DURBAN’S GAS-TO-ELECTRICITY PROJECT

CCAC WORKSHOP
SAO PAULO
11-12 SEPTEMBER 2014

John Parkin
Deputy Head: Plant & Engineering
eThekwini Municipality
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
GAS PRODUCTION

“A rule-of-thumb is that 6 – 10 m$^3$ 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
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 Description</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>
<tr>
<td>Event</td>
<td>Date</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<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>
</tbody>
</table>
## LFG-to-Elec CDM Project Time Frame Cont

<table>
<thead>
<tr>
<th>Event</th>
<th>Dates</th>
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</thead>
<tbody>
<tr>
<td>3\textsuperscript{rd} 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>4\textsuperscript{th} &amp; 2\textsuperscript{nd} Verifications Mariannhill &amp; Bisasar</td>
<td>March 2013</td>
</tr>
<tr>
<td>2\textsuperscript{nd}, 3\textsuperscript{rd} &amp; 4\textsuperscript{th} Issuance Mariannhill</td>
<td>May, June, Aug 2013</td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>Reregistration of Mariannhill Project (ACM 0001)</td>
<td>December 2013</td>
</tr>
<tr>
<td>2\textsuperscript{nd} Issuance Bisasar (749 633)</td>
<td>February 2014</td>
</tr>
<tr>
<td>5\textsuperscript{th} Verification Mariannhill</td>
<td>March 2014</td>
</tr>
<tr>
<td>5\textsuperscript{th} Issuance Mariannhill (33 937)</td>
<td>June 2014</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 Felehetsa / WSP Environmental
- External Verifiers (was SGS now DNV)
- 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)
WE’RE STILL LEARNING

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.
## ELECTRICITY SALES BISASAR

<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>432480</td>
<td>19,00</td>
<td>82 171,20</td>
<td>6,20</td>
<td>26 800,79</td>
</tr>
<tr>
<td>STANDARD</td>
<td>1138080</td>
<td>5,76</td>
<td>65 507,89</td>
<td>4,27</td>
<td>48 550,49</td>
</tr>
<tr>
<td>OFF PEAK</td>
<td>1943920</td>
<td>3,13</td>
<td>60 747,50</td>
<td>2,71</td>
<td>52 602,48</td>
</tr>
<tr>
<td>SUR-Charge</td>
<td>10,05%</td>
<td></td>
<td>12 795,38</td>
<td></td>
<td>12 795,38</td>
</tr>
<tr>
<td>Rural Levy</td>
<td>0,52</td>
<td></td>
<td>18 169,86</td>
<td></td>
<td>18 169,86</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>239 391,82</td>
<td></td>
<td>158 918,99</td>
</tr>
</tbody>
</table>

**ORIGINAL REFIT (9,2c) US$ 323 332**
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
- 1.8m tons of CO₂ equivalent destroyed to date
- > US$ 11m worth of electricity generated to date
- > 267 000 MWh generated
- > US$ 340 000 electricity income in July 2012
CASH FLOW

INCOME

- ELECTRICITY SALES
  US$ 185 000 / month

- CARBON CREDITS
  US$100 000 / month
  €5/CER

- TOTAL
  US$ 3 400 000 / annum

EXPENDITURE

- CAPITAL EXPENDITURE
  TO DATE US$12 600 000

- ANNUAL OPERATING
  US$ 1 300 000
Concluding Comments

-Landfill gas offers a viable renewable energy source only when linked to Carbon Finance, CDM or ReBid ($0.072/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
HOPE THINGS ARE CLEARER

www.dbnlandfillgas2elec.co.za