INFORMATION MEMORANDUM
(Revised)
Blocks – IV, VIII, IX & X
Thar Coal Fields
District Tharparkar @ Mithi, Province Sindh Pakistan
Coal and Energy Development Department
Government of Sindh
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<tr>
<td>EOI</td>
<td>Expression of Interest</td>
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<tr>
<td>GoP</td>
<td>Government of Pakistan</td>
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<td>GoS</td>
<td>Government of Sindh</td>
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<td>IRSA</td>
<td>Indus River System Authority</td>
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<td>KESC</td>
<td>Karachi Electric Supply Company</td>
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<td>MMDD</td>
<td>Mines and Minerals Development Department</td>
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<td>MoF</td>
<td>Ministry of Finance</td>
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<td>MoPNR</td>
<td>Ministry of Petroleum and Natural Resources</td>
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<td>MoWP</td>
<td>Ministry of Water and Power</td>
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<td>NEPRA</td>
<td>National Electric Power Regulatory Authority</td>
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<td>PGS</td>
<td>Pakistan Geological Survey</td>
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<td>PMU</td>
<td>Project Management Unit (Thar Coal-Energy – Karachi)</td>
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<td>PPIB</td>
<td>Private Power Infrastructure Board</td>
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<td>PSC</td>
<td>Project Steering Committee</td>
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<td>PSU</td>
<td>Project Support Unit (Power – Islamabad)</td>
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<td>Oil and Gas Regulatory Authority</td>
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<tr>
<td>RFP</td>
<td>Request for Proposal</td>
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<td>SCA</td>
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<td>SIDA</td>
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<td>SPPRA</td>
<td>Sindh Public Procurement Regulatory Authority</td>
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<td>Thar Coal Energy Board</td>
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<tr>
<td>TOR</td>
<td>Terms of Reference</td>
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<td>WAPDA</td>
<td>Water and Power Development Authority</td>
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INTRODUCTION

1. Pakistan: An Overview
Pakistan has an area encompassing 796,096 square kilometers and is bordered by India on the east, China on the northeast, Afghanistan on the northwest while Iran shares its border in the southwest with the Arabian Sea in the south of the Country.

Pakistan is a multi-cultural society where many ethnic groups are represented and speak a variety of languages. Urdu is the national language of Pakistan; however, both Urdu and English are used in official matters and business transactions. Various dialects are spoken throughout the country and many of the educated population are tri-lingual, speaking the regional language, Urdu and English. Islam is the national religion, but there are other minority religions such as Christianity and Hinduism who make up over 3 percent of the total population.

Population
The population as of the 1998 census was 132.35 million, as compared to 85.09 million recorded in the 1981 census. The average growth rate over the past 10 years has been approximately 2% per annum. The population at the end of 2010 is estimated to be around 180 million. According to the last census, over 50% of the total population is less than 20 years old, while 52% are males and 48% are females.
2. State of Energy in Pakistan

The Pakistan’s energy sector faces a number of critical challenges: (i) an energy and power resource deficit with power shortages reaching 25% of peak demand in summer FY10; (ii) 13% of households in Pakistan lack access to electricity (19% in rural areas which represent 2/3’s of Pakistan’s population; (iii) a lack of long-term energy balance with declining gas supplies leading to greater dependency on imported oil; (iv) a financial deficit; (v) low generation efficiency - gas and oil fired thermal power generation plants are operating at significantly low efficiency and transmission and distribution losses are at a quarter of generated electricity; and (vi) rising energy costs, exacerbated by the high dependence on imported oil in Pakistan’s energy mix, particularly in power generation, have adversely impacted the poor and the country’s industrial competitiveness.

Strategy. The Government of Pakistan’s (GOP) energy sector development strategy aims to enhance energy supply sustainably – for growth and expanded access - while reducing the dependence on imported oil. Policy measures include (a) enabling a financial recovery, especially in the power sector; (b) implementing a social protection program to assist the poor in receiving a minimum amount of affordable energy; (c) streamlining GoP’s institutional set-up in the energy sector to increase decision-making efficiency; and (d) increasing private sector participation including through public-private partnerships (PPPs).

Future Scenarios. The Government estimates that energy demand will continue to grow during the next two decades, with Pakistan requiring an estimated additional 35,000 MW of power generation capacity by 2020. Based on the analysis, the expected new power generation build-out will be about 7,700 MW\(^1\) of additional capacity by 2020, leaving a gap of over 27,000 MW. The GoP expects a significant demand-supply gap to remain in the short-medium term, even after the concerted demand-side management, and the expanded deployment of lower-carbon energy resources such as indigenous hydropower, natural gas, and renewable. Likely scenarios of energy sector development are as follows:

- The Government is pursuing policy to replace Oil with Indigenous Coal in power generation. This would provide fuel security, foreign exchange savings, adequate power and greater viability for Coal Projects on local coal. The dried lignite from Thar, after briquetting, can be transported and utilized by retrofitted Thermal Power Plants in the country. It is estimated that USD 7-8 bn could be saved annually if the existing Thermal power plants were converted from Furnace Oil to Coal. There is a capacity of 2967 MW in GENCOs and 2150 MW in Independent Power Plants (IPPs) which can be converted to Coal (Total 5117 MW) with a cost of USD 1.5-2.0 bn. Initially these power plants can use imported coal. However, the conversion be designed having compatibility with Thar coal. It will provide added incentive to investors in Thar coal mining.

\(^1\) Assumes 7,000 of a total 10,000 MW of new hydro potential, no net increases in gas or oil, and 700 MW of a total of 9,700 MW for wind.
• The highest priority is being given to improving the efficiency of the electricity supply; and also to implement conservation measures. Installed generation capacity was 19,566 MW in June, 2008, and current transmission and distribution losses (technical and non-technical) are estimated at about 25% of total generated power.

• Pakistan’s hydroelectric potential is estimated at 40,000MW, out of which the economic hydroelectric potential is around 20,000MW. However, production is seasonal (Pakistan's current installed hydropower capacity of 6,400MW falls to less than 2,000MW during the 4-5 months of winter when water flows are minimal) and best suited to meeting peak-time demand, with base demand best met by thermal power sources (and in some cases by large storage hydro). Indicated hydropower installed capacity could rise by 10,000MW by 2030. However, given the long lead times and high costs the GoP will seek to complement new hydropower projects with other energy sources, particularly to meet base load needs.

• The supply of natural gas for power generation is declining, and there is little or no natural gas supplied for power generation during the 3-month winter period. Proven reserves have increased modestly from 26TCF in 2000 to 30TCF in 2007. Production has remained flat over the past 3 years, while demand in non-power sectors has grown. New gas discoveries are expected to only partially compensate for depleting supply.

• Pakistan's wind potential is estimated at 9,700MW; however, like hydro power it is less reliable for base load needs and more suitable for peak loads. The wind power will complement an expanded base-load electricity system but is not an acceptable substitute for base-load itself.

Coal – A New Endeavor for Pakistan

Within Pakistan’s energy portfolio, natural gas and oil dominate (at least 1/3 of power is based on imported oil). Pakistan’s coal resource potential is estimated to be around 185 billion tonnes, with present production of only 5 million metric tons per year, mostly for local industrial use. About 175 billion tons are located in Sindh province at Thar—one of the largest single coal deposits in the world, yet to be exploited. The coal quality is ‘lignite’ a fossil fuel with a heating value 5,700-7,300 Btu/lb. Thus, the development of indigenous coal resources for large-scale base load power generation would be new to Pakistan.

