Songo Songo Gas Field
Increasing Reserves & Expanding Gas Distribution

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Introduction

- First developed and largest commercial producing gas field in Tanzania and East Africa
- End 2008 audited remaining 2P gross, life of field reserves 902 Bcf.
- Current maximum gas processing capacity 90MMscfd. Six wells on main field capable of delivering in excess of 200 MMscfd.
- The field currently supplies gas that is used to provide in excess of 50% of Tanzania’s electricity generation.
- 25 industrial sites in the Dar es Salaam region currently supplied.
- Developing CNG market.
- Songo Songo West prospect is a low risk, high potential resource, which could underwrite the expansion of the utilisation of gas.
### Songo Songo Field development summary

**EXP.** | **APPRAISAL** | **STALLED AWAITING GAS MARKETS** | **PRE-PROJ** | **PROJ** | **PRODUCTION**
---|---|---|---|---|---
1990 | 2000 Construction | Songo Songo Project Financial close | 2007 SS-10 development well

#### Songo Songo Gas

- A proportion of the gas produced from Songo Songo field is sold under a 20 year contract to Songas Limited: Protected Gas (PG).
- Protected Gas accounts for approximately 215 Bcf of remaining reserves or approximately 45 MMscfd.
- PAT has the exclusive right to produce and market all gas in excess of the PG, termed Additional Gas (AG).
The Songo Songo Field

- Broad N-S to NNW-SSE trending, faulted anticline
- Crest of structure ~1,680m TVDSS, common GWC 1940m TVDSS
Songo Songo Field - Geologic model

- Lower Cretaceous reservoirs.
  - Neocomian to Albian primary potential.
  - Cenomanian secondary potential, but distribution poorly understood.
- Middle & upper shoreface to beach / foreshore environments.
- High net to gross.
- Good gas reservoir quality:
  - Average phi 20%
  - Average k 40mD
- Petrel™ static geologic model provides Orca P50 (mid case) volumetric GIIP of 1,571 Bcf
Songo Songo Field – Simulation Model

- Downhole pressure gauges in four producing wells:
  - Retrieved annually.
- Programme of well shut-in and production testing.
- Annual cycle of interpretation:
  - Pressure transient analysis
  - Well performance curves
  - Material balance analysis
- Update simulation model to continuously:
  - Monitor reservoir behaviour and performance
  - Evaluate field reserves
  - Ensure Protected Gas can be met and manage forecast Additional Gas sales.

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In 2007 inconsistencies in Gas Initially In Place (GIIP) derived from volumetric methods when compared to simulation model and material balance were apparent.

2008 reservoir studies aimed at resolving this:

- Depth conversion – 18% increase in GRV
- Field wide petrophysical review – SS-10 indicated a 13% increase in Net Pore Volume
- Re-evaluation of reservoir facies and depositional model – 940ft of core
- Re-build of Petrel™ geologic model
- Re-build of Eclipse™ simulator model
Songo Songo West Prospect

- Songo Songo West (SS West) prospect located approximately 2.5km west of the producing field.
- Geologically similar structure to Songo Songo field.
- Anticipated to have same reservoir as Songo Songo.
- The discovery of gas by Aminex in the Kiliwani North field with a GWC ~30m deeper than Songo Songo proves there is significant upside to the resource potential of SS West.
- Ready to drill.
SS West – Conceptual development scenario

- Drill southern location first.
  - If successful, integrate with existing Songo Songo field facilities for a long term well test.
- Appraise structure in the north.
  - Prove aerial extent of reservoir and closure.
  - Improve reserve assessment.
- Development via:
  - Two unmanned, wellhead platforms.
  - A new gathering manifold just upstream of the current SSI gas processing facilities
  - A new offshore pipeline from Songo Songo Island to shore.
  - Processing of gas onshore.
  - Transportation to Dar es Salaam via a new onshore pipeline.
  - Further trunk lines to more distant markets & connection to low pressure ring main from the Dar es Salaam end of the pipeline.
GIIP & Prospective Resources

- Audited Gas Initially in Place, 31 December 2008

| Audited Songo Songo Field GIIP Bcf* |
|---|---|---|
| 1P | 2P | 3P |
| Total | 1,236 | 1,433 | 1,562 |

- Since production started in 2004 Songo field audited GIIP has increased by 72% in the 1P, and 61% in the 2P.

| SS West unrisked Prospective Resources Bcf† |
|---|---|---|---|
| P90 | P50 | Mean | P10 |
| Total | 244 | 609 | 740 | 1,539 |

† McDaniel & Associates, September 2008. Geological chance of success 54% for the Neocomian and 35% for the Cenomanian
Increased Reserves

- **Orca Gross Life of Field Additional Gas Reserves increases (2007 to 2008):**
  - 1P up 17% to 457 Bcf (up 65 Bcf).
  - 2P up 17% to 689 Bcf (up 102 Bcf).
  - 3P up 6% to 895 Bcf (up 50 Bcf).

- **Reserves increase due to:**
  - Sustained excellent reservoir performance.
  - Reworking Depth conversion & seismic interpretation.
  - New well data
  - Declining protected volumes.

*Audited field gross reserves on a life of field basis*

Protected Gas reserves slowly decrease through production
Growing Gas Markets

- Potential combined 2P reserves and mean resources for Songo field & Songo Songo West in the region of 1.5 Tcf
- PAT seeks to build on current success to grow existing and create new gas markets.
- PAT currently supplies gas to four of the potential markets for Additional Gas:
  1. Power markets in Tanzania & East Africa.
     - Gas for power currently sold to Songas and TANESCO
     - Increasing demand for gas downstream led by the power sector. Significant growth forecast in the period 2010 – 2026
     - Kenya is also heavily reliant on hydro & imported oil for power generation
     - Investment in transmission networks could place Dar es Salaam as a thermal generation hub for East Africa.
2. **Industrial markets in Dar es Salaam.**
   - PAT has installed 43kms of low pressure pipeline to deliver Additional Gas to 25 industrial customers.
   - A further 8 customers signed contracts.
   - Supply to Wazo Hill Cement Plant commenced April 2009 for a contracted period to July 2014.
   - Significant surplus system capacity to accommodate further growth.
Growing Gas Markets

3. CNG for vehicles, hotels and industries
   • In July PAT commissioned a CNG mother station consisting of one CNG compressor, a vehicle dispenser and two trailer filling facilities to deliver 0.7 MMscfd.
   • Low volume high value market, displacing expensive alternative energies.

4. Gas markets in Tanga and Mombasa
   • Only in the event of sufficient reserves.
   • Tanga 220 kms north of Dar es Salaam, several potential industrial customers.
   • Extension to Mombasa Kenya where there is significant power and industrial markets

- Orca is a leader in developing Tanzania’s natural gas resources & well placed to help execute Tanzania’s vision of future growth.
Orca / PanAfrican Energy acknowledges the dedication and cooperation of our partners and stakeholders:

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