

# THE ZAMZAMA GAS FIELD

## PAKISTAN



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### Summary

- BHP Billiton has approved the first phase of the Zamzama gas field development, situated in the Sindh province of southern Pakistan.
- Phase I will commercialise the 1.7 trillion cubic feet (Tcf) of gas resources in the core area of the field, initially produced via a smaller extended well test (EWT) facility which commenced production in March 2001. The EWT is currently producing around 100 million standard cubic feet of sales gas per day (MMcf/d) under contract to the Sui Southern Gas Company Limited.
- The development of the Zamzama field is an example of project delivery within BHP Billiton Petroleum's gas commercialisation growth strategy.
- The capital cost for this phase of the field development will be approximately US\$100 million (US\$40 million net to BHP Billiton), representing a highly efficient, low cost development of a major gas resource. The joint venture partnership has already invested a total of \$52.4 million during the exploration and appraisal phase and to construct the EWT facilities.
- The development of the Zamzama field provides an attractive rate of return, with a Phase 1 development cost of less than US\$0.50 per barrel of oil equivalent. Incremental capital expenditure (eg infill drilling and wellhead compression) will be required later in the field life.
- The core area of the field to be developed has estimated proven and probable gross reserves of 1.7 Tcf, of which BHP Billiton's equity share is around 650 billion cubic feet (Bcf).
- First gas from Phase I is planned for mid 2003. Plateau production (including existing EWT production) is expected to be around 300 MMcf/d of sales gas and 2000 barrels per day of condensate (gross).
- Gas from the Zamzama development will be sold under contract to Sui Southern Gas Company Limited and Sui Northern Gas Pipelines Limited.
- BHP Billiton Petroleum (Petroleum) is well placed to develop further growth opportunities in a country which has strong gas demand growth projections.
- Participants in the Zamzama development are BHP Petroleum (Pakistan) Pty Ltd (Operator), 47.5%\*; LASMO (MP) Ltd (a wholly owned subsidiary of Eni S.p.A.), 23.75%\*; PKP Exploration Ltd (formerly Premier Exploration Pakistan Ltd), 23.75%\* and Government Holdings (Private) Ltd, 5%\*.

\* In the event that Government Holdings exercises its option to acquire an additional 20% equity, revised interests would be: BHP Petroleum (Pakistan) Pty Ltd, 38.5%; Government Holdings (Private) Ltd, 25%; PKP Exploration Ltd, 18.75% and LASMO (MP) Ltd, 17.75%#.

#The allocation of an additional 1% equity to BHP Petroleum (Pakistan) Pty Ltd from LASMO (MP) Ltd is as a result of the terms of the farm-in agreement executed in 1997.

### Key Data

P50 Reserves (in core area of field):	1.7 Tcf
Full field production:	300 MMcf/d gas from 2003
Field life:	15 - 25 years
Capex (this phase):	US\$100 million gross (US\$40 m net to BHP Billiton)
Opex (pa):	US\$7 million (gross)
Fiscal terms:	55% income tax rate Wellhead Royalty of 12.5% (deductible)

## Strategic Context

The development of the Zamzama field forms part of BHP Billiton Petroleum's gas commercialisation activities. Gas commercialisation is one of Petroleum's three core areas of business focus, which also include high margin oil exploration and production, and securing access to discovered but undeveloped resources in the North Africa and Middle East regions.

Petroleum began exploration activities in Pakistan in 1994, recognising that the country's hydrocarbon sector presented significant business opportunities due to its sizeable and growing domestic gas market, prospectivity for gas and competitive fiscal terms.

The Zamzama field was discovered in 1998. It is a significant gas resource and lies close to existing pipeline infrastructure, which has enabled a low-cost development approach to be applied.

The Zamzama field represents BHP Billiton's first commercial production in Pakistan. A number of additional exploration opportunities in Pakistan, aimed at securing medium to long-term growth, are also being pursued.