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2 Economic Survey of Pakistan, 2007-08.
3 The government projections for 2030 are from the Medium-Term Development Framework 2005-10
Since the discovery of the Thar Coalfield, the government has shown strong interest in developing the lignite resources for power-generation. The government has made a decision to allow for a flexible approach towards the size and bundling of the projects, has planned improvements to infrastructure, and allocated funding to commence technical studies in the Thar area, including hydro-geological assessment. Issues such as coal pricing, resource rents, tariffs for power, and uptake arrangements are being addressed. Thar Coal & Energy Board (TCEB) has been declared as coal pricing agency and TCEB has developed a Coal Pricing model through international consultants.

The government has declared Thar Coal as projects of strategic importance and considers development of Thar coal as a matter of national security. As the national energy crisis becomes critical, the Government of Pakistan considers development of coal to power sector and indigenous coal is a must for Pakistan. The Government considers the development of indigenous thermal coal as a least cost fuel source for power generation and all coal for industry application is essential.

**Comparison of Coal Quality at Thar**
Thar lignite having a stripping ratio of 6:1 and heating value of 6200 ~ 11000 Btu/lb is similar or somewhat better than many lignite resources where successful mining and power generation is being done. For example:

- **India’s Neyvelli lignite** has a heating value of 5,200 Btu/lb and stripping ratio of 7:1 coals. Total generation based on Neyvelli lignite is more than 2,700 MWs.
- **Hungary’s lignite** has stripping ratio of 9:1 and heating value of 3035 Btu/Lb and power generation above 1800 MWs.
- **Germany’s Rhineland lignite** having stripping ratio of 4.9:1 and heating value of 4514 ~ 11054 Btu/lb is fueling power generation of more than 10,200 MW.
## Comparison of Thar with Other International Mines

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Stripping Ratio (m³ : t)</th>
<th>Heating Value (MJ/kg)</th>
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<tbody>
<tr>
<td>Thar</td>
<td>6.6 : 1</td>
<td>11.6</td>
</tr>
<tr>
<td>Kosovo</td>
<td>1 : 1</td>
<td>7.8</td>
</tr>
<tr>
<td>Rhenish Area, Germany</td>
<td>4.9 : 1</td>
<td>8.9</td>
</tr>
<tr>
<td>Hambach, Germany</td>
<td>6.3 : 1</td>
<td>10.5</td>
</tr>
<tr>
<td>Hungary</td>
<td>9 : 1</td>
<td>7.1</td>
</tr>
<tr>
<td>Greece</td>
<td>10:1</td>
<td>5.02</td>
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![Graph showing moisture content of raw coal vs. ash content of raw coal]
Part-II

GOVERNMENT COMMITMENT TO ATTRACT PRIVATE INVESTMENT IN THAR

The Government of Sindh seeks to develop the Thar coal reserves in a strategic and systematic manner that will ensure the country’s national security and long-term use of indigenous coal for electricity generation and industry use. Government seeks to develop several large-scale coal mining operations and supports and encourages domestic and foreign investment in the coal sector. Government supports competitive bidding of coal resources to be implemented and managed at the Provincial level. Government supports the market-based evaluation of tenders, equitable distribution of revenues and transparent issuance of licenses, leases and project awards. Government further supports the transparent operation of Pakistan’s coal sector and surety of tenure (enforceable contract terms) for all legitimate investors. In the development of the coal reserves, Government seeks to protect its environment and its people. Government seeks to accelerate the development of its coal resources with specific emphasis on power generation. In this regard, considerable emphasis will be given to the Thar Coal Fields, host to at least 95% of the country’s coal reserves.

Government is promoting the coordinated development of the coal industry and related industries. The construction of large-scale coal mining should be linked with conditions for water resources, transport and power to enhance local industrial and economic development. In support of large-scale coal mining at Sindh, the Thar Coal Energy Board (TCEB) will serve as a coordinating body for Federal, Provincial and District institutions and will promote information exchange among key stakeholders.

Government Commitment

Government of Sindh & Pakistan is committed towards provision of an enabling environment that can ensure availability of safety-valves against investment risks, provision of tenure security and evolving an ‘integrated link’ of mining with power generation. To achieve this Government of Sindh & Pakistan focuses on strengthening institutional structure, developing physical infrastructure & implementing investor friendly policy & regulatory mechanism.

Thar Coal & Energy Board (TCEB) is one stop organization responsible undertaking all strategic decisions pertaining to Thar Coal development. TCEB facilitates and coordinates all the investors in seeking licenses, permits and expedites infrastructure development. Government of Sindh & Pakistan has prepared and implementing infrastructure projects that includes provision of water, effluent disposal mechanism, transmission network for evacuation of Power, and construction of rail & heavy duty road network for transportation of machinery up to Thar Coal field.

Government will ensure that social safeguards are in place for communities and citizens impacted by coal and related development. Government has established a predictable and enforceable legal and regulatory framework to support sector operations.
INSTITUTIONAL FRAMEWORK SUPPORTING DEVELOPMENT OF THAR COAL

Institutional arrangements that support power operations are federally administered while institutional arrangements that support Coal operations are provincially administered. Since, large-scale coal mining or related coal-fired power generation is new to this country, the Government of Pakistan and Government of Sindh have taken important measures to promote federal-provincial government synergies. These institutional relations have been especially defined in the past two years in a targeted manner to ensure institutional clarity and an investor-friendly environment for Thar coal activities.

Institutions
The regulatory and institutional frameworks for the mining and energy sector in Pakistan are clearly defined. The current legal framework of the mining sector in Pakistan consists of three generation of documents, conceived under different circumstances. Solid minerals (including coal and coal bed methane) are a provincial subject in Pakistan, while hydrocarbons (mineral oil and gas) within the province or the territorial waters adjacent thereto shall vest jointly and equally in that province & the federal government. The authority responsible for the development of the mining sector is the provincial government, while the large-scale production and distribution of electricity is principally the responsibility of the Federal Government.

Provincial Institutions. Each province has its own Department of Coal and Energy Development with the mandate to grant mining licenses and leases, collect fees and royalties and monitor activities in the mineral sector. In Sindh, the Coal and Energy Development Department (CEDD) has full regulatory authority for coal. The project implementation, in particular infrastructure development projects in coal areas, is through the Sindh Coal Authority (SCA) working under CEDD.

Federal Institutions. The Private Power Infrastructure Board (PPIB) is authorized to promote and facilitate private sector participation in the Pakistan Power Sector. Additionally a number of ministries, departments and agencies are involved in the day to day management and oversight of the energy sector. These are federal agencies including the Ministry of Water and Power (MoWP) which functions as the owner of all public sector assets and utilities, and formulates sector policy and strategy – in consultation with other ministries, notably the Planning Commission, and Ministry of Finance; and the Ministry of Petroleum and Natural Resources (MPNR) fulfills similar functions in the hydrocarbon (oil and natural gas) sector.

