance Mariannhill</td>
<td>May, June, Aug 2013</td>
</tr>
</tbody>
</table>

LFG-to-Elec CDM Project Time Frame Cont
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reregistration of Mariannhill Project (ACM 0001)</td>
<td>December 2013</td>
</tr>
<tr>
<td>2nd Issuance Bisasar (749 633)</td>
<td>February 2014</td>
</tr>
<tr>
<td>5th Verification Mariannhill</td>
<td>March 2014</td>
</tr>
<tr>
<td>5th Issuance Mariannhill (33 937)</td>
<td>June 2014</td>
</tr>
<tr>
<td>6th Verification Mariannhill, first under ACM 0001</td>
<td>November 2014</td>
</tr>
<tr>
<td>No issuance to date</td>
<td></td>
</tr>
<tr>
<td>Notification of reregistration for Bisasar</td>
<td>September 2015</td>
</tr>
</tbody>
</table>
Calculated Emission Reductions (in tons)

<table>
<thead>
<tr>
<th>Site</th>
<th>Methane Destruction</th>
<th>Electricity Generation</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisasar Road</td>
<td>5,295,296</td>
<td>800,704</td>
<td>6,096,000</td>
</tr>
<tr>
<td>Mariannhill</td>
<td>1,112,568</td>
<td>112,344</td>
<td>1,224,912</td>
</tr>
<tr>
<td>La Mercy</td>
<td>488,972</td>
<td>24,511</td>
<td>513,483</td>
</tr>
<tr>
<td>TOTALS</td>
<td>6,896,836</td>
<td>937,559</td>
<td>7,834,395</td>
</tr>
</tbody>
</table>
THE PARTICIPANTS

- In House Project Management
- World Bank Prototype Carbon Fund
- Department of Trade & Industry
- Department of Energy
- French Development Bank
- EIA Felehehsa / 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
WHEN THINGS GO WRONG
GAS CHILLER

- DROPPING OUT 95 l/hr
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
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
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
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)
GOOD WORK, BUT I THINK WE MIGHT NEED JUST A LITTLE MORE DETAIL RIGHT HERE
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.
<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>HIGH RATE</th>
<th>AMOUNT</th>
<th>LOW RATE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEAK</td>
<td>599429</td>
<td>15,64</td>
<td>93 750,70</td>
<td>5,10</td>
<td>30 570,88</td>
</tr>
<tr>
<td>STANDARD</td>
<td>1456209</td>
<td>4,74</td>
<td>69 024,31</td>
<td>3,51</td>
<td>51 112,94</td>
</tr>
<tr>
<td>OFF PEAK</td>
<td>1739972</td>
<td>2,57</td>
<td>44 717,28</td>
<td>2,27</td>
<td>39 497,36</td>
</tr>
<tr>
<td>SUR-CHARGE</td>
<td></td>
<td>10,05%</td>
<td>20 852,98</td>
<td></td>
<td>12 178,71</td>
</tr>
<tr>
<td>RURAL LEVY</td>
<td></td>
<td>0,45</td>
<td>17 080,25</td>
<td></td>
<td>17 080,25</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>€ 245 425,52</strong></td>
<td></td>
<td><strong>€ 150 440,14</strong></td>
</tr>
</tbody>
</table>

**ORIGINAL REFIT (6,13) € 232 670,89**
CURRENT STATS

- 7.5 MW Generation of Electricity Capacity
- Electricity Supply to 3 750 small houses
- Total LFG Flow ~ 4 400 Nm³/hr at 53% CH₄
- >20 000 Tons CO₂ equivalent destroyed /month
- 2,25m tons of CO₂ equivalent destroyed to date
- > € 9,3m worth of electricity generated to date
- > 315 000 MWh generated
- > € 280 000 electricity income in July 2015
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
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
Six African projects named among world’s 100 most innovative

By: Irma Venter
Published: 27 Aug 12
EXCEEDED EXPECTATION
HOPE THINGS ARE CLEARER

www.dbnlandfillgas2elec.co.za