## Hydrocarbons in Pakistan

Pakistan has over 20 Tcf of proven gas reserves. Current gas production is 0.7 Tcf of natural gas per year, all of which is consumed domestically. The three largest producing fields are Sui (750 MMcf/d), Mari (500 MMcf/d) and Qadirpur (300 MMcf/d).

According to Pakistan's Oil and Gas Ministry, demand for natural gas in Pakistan is expected to increase by approximately 50% by 2006. The Government of Pakistan hopes to satisfy most of the short-term demand with new domestic developments, and plans to make gas the "fuel of choice" for electric power generation projects.

Production from the Zamzama field will generate significant income for Pakistan through royalties, taxes and equity participation. Zamzama gas will contribute to reducing the need for fuel oil imports, resulting in significant savings in foreign exchange reserves for the country.

## Background

In 1993-1994 Petroleum conducted an exploration review of Pakistan which highlighted the Indus Basin as a prospective region close to existing pipeline infrastructure.

In February 1995 Petroleum was awarded an operated interest in the Dadu Concession (Block 2667-1), located in the Sindh province of Pakistan, approximately 200 km north of Karachi. Partners in the concession were BHP Petroleum (Asia Pacific) Inc, 95% (which subsequently transferred its interest to BHP Petroleum (Pakistan) Pty Ltd) and the Government of Pakistan, 5%. In 1997 Petroleum farmed-out 50% of its interest to Premier and Monument, leading to revised equity interests of BHP Petroleum (Pakistan) Pty Ltd, 47.5%; Premier Exploration Pakistan Ltd (now PKP Exploration Ltd), 23.75%; Monument Resources (Pakistan) Ltd, 23.75% and Government Holdings (Private) Ltd, 5%. Subsequently Monument was purchased by LASMO, which is now a wholly owned subsidiary of Eni S.p.A.

In 1996 the Dadu Joint Venture embarked on an exploration program, which resulted in the identification of the Zamzama prospect.

## Exploration History

In February 1996 Petroleum acquired 196 kilometres of 2-D seismic data on the Dadu exploration block, which resulted in the identification of the Zamzama structure.

The first exploration well on the block, Zamzama-1/ST1, was spudded in January 1998. Drilled to a total depth of 3,938 metres, the well encountered hydrocarbons in the Khadro and Pab sandstones, and wireline logs subsequently confirmed a gas column in excess of 300 metres.