Thar Coal and Energy Board (TCEB). The coordination and cooperation between federal and provincial governments is a key to the success of the Thar coal-to-power development. In recognition of both the need for coordination and the potential future importance of Thar based coal-to-power development, the TCEB was created in July 2008 the GoP and the GoS to act as a one-stop organization on behalf of the Islamic Republic of Pakistan and the Province of Sindh, with respect to all matter relating to, inter alia, facilitation of transactions for the Thar coal mineral resource and power generation using this coal. The Provincial Assembly of Sindh has also

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4 Article 172 (c) Constitution of Pakistan amended in 18th Constitutional amendment bill 2010 the ownership of mineral oil and gas is under joint ownership of federal Government & the province.
approved the Thar Coal & Energy Board Act, 2011 in June, 2011. The TCEB has following members:-

- Chief Minister, Sindh Province (Chair)
- Federal Minister for Water and Power (Vice Chair)
- Federal Minister for Finance
- Federal Minister for Law and Justice
- Deputy Chairman, Planning Commission
- Provincial Minister for Irrigation
- Provincial Minister for Finance
- Provincial Minister for Revenue & relief
- One Female MNA from Thar region
- Secretary, Ministry of Water and Power
- Chief Secretary, Sindh Province
- One eminent person nominated by the Government of Sindh
- Secretary, Coal and Energy Development Department (CEDD)
- Managing Director, TCEB (Member/Secretary to Board)

Thar Coal Energy Board (TCEB). TCEB is established as a one-stop organization where federal and provincial governments meet to facilitate investments in Thar. TCEB is the lead institution to coordinate the overall development of the Thar Coal Basin and coordinates Federal, Provincial and District stakeholders. TCEB facilitates infrastructure development at Thar, serve as the Coal Pricing Agency for Thar coal, and assesses and approves applications for projects at Thar. The rationale for the establishment of the Thar Coal Energy Board (TCEB) was to institutionalize the Government of Pakistan and the Government of Sindh’s commitment to the unprecedented development of the Thar Coal Basin. TCEB members represent Federal and Sindh Government interests as well as the private sector. The creation of TCEB ensures that a legally empowered body is in place and is dedicated to the mobilization and monitoring of the development of the Thar Coal Basin.
The core functions of the TCEB are:

1. The promotion and facilitation of investment at Thar
2. The coordination of federal, provincial and district government in Thar development
3. Provision of assistance to Thar investors in obtaining permits, licensing
4. To serve as Coal Pricing Agency

The TCEB conducts regular meetings and is supported by the TCEB Secretariat. The TCEB Secretariat supports the day-to-day needs of the TCEB including research and assistance, coordination of meetings, record-keeping and overall coordination of TCEB activities.
Set of Incentives, Concessions and Protections for Development of Indigenous Resources

On the recommendations of Thar Coal & Energy Board the Economic Coordination Committee of Federal Government (legal constitutional forum headed by Federal Finance Minister) has approved a set of incentives, concessions and protections for development of indigenous Coal resources of Sindh. The following set of incentives, concessions and protections are available to facilitate investors for development of indigenous Coal resources of Sindh:-

Special Economic Zone

- Thar Coalfield is declared as Special Economic Zone, and the projects of development of Thar (also including coal mining and power generation) declared as ‘Projects of National Security’

Rate of Return

- 20% ($ Based) IRR to firms which achieve Financial Close before 31st December 2015 for Mine & Power Plants based on indigenous coal and additional half a percentage IRR i.e. 20.5% IRR for firms which Financial Close by or before 31st December 2014.

Exemptions/concessions

- Zero percent customs duties on import of coal mining equipment and machinery including vehicles for site use.

- Exemption on withholding tax to shareholders on dividend for initial 30 years.

- Exemption on withholding tax on procurement of goods and services during project construction and operations.

- Exemption for 30 years on other levies including special excise duty, federal excise duty, WPPF and WWF.

Protections

- Currency Exchange Rate Protection:

  (i) To enable maximum competition from Suppliers and Contractors, the Mining & Independent Power Producers (MIPPs) are protected from the impact of exchange rate variation between US dollars, Euros, Pounds Sterling and Japanese Yen up to Commercial Operation Date (COD).

  (ii) At the COD, the capital cost be fixed in US dollars based on actual currencies of EPC Contract is acceptable to concerned agencies at the time of tariff determination, sources of financing, payments and actual exchange rates against rupee for the four currencies (US dollars, Euro, Pound Sterling and Japanese Yen) on the relevant dates.
(iii) To broaden the access for debt financing, debt can be obtained by MIPP in US Dollar, Pound Sterling, Euro and Yen. This will receive the same treatment as currently available for US dollar denominated debt.

(iv) As O&M costs are incurred subsequent to COD, O&M Cost Adjustment will continue to be based on exchange rate variations between Pak Rupee and US dollars.

(v) The Performance Guarantees to Government of Pakistan and Letter of Credits will be accepted in Euro, Pound Sterling and Yen in addition to US$.

- **EPC Cost Escalation**

MIPPs are expected to apply for Coal Pricing on the basis of reasonable assurance of fixed price EPC contract, while taking into account all timelines and milestones up to the Financial Close. However, any legitimate cost escalation between the date of application to Government of Pakistan (for tariff determination) and the Financial Close, would be accounted for in the predetermined tariff by taking into consideration the period in which prices of EPC contract are fixed, and the timelines and milestones up to the Financial Close (which are known to both the MIPP & GoP at that time). These timelines and milestones would be recorded in the tariff determination. If any delay in meeting the milestones can be legitimately attributed to the Government, then justifiable escalation in tariff would be allowed by relevant agency.

- **Return on equity**:

The Return on Equity will be allowed in one currency i.e. US dollars. All Return on Equity (for foreign exchange and rupee based equity) be converted to equivalent US dollars amount at reference exchange rate and adjusted for variations in US$/Rs rates as presently being done for return on foreign component of equity.

In addition to the aforesaid incentives, Coal Based Power Projects and Coal Mining Projects in Sindh shall have the same incentives, concessions, protections and security package as that available to IPPs developed pursuant to Power Generation Policy 2002 (as amended from time to time).
Ongoing Efforts of GoS for Institutional Strengthening

Water Master Plan for Thar Coal Fields including Hydro geological, Water Supply and Wastewater Management Studies

Thar Coal Fields are located in Thar Desert area occupying East and South-Eastern portion of Sindh Province of Pakistan. Being a desert, the area is extremely dry arid region with very low scanty rain fall and limited water resources. The supply of water for the development of coal mines, power plant and related domestic complex is vital for successful future operation of the facilities. The GoS has embarked upon a detailed study for preparing Water Master Plan for Thar Coal fields. This includes studies of Hydro-geological, Water Supply and Waste Water Management.

(Ground Water Pumping Test in progress)

The proposed consulting services are aimed therefore for feasibility level hydrological, hydro-geological and waste water management studies covering technical, institutional and economic analysis, social/environmental assessment, procurement and financial management, so that the recommended option of the study could form a basis for continuation to a second phase for a detailed design, tender drawings and project implementation suitable for international assistance.

The main objective of the consulting services is to support Sindh Coal and Energy Development Department, Sindh Coal Authority (SCA), Government of Sindh (GOSindh), and Government of Pakistan (GOP) in: (i) hydrological studies of the Thar coal mine area, and assessment of water demand during various phases of development of mines and power plants in future, including the use of lignite drying plants; (ii) assessment of best source/option for meeting water demand in short, medium and long term given the available surface and groundwater resources and their
location (iii) hydro-geological investigation of the area and assessment of groundwater resources and quality of groundwater and required monitoring of observation network for two years; (iv) estimate of drainage effluent and wastewater that is likely to be generated from the mines and the industrial complex, taking cognizance of the 25 mil m³ (this is only the value for one mine) per year mine effluent in the feasibility study and the proposed options for treatment to use it for human consumption or alternatively options for proper disposal of this effluent; and (v) feasibility level designs for least cost option for water supply and wastewater disposal system. The consultancy work on this scheme will be started in January, 2012 and duration of the project is 2 years.

**Environment and Social Studies including Land Use Plan and Resettlement Frameworks for Thar Coal Fields.**

The development of Thar coalfields and associated establishment of coal-to-power projects are among the major objectives of the Government of Sindh. However, before the start of full scale mining and establishment of associated power plants, the government has planned to have Environmental and Social studies including Resettlement Frameworks and Land use Plan in place, and develop a Geographic Information System (GIS) for Thar Coal Fields. This would facilitate all stakeholders including investors by providing vital geographical information and also set basis against which changes in the environment and socio-economic situation in the area can be assessed once mining and power generation and associated activities begin. This study entitles as ‘Environmental and Social Studies including Resettlement Frameworks, Land Use Plan for Thar Coal Fields’ comprises two components; I) Environment and Social studies and II) Land Use Plan.
The objective of component I-‘Environment and Social Studies’ to be carried out over an area of 22,000 sq. km. in the Thar basin, is to ensure that there is a basis for measuring and determining what impacts (positive or negative) mining, power generation, transmission and associated activities will have on the environment, people and their livelihoods, and cultural heritage of Thar basin.

