



# 90 MW RABAI POWER PLANT, KENYA

2009/2010

## Project Development

BWSC has been involved in Independent Power Producer (IPP) projects since 1996 and has obtained the necessary expertise to bring any IPP project from cradle, through state-of-the-art construction, to productive and successful operating years. Electrification programs have led to a constantly growing demand for electricity in Africa. IPP programs supply power while relieving governments from the financial burden of capacity expansion. A vital spin-off is technology transfer with state-of-the-art solutions and education of local employees for the benefit of the country.

### Challenging green field development



Rabai, September 2008

The Rabai Power Project was twice awarded 'African Power Deal of the Year' by leading project finance magazines. By financial close in October 2008, BWSC and our co-sponsor Aldwych had negotiated and finalized more than 130 formal agreements between the various stakeholders.

The Rabai project development has succeeded in spite of external challenges not limited to re-tendering, the site being moved from Nairobi to Mombasa and the world economic crisis in 2008.

BWSC has a proven record in mastering the continuity of the entire project value chain:

- o Forming developer/sponsor group
- o Bidding for and negotiating power purchase agreements
- o Identifying investors and securing equity
- o Identifying lenders through competitive bidding
- o Financial close, triggering EPC commencement
- o Engineering, Procurement & Construction
- o Operations & Maintenance.



Signing Ceremony, Nairobi, October 2008

### IPP - A win-win deal

The key for IPP projects is to secure benefits for all stakeholders on a win-win basis.

The Rabai Power Plant, which is a major milestone in the Kenyan Government's long-term energy plan, provides a thermal, cost-effective and reliable power supply to meet Kenya's increasing demand for electricity through a

Power Purchase Agreement (PPA) signed between Rabai Power Ltd. (RPL) and The Kenya Power & Lighting Company Ltd. (KLPC). The plant allows for the partial displacement of less efficient plants and back-up generators. This is a pioneer project in the revitalization of Kenya's green field power scheme, which had been dormant for eight years.

IPPs not only relieve governments from the financial burden of capacity expansion in the power sector, but also lead to more competition, higher efficiency, and ultimately lower electricity rates for consumers.





## Engineering, Procurement & Construction

BWSC designed and constructed the 90 MW Rabai Power Plant on a full turnkey basis.

The EPC project was fast tracked with early generation less than a year after financial close.

Interim Taking-Over Certificate for the 83 MW diesel plant was achieved in October 2009 while Final TOC, including Steam Cycle plant increasing output to 90 MW, was achieved in the spring of 2010.



The plant showcases the unique Combined Cycle Diesel principle in which the engines' exhaust gases generate steam in the Heat Recovery Boilers which feed a Steam Turbine Generator, whereby the electrical output of the plant is increased without extra fuel consumption, hence increasing plant net efficiency.

BWSC uses its independence and flexibility to custom design power plants utilizing equipment from the World's leading suppliers.

Special emphasis was put to select Kenyan subcontractors for all construction and erection work. BWSC know-how has been transferred through specialist supervisors to build the plant to international standards - with an impressive safety record.

Production from the Rabai Power Plant ended power rationing in the coastal region of Kenya less than a year after financial close. The full plant provides reliable power for up to 400,000 households and businesses.



## Operation & Maintenance

The Rabai Power Plant is operated and maintained by a total staff of 53 Kenyans and initially two BWSC expatriate managers.

Rabai Operation & Maintenance Ltd. (ROML), owned by BWSC and Aldwych, has a 20 year O&M contract with RPL after which time the plant is handed over to KPLC.



Downtime is minimized by an integrated maintenance system which coordinates preventive work, tracks spare parts, and allocates resources.

The optimal selection of spares for Rabai was coordinated with procurement of the equipment during the EPC phase.

The staff in Rabai has access to expedient and proficient BWSC headquarters support to troubleshoot and source spare parts from selected suppliers. Detailed O&M manuals and strict adherence to the manufacturer's maintenance instructions ensure continued integrity of the plant.



BWSC also has a 10 year spare parts and technical service agreement with RPL.

### High availability

The key to high availability is a combination of the right equipment, competent staff, spare parts and O&M procedures.

BWSC drew on an international pool of human resources to train and assist the new organization. Recruitment of Kenyan O&M personnel started half a year before taking-over to allow time for upgrading of their competences through courses and hands-on training.



The mandatory training in health, safety and environment was performed by the Directorate of Occupational Safety and Health Services. Fire-fighting courses were held at the Kenya Petroleum Refinery and first aid courses by Kenya Red Cross. These activities continue on a regular basis through external and internal exercises and programs designed to prevent incidences occurring.

### The long-term view

The plant is built to last and to maintain high performance throughout its lifetime. The long term view dominates the way BWSC meets external and internal stakeholder expectations through integrated Project Development, EPC and O&M.



# Fast Track 90 MW Combined Cycle Diesel Plant

## Aerial photo



- |                           |                          |                            |
|---------------------------|--------------------------|----------------------------|
| 1. Fuel Unloading Station | 4. Heat Recovery Boilers | 7. Steam Turbine Building  |
| 2. Tank Farm              | 5. Stack                 | 8. Air Cooled Condenser    |
| 3. Power House            | 6. Radiator Coolers      | 9. Administration Building |
|                           |                          | 10. Welfare Building       |

## Summary

### Contract

Type..... Turnkey  
 Plant net output ..... 90 MW

Effective contract ..... October, 2008  
 Interim Taking-Over (DE Plant) ..... October, 2009  
 Final Taking-Over (Total Plant)..... May, 2010

### Technical Data

#### Diesel Engines, 5 units

Make..... Wärtsilä, Finland  
 Type..... 18V46  
 Speed ..... 500 rpm  
 Rated output ..... 17.55 MW

#### Generators, 5 units

Make..... ABB, Finland  
 Type..... AMG 1600SS12 DSE  
 Voltage/frequency..... 11 kV / 50 Hz  
 Rated output ..... 17.1 MW / 21.3 MVA

#### Step-Up Transformers, 2 units

Make..... Areva, Indonesia  
 Cooling ..... ONAN / ONAF  
 Ratio ..... 11 / 132 kV  
 Rated power ..... 60 MW / 75 MVA

#### Radiator Coolers, 5 units

Make..... GEA, France  
 Type..... Two bay aircoolers

#### Heat Recovery Boilers, 5 units

Make..... Aalborg Industries, Denmark  
 Type..... Vertical, exhaust gas / water, finned tubes

#### Steam Turbine

Make..... Peter Brotherhood / Dresser-Rand, UK  
 Type..... Single cylinder, multi stage, impulse

#### Steam Turbine Generator

Make..... Converteam Ltd., UK  
 Voltage/frequency..... 11 kV / 50 Hz  
 Rated output ..... 8.4 MW / 10.5 MVA

#### Air Cooled Condenser

Make..... Bronswerk, Belgium  
 Type..... 3 bay A-frame condenser  
 Rating..... 24.8 MW

#### Stack

Make..... Danpro Steel Construction, Denmark  
 Type / Height ..... Lattice Tower / 55 m

# RABAI POWER LIMITED

DEVELOPERS, SPONSORS & SHAREHOLDERS



## OTHER SHAREHOLDERS



INVESTMENT FUND FOR  
DEVELOPING COUNTRIES



Finance for Development

## SENIOR LENDERS



GRUPE AGENCE FRANÇAISE DE DÉVELOPPEMENT

## MEZZANINE LENDERS



GRUPE AGENCE FRANÇAISE DE DÉVELOPPEMENT

## ELECTRICITY OFF-TAKER



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