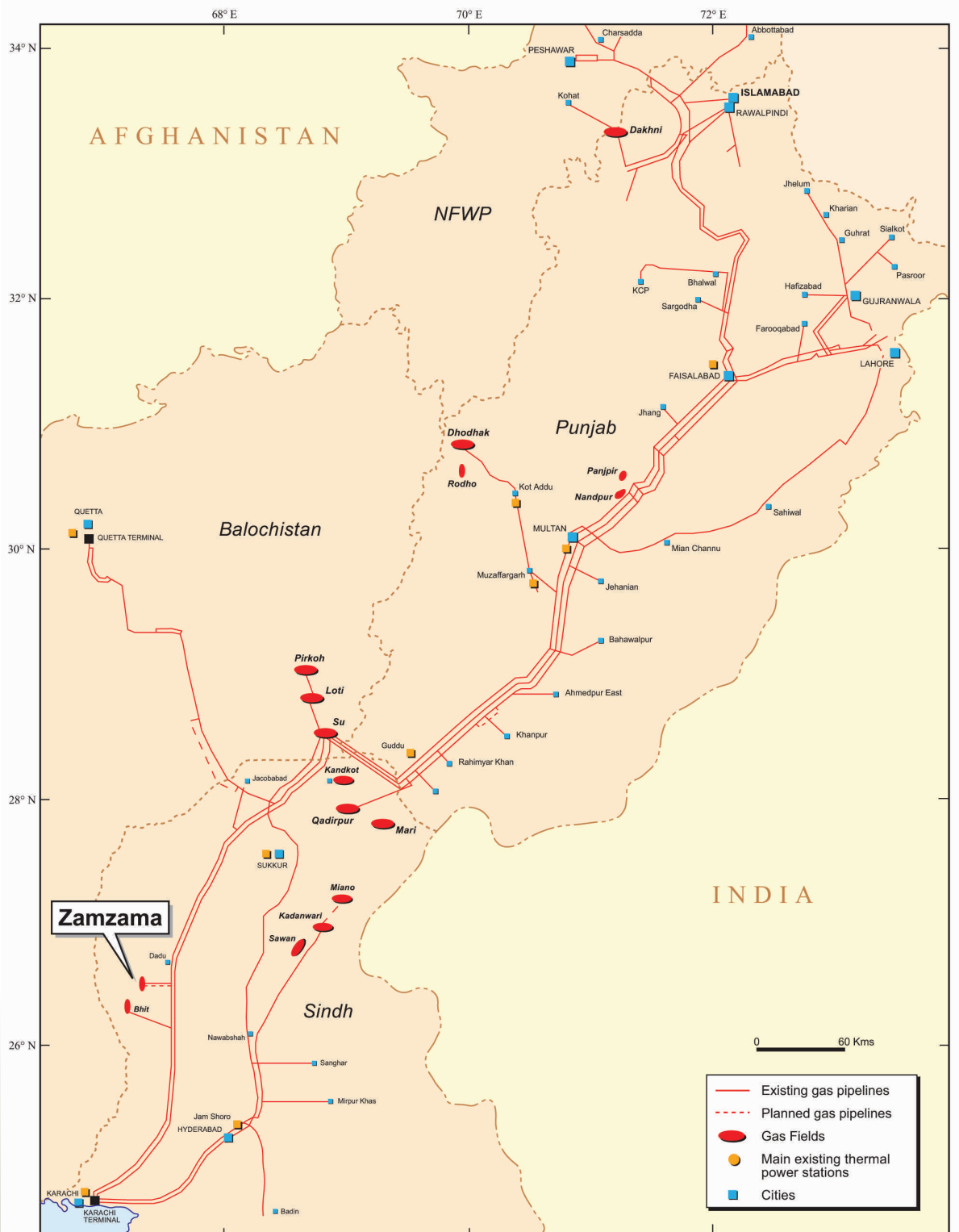
The appraisal program involved 3-D seismic acquisition and the drilling of the Zamzama-2 appraisal well. Zamzama-2 was drilled to a total depth of 3,933 metres and confirmed the presence of hydrocarbons in the Khadro and Pab formations. Subsequent pressure testing and wireline log data confirmed a gas column in excess of 350 metres, and the well tested in excess of 90 MMcf/d, a record rate for Pakistan.

## The Zamzama Field

The Zamzama field is a major resource, covering an area of around 120 square kilometres, and ranking fourth in terms of Pakistan's discovered gas reserves. Once under full development the field will add approximately 15% to Pakistan's daily gas production, thus reducing the requirement for fuel oil imports. As a substitute for oil imports, Zamzama gas is expected to provide significant foreign exchange savings for the country.

The field is located in the Dadu Concession in the Sindh province of southern Pakistan and lies close to existing pipeline infrastructure. The main Sui Southern-operated pipeline, which carries gas from the Sui field to Karachi, lies approximately eight kilometres (km) east of the Zamzama field.

Zamzama is one of several gas fields discovered in the Sindh province. The most recent include the Bhit gas field, which lies to the south west of Zamzama, and the Kadanwari, Sawan and Miano fields to the north east.



## Reserves

The total estimated proven plus probable recoverable reserves for the core area of the Zamzama field to be developed are 1.7 Tcf of gas (gross), of which BHP Billiton's equity share is around 650 Bcf. Potential additional prospective gas resources in the order of 1300 Bcf have been identified within the undrilled "footwall" to the east and the northern "Phulji" areas of the Zamzama field.

The field will have a plateau production rate of around 300 MMcf/d and 2000 standard barrels of condensate (stb/d) for 10 to 12 years, and an expected economic field life of 15 to 25 years.