The rationale of component II- developing a ‘Land Use Plan’ is that the mining and power development projects will result in substantial changes and transformations of the spatial structure and land use in the affected areas and communities. The Consultant will examine the current social and economic development situation in Thar and options for future development in the district as mining and power projects come online. This effort will focus on the needs and perceptions of different segments of the population (and other stakeholders) as well as review government and any private sector development plans. The building and operation of new mining and power projects is planned for a long term period, resulting in long-term development process. Various activities changing the present land use, the landscape and socio-economic conditions will happen in parallel. In this context, this land Use Plan is seen as a preliminary planning document which sets out the future spatial development under the above setting. This component of ‘Land Use Plan’ will result in development of a plan for optimal utilization of land for the purpose of coal and power generation and relate facilities for employees of the projects and population of the area in general.

This work will also be closely linked to other technical studies supported by the TCAP PMU. Development scenarios based on the proposed investments in mining, power generation and transmission in the area need to be discussed with possible social and economic (direct and indirect) outcomes for the communities, and identify main sector-wise investments that would be required to (a) facilitate investments in the area; and (b) provide for economic growth across the local populations in the region.

Component-I and II of this scheme would cover a collection of activities that will ensure adherence to internationally accepted World Bank safeguards and GOP environmental and permitting requirements as they apply to the anticipated coal to power and associated infrastructure and development project(s). Whereas, the Component-III would build upon and enhance existing GIS capabilities required for two purposes; a) tenement management and b) investors facilitation. Tenement boundaries, both current and historical will need to reside within GIS for Thar Coal fields.

**Current Status of Development of GIS for Thar Coalfields**
The GoS is developing GIS for Thar Coalfields for tenement management and investors facilitation. The work in this regard is going on which include developing land use plan, resettlement plan and related social & environmental registries.
Tasks Completed

Preparation of Base Map

The GIS Consultant has developed high (0.6-0.5) and low resolution sheets (15-30 meters) which combine hydrological, topographical, social, and environmental and infrastructure data (including existing roads, power grids etc). The high resolution images covered existing blocks using high / low resolution Digital Elevation Model (DEM), technical specifications are DEM Positional Accuracies: (For High Resolution) CE90 4-5 meters LE90 2-3 meters NMAS 1:5000 Ortho-corrected Yes, Target Elevation Angle >72 deg Mosaic Yes – High positional accuracy (For Low Resolution) SPOT DEM (30 m or less horizontal accuracies & < 20m vertical) Projection: UTM Zone 42 / Survey Sheets in LCC Local cartographic Grid, while the entire area of 9100 square kilometer can be covered through low resolution images. The data is being collected and updated as a continuous process incorporating findings of studies undertaken at different stages of project.

Web-Portal

The Consultant has designed a Thar Coal Web-Portal to comprise a fully digital system incorporating appropriate software for tenement management or GIS. The System designed so as to facilitate its immediate or eventual linking to the Coal and Energy Development Department website for internet publishing of information on the status of tenements and applications. This includes provision of on-line access to a regularly updated tenement map of Thar Coal so that investors are able to see which areas are available for application.

Geotechnical Investigation Spatial Data

The GIS Consultant has undertaken technical investigation of contours of water tables including geospatial subsurface groundwater regime on the basis of available geophysical investigations and seams on bore log lithologies by hydrogeology consultant(s). This data would be integrated with the results of “Hydrological, Water Supply and Wastewater Management Studies” to be undertaken by firm engaged by Government of Sindh by April 2010. The data will transfer into the GIS and the Consultant shall make a determination as to whether there is sufficient data to prepare 3D model based on the sub surface horizontal and vertical domains delineated and assessed for the domain of aquifers and sub-surface stratification identified by the respective consultant. If not, Consultant shall model according to the data available and provide guidance to the Coal and Energy Department on additional data collection that would be necessary to complete geospatial modeling. This spatial data will contribute in developing tenement mapping and preparing an integrated Geo-data base. Integration and interpretation of geophysical logs and translation into multi layers subsurface strata mapping and geo database records. The GIS model should enable investors to assess in quantifiable terms extents in 3D space.
Ongoing Tasks

Demand-Supply Assessment of Land for various uses

The demand and supply assessment would be undertaken on the basis of available spatial data including integration of Land Record available primarily with Revenue Department. The analysis would contribute in developing Optimized Spatial Re-allocation Plan, Resettlement Plan, Water Master Plan and Regional Development Plan, which will be developed under separate from this assignment contract(s).

Develop an Environmental and Social Data Monitoring System and Registry

Settlements, rural economy and land use patterns: The GIS data collected and compiled by consultant is being integrated with two studies entitled as “Social and Environmental Studies, Land Use Plan including Resettlement Framework” and “Hydrological, Water Supply and Wastewater Management Studies” to be initiated by the Government of Sindh by April 2010, for the purposes of GIS, shall

(i) describe current settlements within the study area (collect coordinates) and their immediate environs by their location, administrative status, land ownership and use patterns,

(ii) List and describe all sites of significant archaeological, religious, and cultural importance. These should be digitized and their coordinates mapped.

The Consultant also map and digitize the following:

Population centers, road network, surface water networks, drinking water sources such as tube wells, ponds, etc, health units, clinics and hospitals; schools; etc as baseline data as acceptable capture scales.

Whenever possible, the current infrastructure elements should be shown using maps, graphs, and images.

This registry will be loaded and operationalized at the Coal and Energy Department so that it can be used for monitoring, reporting and statistical purposes. The registry will be designed as a “change monitoring” tool that will portray point sources of pollution, emission plumes, modeled environmental impacts, changes to land use and land cover, infrastructure development, spatial changes in population centers and communities, and have an inventory and updated status on any optimized resettlement plans. The integration shall also include land use revenue records integration, for which fair amount of data is available with the Board of Revenue, GIS consultant shall undertake the necessary field measures for establishing the control points to be integrated on GIS platform.
Specific data layers within this GIS would include *inter alia*:

1. Existing Topography of each developed block and for the four new proposed blocks.
   i. Digital Elevation Model (DEM) shall be purchased for the above given blocks (Nine 09 No.) at highest available resolution scale to achieve the requisite topographic accuracies with added verification through Dual Frequency Differential GPS (DGPS). The remaining project area shall be covered for topographic assessment with medium to low resolution DEM. DEM will be purchased by the consultant but will remain the property of Government of Sindh.

2. The initial structure for an ongoing development of a land-use plan, incorporating data currently available (or that will be made available during the course of this contract) to carry out:
   a. Identification of appropriate locations for proposed worker colonies and will also suggest infrastructure development within and between the blocks for the ongoing projects and for future needs. The task will be carried out in coordination with the TCAP office and Sindh Board of Revenue based on the land classification of Deh maps. Would also suggest.
   b. Proper location for development of new blocks in Thar coalfields. Additional areas of prospecting areas shall be identified on the basis of the Board of Revenue records (Deh maps) and other GIS based infrastructure details.
   c. Layout mapping for required services including right of way for different blocks for smooth working of investors.

3. Underlying Geological Stratification information based on existing data with the department to become part of Geodatabase, which will be submitted in form of a report.

4. Block wise details including following :-
   - Geological Data.
   - Aquifer data (based on available data).
   - Accurate Coordinates of each Block.
   - Exact location and number of villages in each block with number of household and exact coordinates.

5. Villages /settlements with coordinates in entire coalfield area.

6. Digital Elevation (3D) Model at 0.6 Resolution for existing blocks & proposed four new blocks.

7. Required GIS data for Re-settlement Plan :-
   - Deh Maps overlay on high satellite image.
   - Land use categorization based on land record.
   - Proposed re-settlement location identification.

8. Web Portal for entire coalfield with defined protocols.

9. Setting up an E-commerce applications to allow purchase of data on web through credit card payments by interested investors all over the world.
Part –III

Detailed Description of Thar Area

Thar Coal fields are located in Thar Desert area occupying East and Southeastern portion of Sindh Province of Pakistan. Being a desert, the area is extremely dry arid region with very low rainfall and limited water resources. The supply of water for the development of mine, power plant and related domestic complex is vital for successful future operation of facilities. The estimated coal reserves of the Sindh Province is nearly 185 billion tones in mine fields like Thar, Badin, and Thatta-Sonda-Jherrack of which Thar mines possesses one of the biggest Lignite deposits spread over 9100 sq. km in the Tharparkar district.

The investigation drilling in the past revealed that the coal is in-seams with extractable thickness of 22 m at a depth of 110 m up to 200 m. The upper seam layer of coal reserve reportedly contains in-situ water.
Role of Thar Coal. To address the persistent energy gap, the large indigenous coal (lignite) resources at Thar in Sindh Province form an integral part of Pakistan’s long-term energy security strategy. The Thar resource has a very good potential – depending on the scale of the mining operations - to be an economic option compared to other energy-sources. Development of Thar is expected to emerge through a partnership of government and the private sector, wherein the private sector would assume investment risk subject to viable commercial market conditions and the government would provide the governance and stability necessary to facilitate such investments.

Background about the Discovery of Thar Coal Reserves

- The tangible indications that coal was present beneath the sands of the Thar Desert came with the drilling of five water wells by the British Overseas Development Agency (ODA) in collaboration with the defunct Sindh Arid Zone Development Authority (SAZDA).

- Water drill hole ODA2 was drilled in 1988 near the village of Khario Ghulam Shah about 15 km east of Islamkot. The descriptions of cuttings from this well noted "Carbonaceous Shale" between depths of 126-129m.

- On the basis of the presence of coal in ODA2 water well the Geological Survey of Pakistan (GSP), and United States Geological Survey (USGS) examined and described drill cuttings from other nearby SAZDA wells in March 1989.
• The hole No.TH-5 was geophysical logged along with other holes and it was estimated the total coal present in well was 19 m. Further confirmation of the coal presence in Thar Desert exploration program was carried out by drilling 4 boreholes.

• In October 1992, the Geological Survey of Pakistan (GSP), and United States Geological Survey (USGS) began a 21 bore holes exploration program to define the magnitude and geographic limits of the Thar Coal field.

• In 1993, an additional 10 bore holes were drilled under a contract with the John .T. Boyd Company under the auspices of USAID, additional 03 drill holes were also drilled by GSP under the auspices of USAID.

• The studies proved that Thar coalfield is spread over an area of more than 9100 square kilometers with dimensions of 140 km (north-south) 65 km (east-west) having 175.506 billion tones of Lignite (coal), categorized "A" to "B".

• The GSP carried out the drilling program for development of the blocks for further proven coal reserves from 1994-2000 and Blocks I, II, III and IV were developed.

• In 2005-2006, Sindh Coal Authority developed Block V and VI through foreign firm viz. Northeast Coalfield Geological Survey Bureau, China.

• In 2008-09, Sindh Coal Authority developed Block VII, VIII and extended the block III up to 56 Sq.km (i-e Block III-B) through a local company viz. M/s Deep Rock Drilling Pvt. Limited.
General Geology of Thar

The studies conducted so far, show that the Thar coalfield rests directly on relatively shallow, rifted basement rocks of late Pre-Cambrian age. The area is completely covered by sand dunes. On the basis of drill hole data, four sub-surface litho-stratigraphic units have been identified. The units are dune sand (recent), Alluvial deposits (sub-recent), Bara formation (Paleocene and Basement Complex (Pre-Cambrain). The Due sand (50-90 meters) comprises sand silt and clay.

Alluvial Deposits (11-127 meters thick) comprise sandstone, siltstone and clay stone. The Bara formation (50-125 meters thick) consists of clay stone, shale, sandstone and coal, whereas, the basement complex comprises mainly of granitic rocks. The drilling data has indicated three aquifers (water-bearing zones) at an average depth of 50, 120 and more than 200 meters.
- Cumulative coal thickness Isopach map of Thar Coalfields
Overburden Isopach of Coalfield Pakistan
**Ground Water Source.** The past investigation drilling revealed that the coal is in-seams with extractable thickness of 22 m at a depth of 110 m up to 200 m. The upper seam layer of coal reserve also reportedly contains in-situ water. A recent, bankable feasibility study in the block 1 area has given the following information:

Groundwater is present in mainly three different horizons.

- The base aquifer with pump tested transmissivities of 7.9x10⁻³ and 1.8x10⁻³ m²/s is extending throughout the exploration area at a thickness of about 60 meter. This aquifer has an extension in the Thar Desert of about 15,000 km². Recharge is possibly from the Northeast beyond the Indian border.

- The middle aquifer is composed of a variety of mainly disconnected sand lenses and channels with partly high silt content and low permeability within the lignite bearing Bara Formation and the Subrecent Formation. Recharge to these aquifers is likely to be poor.

- The Dune Sand Formation acts as a top aquifer with a water column of few meters only at the formation base on top of the Subrecent. Permeability here is in the range of 10⁻⁵ m/s. Recharge of this aquifer is direct through rainfall infiltration.
Groundwater qualities are saline in all aquifers with dominant sodium chloride contents. TDS is around 7500 in the base aquifer of the exploration area and 4500 in the top aquifer at the village of Varvai. The top aquifer at the village of Tilvai shows extreme high values in the order of up to 11,000/14,000 TDS.

The study further looks at an option to employ lignite drying plants. The lignite would be dried in the process from originally 47.5% to 12%. The water is condensed and treated and cleaned for the boiler and cooling process in a treatment plant. By a raw lignite supply of about 6 Mio t/a the water from the drying process is with about 2 Mio m3/a, sufficient to run the power plant with closed coolers with an amount of about 1.7 - 1.8 Mio m3/a and for other users related to the mine and power plant.

Another source of water for cooling tower make-up and blow-down, treatment and demineralising for cycle processes and general use could be the underground water from the dewatering measures with dewatering wells in the area of and around the mine site to depressurise the aquifers. Depending on the depth of the mine the groundwater amount in order of around 25Mio m3 per year will be pumped, starting 4 years before any coal is mined. However details must be investigated in that regard because the adjacent mine development in block II and the depressurisation of the aquifer in that area close to the project area of block I.
may interfere very drastically the yield of the dewatering wells in the investigated mine area (- 40%). Consultants are to look very closely at this point of the hydrological study to cover the influence of the entire area affected. The groundwater developed in the area adjacent to these mines where Left Bank Outfall Drain (LBOD) runs through also has similar water quality. Therefore this imposes not only a water quality problem for use, but also if the mines are developed, and if the resulting groundwater is significantly saline, the effluent has to be disposed off properly. For coal mining saline water from the upper layers of coal seam is likely be drained out. It is difficult to estimate the amount of effluent that would be generated; however, it could be substantial that it requires proper planning of disposal systems as the effluent would be highly saline and polluted. Options for disposal of this effluent have to be thoroughly studied and designed carefully in order to avoid damages to the surrounding area. Moreover, the groundwater could yield only limited supply for short run and reliability that it would be a question for establishing the costly desalination facility unless the quality and reliability are proven portable.