Situated in the highly productive Pab reservoir, at a depth of around 3,500 metres, Zamzama gas is sweet and dry, with a low condensate to gas ratio of 6.5 barrels/MMcf. Its relatively high (21%) nitrogen content, which will not be removed at the plant, means the gas has a gross heating value of approximately 800 BTU/scf (British thermal units per standard cubic foot).

## Gas Sales Contracts

In July 2001 the Zamzama Joint Venture offered the Government of Pakistan, which has the right to buy the gas under the licence agreement, sales gas for purchase from the Zamzama field. This offer was approved by the Economic Coordination Committee, and a total of 350 MMcf/d of gas was allocated to Sui Southern Gas Company Ltd (SSGCL) and Sui Northern Gas Pipelines Ltd (SNGPL) as the Government's nominated buyers.

Sales of gas from the Zamzama Field Development will be defined by three commercial agreements: a Gas Sales and Purchase Agreement with each of Sui Southern Gas Company Ltd and Sui Northern Gas Pipelines Ltd, and the Gas Pricing Agreement.

The gas sales agreements define initial maximum daily quantities of 190 MMcf/d to be supplied to SNGPL and 130 MMcf/d to SSGCL, with annual contract quantities of 69.3 Bcf and 47.5 Bcf respectively, the take or pay levels in respect of which are 75% under each gas sales agreement. Proved gas reserves from Zamzama are dedicated to SNGPL and SSGCL pro rata to the annual contract quantities.

The Gas Pricing Agreement covers the arrangements for the price structure of the produced sales gas. Modifications to the 1994 Petroleum Policy have been negotiated whereby a progressive ceiling on gas price applies for oil prices above US\$16 per barrel with a floor at US\$10 per barrel.

## Fiscal Considerations

The development of the Zamzama field provides an attractive rate of return, with a development cost of less than US\$0.50 per barrel of oil equivalent (boe).

The Dadu Petroleum Concession and the Zamzama Field are subject to the terms of Pakistan's 1994 Petroleum Policy and fall within Zone III defined in this Policy.

Under the terms of the Policy, royalty is charged at 12.5% of the wellhead value of oil and gas, although royalty paid is creditable against any Income Tax liability. Income Tax is levied at a rate of 55%, with deductions for operating costs, Depreciation of capital costs and a Depletion Allowance. A Workers' Participation Fund and Workers' Welfare Fund provide for contributions of 5% of book income, and 2% of taxable income respectively, and are deductible against Income Tax.

All payments to foreign producers are made in US dollars, and are guaranteed by the Government of Pakistan. The payment mechanism is by remittances via the State Bank of Pakistan, and experience with the Zamzama extended well test has demonstrated the efficiency of this process, with all payments made in full and on time.

## Phased Development Approach

The Zamzama field is being developed using an innovative phased approach. Gas production commenced in March 2001 via an extended well test (EWT) as a precursor to full field development, and output is currently averaging in excess of 100 MMcf/d. Gas is lifted from the Zamzama-1/ST1 and Zamzama-2 wells and treated at a minimum processing facility for gas dehydration, dew point control and condensate stabilisation and handling, before being compressed and delivered eight kilometres into the main Sui Southern Sui-Karachi gas pipeline. Gas from the EWT is sold to the SSGCL under an initial 21-month contract, which will remain in place until new sales agreements relating to the field development come into effect.

Production via the EWT enabled the early delivery of gas to the market while retaining flexibility in the planning for the field development. The EWT was integral to the management of technical and commercial risks associated with the development of the field, providing valuable long-term well and reservoir productivity data while also securing a position in the market. In addition BHP Billiton, as operator of the field, has acquired valuable Pakistan project management and operating experience.

First gas from the EWT was achieved ahead of schedule and under budget, with capital costs of around US\$18 million. No lost time injuries were incurred during the project, and this experience will be applied to the field development activities.