**Surface-water Source.** As an alternative for possible consideration of getting required water resources to the said mining complex including passing by towns and villages is to divert the surface water from the Nara Canal System, which takes off from Sukkhir Barrage in the Northern area of the desert, and runs along the Western boundary of the Thar Desert area until it drains into sea through Left Bank Outfall Drain (LBOD) and KPOD. In particular, when it comes to the vicinity of Thar mines area in Tharparkar district, the Nara main canal branches out into distributaries. The nearest branch canal to the area is Mithrao Branch canal. A water pipeline for the domestic water supply to the existing towns and villages has been constructed from one of the Noakot distributary of the Mithrao Branch. This pipeline is used to supply water to the population of Mithi area which is the district head quarter of Tharparkar district including few other villages and towns of the district. Being tail-end of the system, water is supplied weekly through a pipeline of 12 inches diameter with multiple booster pumping stations. The current pipeline has capacity possibly to meeting the current water requirements but may not be enough for the future plants and population of the complex under consideration. In order to provide fresh water to Thar Coalfields, the Government has approved a scheme for supply of 300 cusecs fresh water from Nara Canal. Apart from this the government is also evaluating the option of supply of water from LBOD to Thar Coalfield. This water can be used in power plants after treatment.
ENVIRONMENTAL ASPECTS

Area Description

Thar coalfield is a part of the Thar Desert. It is bounded in the north, east and south by India, and in the west by flood plains of the Indus River. The terrain is sandy and rough with sand dunes forming the topography. The relief in the area varies between near sea level to more than 150 meters above sea level.

The climate is essentially that of an arid to semi-arid region with scorching hot summers and relatively cold winters. The main livelihood of the population is dependent on agriculture and livestock rearing. Both the activities depend on rainfall, which is sparse, often erratic and falls between July and September. After the rains, the desert subsoil aquifers are recharged and the pasturelands are regenerated. However, by February, the aquifers are mostly depleted and the pasturelands dry up.

Fauna in the Block I-X

This area is home to species of birds and animals including the Chinkara (Gazelle benetti), desert fox (vulpes vulpes griffithi), Jackal (Ganis aureus), Mongoose and the Sindh Peacock (Pavo cristatus). Other birds found in the area are partridge (Favncolinus pondocerianus menaesis), Barn owl (Tyto alba), Indian scoop owl (Otus bakkarnoena), Sindh Night Jar (Caprimulgus mahrattensis), and Dove (streptopelia senegalensis). Venomous snakes viz khapar (Sindh Rattler) and Cobra are common in the rainy season. Vegetation consists mostly of stunted scrub and bush although trees such as the hardy kandi (propos ginerasia) do occasionally dot the landscape. The main natural ground cover is provided by grasses which are nutritive and a palatable fodder for the livestock. The people therefore are not engaged in agriculture as intensely as the rest of rural Pakistan.

National Legislation, Regulations and Policies

The cornerstone of environmental legislation is the Pakistan Environmental Protection Act of 1997 (PEPA), which superseded the Pakistan Environmental Protection Ordinance of 1983. The Act establishes the general conditions, prohibitions, and enforcement for the prevention and
control of pollution, and the promotion of sustainable development. The Act also establishes and delineates the powers and functions of the Pakistan Environmental Protection Council (PEPC), Pakistan Environmental Protection Agency (Pak-EPA), provincial Environmental Protection Agencies (EPAs), and Environmental Tribunals. In particular, the Act creates the authority for delegation of environmental management functions to the provincial EPAs. Nothing in the Act prohibits provincial governments from adopting more stringent standards or regulations.

Under the PEPA, the Federal government has the authority to delegate any of its environmental management functions and powers to provincial governments, government agencies, or local authorities. Provincial governments in turn may delegate powers to any lower-tiered government agency. This provision establishes a framework for environmental federalism within which environmental management responsibilities are shared amongst Federal, provincial and local governments. Environmental federalism is built on the belief that governance is strongest when implemented at the level closest to the beneficiary, and which was further promoted in Pakistan by the Local Government Ordinance of 2001, which introduced a new system of local government aimed at promoting responsibility at the local level. According to this Ordinance, rural and urban local councils were responsible for “the prevention of pollution of water or land from such sources and in such manner as the by-laws may provide.”

According to PEPA, no development program can be undertaken unless an initial environmental examination (IEE) or an environmental impact assessment (EIA) is conducted, and approval is received from the federal or relevant provincial EPA. The categories of programs, for which an EIA or IEE has to be carried out, are defined in the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000. In Sindh the guidelines for the preparation of IEE and EIA are the same general guidelines that were prepared by Pak-EPA in 2000. The Pakistan EPA has issued several guidelines and policies and procedures for preparation of EIAs. In consultation with SEPA, TCAP will devise specific environmental guidelines for opencast mining in Sindh.

Below are links to different Pakistan EPA issued guidelines:

- EIA Guidelines & Overview (PDF-76 KB)
- EIA Graphics Overview (PDF-148 KB)
- Front Sheet (PDF-45 KB)
- Policies & Procedures for review & approval (PDF-206 KB)
- Guidelines for preparation and review of Environmental Report (PDF-393 KB) Guidelines for Public Consultation (PDF-209 KB)
- Guidelines for Sensitive & Critical Areas (PDF-312 KB)
- Pakistan Environmental Legislation & Environmental Quality Standards (PDF-110 KB)
- Sectorial guidelines for Environmental Reports, Major thermal Power Stations (PDF-213 KB)
- Sectorial guidelines for Environmental Reports, Major Chemical & Manufacturing Plants (PDF-222 KB)
- Sectorial guidelines for Environmental Reports, Industrial States (PDF-192 KB)
- Sectorial guidelines for Environmental Reports, Major Roads Guidelines (PDF-202 KB)
SOCIAL ASPECTS & RELEVANT LABOR LAWS

Tharparkar district is located at the extreme southeast corner of the Sindh province. It is one of the poorest and most under-developed districts of Sindh. Tharparkar district is spread over an area of 22000 square kilometers and has a population of more than one million. The District is divided into three ecological zones-the south-eastern is hilly and is rich in mineral deposits, the central area is with sand dune, and on the west is the barrage area which is fertile. During the summer the climate is very hot and dry, while winter are not as intensive and harsh as compared to summers. The rainfall varies year to year. Most of the rainfall is received in monsoon period of July to August. Despite the abundance of sand and sand dunes, Thar is an area with crops growing and cattle grazing.

Demography of the Tharparkar District

Population Census 1998 depicts that total population of Thar district is about one million, concentrated into four Talukas (sub district), Mithi, Diplo, Chachro and Nagar Parker. The area of the Thar district is 22000 km$^2$ yielding a population density of 46.6 persons/km$^2$. The urban population is only 4.36% of its total population and the rest of 95.64% is rural population. The urban growth rate is 2.7% and rural growth rate is 3.15%. Both urban and rural growth rate has declined as compared to 1972-81 census which was 6.6% and 4.88% respectively. The average growth rate during 1981-98 is recorded at 3.13% as reported during 1981-98 census. In 1961 the population of Thar was 396,000. In 1981 it had increased to 774,617. Now the population of Thar is estimated around 1 million. It means that in the first twenty years (1961 — 1981) it increased by 95% and that in later 17 years (1981 — 1998) has reduces and become 77% increase. The average growth rate is 3.9% per year, which is higher than the national average.

Age Structure of the Tharparkar District

The Thar district population pyramid shows a very high proportion of population under 5 years which is a total of 18.21%. The percentage below 15 years is 50.28% of the total population. The population aged below one year is 2.65% which is infant population of Thar district. The population of the working age group i.e. 15 to 64 years is 45.98% and 3.78% belonging to category above 64 years of age. The population of the adults is 44.73% in which 42.45% male and 47.37% female. Census report 1998 has categorized the various age groups, such as: 50.28% lies below the age of 15. In which 18.21% are below the age of 5 and 2.65% in infant's category. 32.07% lies between the ages 5 to 15. The survey conducted showed that
56.2% population live in joint family system and 43.8% live as separate couples along with their children. Some 35.9% families having toilet facility and 76.5% having separate kitchen facility.

**Sex Ratio of the Tharparkar District**

The sex ratio (male per 100 female) in the Thar district is 120.6, the ratio in urban area 112 and in rural area 121. The sex ratio differs at various age groups in the district. The fluctuation of ratio at various age group is indication of uneven distribution of population in the district.

![Table 2.1-3: Population of age groups, sex and urban/rural areas in percentage](image)

**Social Structure in the Tharparkar District: Communities and Castes**

The Tharparkar district has a highly heterogeneous population that lives peacefully without any inter-religion or sectarian hostility. The main Muslim castes are Memon, Nohri, Rahuma, Junejo, Sarneja, Halepota, Khaosa, Syed, Bajeer. Samma, Khaskhali, Dal, Mehar, Panhwar, Chandio, Nareja, Faqeer, Sand, and Khokar. The Hindu Castes include Thakurs, Mahraj, Birhman, Mahshwari, Lohana, Menghwar, Kolhi, Bheel and Bajeer. In Thar district generally and block 1 area particularly mostly Sindhi is spoken, while Dhatki accent is common in both Muslim and Hindu communities.
After the 1971 war the estimated Hindu migrated from Tharparkar to India are reported to be 4,000 in numbers. Due to the drought condition in Thar, which normally repeat after three to four years, and is responsible for low rainfall directly effecting the food and fodder for man and cattle, force the population to migrate to the irrigated part of the Sindh province (district Badin, Thatta, Mirpurkhas). That is normally from December to May. Small landowners (Farmers) and tenets temporary migrate with livestock with the male members and with their families to the other part of the province for the survival of the livestock.

**Education and Social Services**

Thar district has a literacy ratio of 18% according to the 1998 censes. In the urban area there is 57.27% literacy ratio where as in the rural area 16.35% population is found to be literate. The male literacy ratio was 28.33% and the female literacy ratio was 6.91%. In rural area male literacy is five-times higher to the female literacy ratio,

**Cultivation**

The locals sow the seeds at every possible place that shows promise of fertility. The main crops are guar and millet mixed with lentils, till, and melons. After the rains the Thar Desert supports extensive grass growth with rains which provide high value feed to livestock. As the rains do not come to the desert every year, the area in the map showing cultivated land stays uncultivated in the dry years and is used for grazing.

The main asset of local people is grazing animals. In a good year the grasses grow and trees provide fodder. In periods of drought, the situation can turn dire for both. The animal population is estimated to be around 4 million cattle heads. Grazing lands represent a major part of land use in Tharparkar. Previously, people migrated with their livestock in the dry seasons to the Indus flood plains and the barrage areas. This helped the pastureland back home in Thar to regenerate. This migration has becoming increasingly difficult as the barrage areas and flood plains have now been brought under extensive cultivation, leaving limited opportunities for Thari livestock to graze. Concurrently, there has been a marked increase in the animal and human population of Thar. Combined these changes have resulted in over grazing of pasturelands.

**Cultural and Historical Heritage**

The Thar district is rich in cultural heritage. The remoteness of the area, the absence of means of proper communications and transport, and the inadequacy of basic amenities in the desert has discouraged immigration in the district. This had rewarding effect on its culture, which has retained its pristine purity. However, there is no cultural or historical heritage located in and around the vicinity of the selected site area. Khario Ghulam Shah is the biggest village among the three villages in the vicinity of study area. It has three graveyards in total, out of which one for Muslims and two for Hindus, according to their caste. Conversely, Tulwai has only one graveyard for the infants. In general the dead bodies are taken from Varvai and Tilvai to Khario Ghulam Shah for the burial. There are no burial sites located in and around the vicinity of the selected site area.
**Existing Labor legislation and implementing agencies**

Under the Constitution of Pakistan, minerals, except uranium, oil, and natural gas, falls under the ambit of the provincial governments. Mineral oil and natural gas come under the joint jurisdiction of the Federal & Provincial Government (Article 172 (c) of 1973 Constitution 18th amendment). The Central Inspectorate of Mines, a subordinate office of the Ministry of Labor, Manpower and Overseas Pakistanis, was created in 1966 to look after matters relating to the safety, health and welfare of workers engaged in federally-controlled mines. Similarly, Provincial Inspectorates of Mines were established under the respective provincial departments for the administration and implementation of the Mines Act of 1923 in mines under their jurisdiction.

This institutional structure has only recently begun to change with the merger of the Inspectorate of Mines and the Directorate of Mines into the Directorate General of Mines. The first Indian Mines Act, passed in 1901, contained provisions on safety and health, but it was not until the Mines Act of 1923 that any restrictions were imposed on the employment of labor. The 1923 Act, contains *inter alia* provision for the exclusion of children under 13-years, the grant of a weekly holiday and the limitation of weekly hours to 60 above ground and 54 below ground. The Act was supplemented by two elaborate series of regulations; one relating to coal mines and one to other mines. In addition, rules were framed by provincial governments. After 1923, two important changes were made in the law. The amending Act of 1928 provided that no mine shall be open more than 12 hours in 24, unless on a system of shifts, and that shifts must not exceed 12 hours and must not overlap. The regulations of March 1929 prohibited the employment of women underground. The different legislation relating to mines empowers the federal and provincial governments to make regulations for providing for the safety of persons employed in mines, their means of entrance and exit, the number of shaft out-lets to be furnished, the fencing of shafts, pits, outlets and pathways, safety of roads and work place; the ventilation of mines and the action to be taken in respect of dust and gases; and the regulation of the use of all machinery.

<table>
<thead>
<tr>
<th>Name</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>The Mines Act, 1923</td>
<td>Administered by the Central and Provincial Inspectorates in the mines of their respective Jurisdiction</td>
</tr>
<tr>
<td>The Thar Coal &amp; Energy Board Act, 2011</td>
<td>The Provincial Assembly of Sindh has approved the TCEB Act in June, 2011. The TCEB having provincial and federal representation is working as on stop organization to facilitate and regulate the coal mining sector in Sindh.</td>
</tr>
<tr>
<td>The Coal Mines Regulations, 1926</td>
<td>Administered by the Provincial Inspectorates only in the coal mines of their respective jurisdiction</td>
</tr>
<tr>
<td>The Mining Board Rules, 1951</td>
<td>As above</td>
</tr>
<tr>
<td>The consolidated Mines Rules, 1952</td>
<td>As above</td>
</tr>
<tr>
<td>The Metalliferous Mines Regulations, 1926</td>
<td>As above</td>
</tr>
<tr>
<td>Sindh Coal and Mines (supplementary) Regulations, 1986.</td>
<td>By the Inspectorate of Mines Sindh in every mine falling in Sindh other than oil, gas and uranium mines</td>
</tr>
<tr>
<td>Sindh Coal Authority Act 1994</td>
<td>Work on draft Sindh Coal Act is in process under auspicious of Coal and Energy Development Department, Government of Sindh</td>
</tr>
</tbody>
</table>
There had been many SR0s/notifications/amendments issued since the last Sindh Coal Act. However, the original and valuable commentary remained unchanged. Beside, the editorial quality of the labour Code has been enhanced considerably. The reference material on notifications/amendments or new mining statutes, rules and regulations relating to the subject of 'labour' can be acquired from the Inspectorate of Mines Labour Welfare, Labour and Manpower Departments of the Federal and Provincial Governments.