## Development Plan

The Zamzama field development will be a dual train facility located on the existing plant site, largely incorporating the existing EWT plant. A minimum of three development wells will be drilled.

First production from the field development is planned for Q3 2003. Once the field is under development, stabilised condensate will be exported via a small diameter pipeline for injection into the Pak-Arab Refinery Company (PARCO) pipeline, 40 km west of the Zamzama plant. The condensate will be refined at PARCO's Muttar refinery in the Punjab province of Pakistan.

The capital cost for this phase of the development is estimated at US\$100 million (approximately US\$40 million net to BHP Billiton). Operating costs are expected to be around US\$7 million (gross) a year.

## Local Content

As the operator of the Zamzama Joint Venture, BHP Billiton is committed to maximising local involvement in the field development wherever practicable. During the construction phase for the EWT, labour and materials-related contracts totalling US\$5.6 million were placed with Pakistani companies including Descon Engineering Ltd, Associated Constructors Ltd, Allied Engineering, NESPAK, Alstom Pakistan and Siemens Pakistan. A similar approach will be applied to the execution of the field development, building on the experience gained and seeking to increase the level of local content. BHP Billiton will encourage joint venture arrangements between local and foreign companies which have complementary capabilities to facilitate the transfer of skills and technological expertise to local companies and personnel.

The Zamzama gas plant also provides direct employment opportunities. The existing EWT plant currently employs 58 people, of whom 34 are from the local Dadu area. The number of staff at the gas plant is expected to increase to around 70 once the facilities are in full operation. More than 600 people worked on-site during the EWT construction phase, of whom over 580 were from Pakistan and more than 100 of whom were from the Dadu area. Around 800 people are expected to be required for the field development construction activities at site, on a similar short-term basis.

BHP Billiton's employment policy is designed to provide maximum opportunities for local people. Priority is given to the communities immediately surrounding the gas plant for unskilled roles, and to those from the Dadu Sub-Division (Dadu and Johi Taluka) where semi-skilled personnel are required. BHP Billiton is committed to sharing expertise, and the Zamzama gas plant currently employs seven trainee technicians in a scheme initiated by Petroleum to transfer oil and gas industry skills to local communities.



## Environment

BHP Billiton implements and maintains health, safety and environmental management systems that are aligned with internationally recognised standards, and are consistent in all countries and areas of its business activity. A comprehensive Operations Management System which implements BHP Billiton's global Health, Safety, Environment and Community Management Standards is in place for Petroleum's operations in Pakistan.

In addition, an environmental assessment study for the Zamzama field development has been prepared. The study identifies all potential environmental impacts and considerations relating to the project and the control measures required to manage any potential environmental effects.

BHP Billiton's Health, Safety, Environment and Community Policy requires each operating business to adopt a strategy of continuous improvements. As part of the planning for the Zamzama field development all the environmental aspects of the existing extended well test operation have been reviewed and areas where improvement can be made have been identified.

## Community Relations

BHP Billiton is committed to building effective relationships with local communities wherever it operates. The Group aims to work with regional and local government, community groups and other organisations to ensure local communities benefit from its activities, both in the short and longer-term.

In Pakistan BHP Billiton Petroleum is working closely with community groups in the Dadu and Johi areas of Sindh province. In addition to providing employment opportunities wherever possible, the company is participating in a number of local development projects. These include the establishment of two community health clinics, one at Fateh Khan Brohi in consultation with the Village Shad Abad Welfare Organisation, and another at Village Dodo Panhwar in consultation with the Child Development Organisation. A micro-credit scheme for the women of Johi has been launched, in partnership with the Sindh Graduate Association (Women's Branch). Other initiatives include the construction of a community water well at Mithoo Khan Lashari, the establishment of a girl's primary school at Dodo Panhwar, a Women's Vocational Centre and a Computer Training Centre at Johi. Additional local educational initiatives are in train.

As the development of the Zamzama field is progressed, BHP Billiton plans to continue to develop this program in consultation with local community groups.

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