**Status of Existing Blocks**

Development of the Thar Coal Field presents an unprecedented opportunity for the investors. Its development will have dramatic impact on the overall energy and economic setting in which the Pakistan operates. It is essential that the development of the Thar Coal Field, which will include large-scale coal mining, power generation and an array of new infrastructure, will have positive and lasting impacts on the people and economy of Pakistan.

*MoU Signed with Global Mining Company on 19th September, 2011*
<table>
<thead>
<tr>
<th><strong>Thar Coal Block</strong></th>
<th><strong>Status/ Timelines</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block-I</strong>&lt;br&gt;Global Mining Company of China&lt;br&gt;Mining of 5 MTPA &amp; 900 MW - Phase I&lt;br&gt;GMC intends to invest US$ 1.5 billion in Key Infrastructure Projects</td>
<td>MoU between GoS &amp; GMC was signed on Sept. 19, 2011.&lt;br&gt;Bankable Feasibility by March, 2012&lt;br&gt;Mine Construction by April, 2012&lt;br&gt;Power Generation by 2014</td>
</tr>
<tr>
<td><strong>Block-II</strong>&lt;br&gt;Sindh Engro Coal Mining Company&lt;br&gt;(JV: 40% Sindh Government; 60% Engro)&lt;br&gt;2 X 600 Power Plant planned&lt;br&gt;Open Pit Mining @ 6.5 Mtpa</td>
<td>Bankable Feasibility completed 31st August 2010&lt;br&gt;Project financing activity continued.&lt;br&gt;Chinese Funding through JEWG is being solicited</td>
</tr>
<tr>
<td><strong>Block III-A</strong>&lt;br&gt;Cougar Energy (UK)&lt;br&gt;400 MW Planned&lt;br&gt;Under Ground Coal Gasification Project&lt;br&gt;Ergo Exergy Technology planned</td>
<td>Desktop studies under process.&lt;br&gt;In negotiation with M/s Fouji Foundation for joint collaboration</td>
</tr>
<tr>
<td><strong>Block-V</strong>&lt;br&gt;UCG Project&lt;br&gt;Under Ground Coal Gasification Project&lt;br&gt;2X50 MW IGCC Power Plant Planned</td>
<td>Unit gasifier design prepared,&lt;br&gt;Technical team mobilized and desktop studies completed.&lt;br&gt;36 bore holes have been drilled.&lt;br&gt;Test Burn Planned in near future</td>
</tr>
<tr>
<td><strong>Block-VI</strong>&lt;br&gt;Oracle Coalfields, PLC (UK)&lt;br&gt;Strip mining;&lt;br&gt;MoU signed with KESC for 300MW</td>
<td>Geotechnical drilling in process through DRD&lt;br&gt;ESIA completed&lt;br&gt;BFS completion by end of October 2011&lt;br&gt;Mine development phase to begin mid 2012</td>
</tr>
<tr>
<td><strong>Blocks VIII, IX and X</strong></td>
<td>Available for investment.</td>
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</tbody>
</table>
### INFRASTRUCTURE AVAILABLE AT THAR

| **ROAD NETWORK** | 70 tonnes load carrying capacity metalled road is available up to Coal field area. |
| **COMMUNICATION** | Telephone & Internet communication through Optic fiber cable is available up to Thar Coalfield area. |
| **DRINKING WATER** | Reverse Osmosis Plants in Thar are available for provision of portable water to residents as well as project staff free of cost. |
| **LODGE AT THAR** | Lodge at Thar with 20-bedded accommodation to facilitate foreign and local investors is being constructed at Islamkot. |
| **REScue STATION** | Rescue Station in coal mining area at Thar coalfield covering an area of 8,200 sq. ft. has been constructed. |
| **LIBRARY** | A Coal library is situated at office of Sindh Coal Authority, Karachi. |

### INFRASTRUCTURE PLANNED AT THAR

| **TRANSMISSION LINE** | NTDC has completed feasibility study for lying of Transmission Line for evacuation of 10,000 MW from Thar. In the first Phase they have to evacuate 1200 MW. |
| **AIRPORT AT ISLAMKOT** | The Civil Aviation Authority is executing the work of construction of Thar Airport at a distance of 8-10 kms from Thar Coalfield which is expected to be operational by December 2012. |
| **PROVISION OF HEAVY ROAD** | Sindh Coal Authority is upgrading the road network from Karachi to Islamkot via the two routes i.e. Hyderabad – Mirpurkhas – Naukot - Mithi and Thatta – Badin - Mithi for facilitating transportation of heavy machinery. The works are planned to be at an advanced stage of completion by Dec 2012. |
| **RAILWAY LINK** | PRACS has prepared feasibility for broad gauge rail link up to Islamkot. |
| **PROVISION OF WATER** | The GoS has planned to construct a water channel to provide 300 Cusecs water to Thar Coalfield. Alternately, the option of provision of treated water from Left Bank Outfall Drain is also being evaluated. |
| **AVAILABILITY OF SKILLED MANPOWER** | To cater for the future requirement of skilled manpower in the upcoming projects of large scale surface mining and power generation, upgradation of the existing Polytechnic Institute is being carried out. Currently diploma certification is being awarded at the Institute. Mehran University of Engineering & Technology Jamshoro at Hyderabad Sindh is producing (average) 40 Graduate Mining Engineers every year. |
Part IV

Technical details of the Blocks Offered

Block-IV

Location and accessibility
- Serial. No: 40 L/1,2,5 & L/5 (Toposheet No.)
- Name/Blocks: Sonalba, Block-IV
- Area (Sq-Km): 82sq-Km
- Coordinates

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GCP</td>
<td>Latitude</td>
<td>Longitude</td>
</tr>
<tr>
<td>1</td>
<td>70.254</td>
<td>24.821</td>
</tr>
<tr>
<td>2</td>
<td>70.334</td>
<td>24.728</td>
</tr>
<tr>
<td>3</td>
<td>70.217</td>
<td>24.729</td>
</tr>
<tr>
<td>4</td>
<td>70.191</td>
<td>24.767</td>
</tr>
</tbody>
</table>

Relief, Topography and Climate
The area of sonalba Block-IV is 25 km east of Islamkot and 2km from Mehari village. The terrain is sandy and rough with sand dunes forming high topography. The intervening valleys are narrow and sometimes broad. Sand dunes cover about 50% of the area of the block. The relief in the area varies between 61.00 and 157.66 m (473ft) AMSL west of sonalba in the northwest part of sandy area. The sand dunes are mostly longitudinal with a NE-SW trend and are stabilized by shrubs vegetation and grass. The drainage system is lacking in the area. The water from the occasional monsoon rains flows to a short distance into the lower interdunal valleys and is either immediately absorbed in or retained on the surface for a couple of weeks.

The area being part of desert is climatically similar to semi arid region with scorching hot summers and cold winters. The mean annual minimum and maximum temperatures are 19 and 35 Degree centigrade respectively. Maximum daily temperature commonly exceeds 45 degree centigardes in april through June.

Water Resources
The sonalba Block-IV area is part of Thar desert and water resources are similar to that is in entire Thar. Surface water is scanty and found in few small “Terrais” inter channel and artificially dry depressions where rain water collects. The water so collected is mainly used for drinking purposes and for livestock. The nearest possible source of surface water for use in power plants is i) LBOD ii) Jamrao Canal iii) Rann of Kachh.

Ground water is similar to what is available in rest of thar. A number of slightly brackish to saline water wells are present in broader low lying inert dunal playa flats near the villages in the area. The sources of water are perched ephemeral aquifers at the contact of sub recent deposits with the overlying sand dunes. The drill hole geology shows presence of possible compact sand aquifer at varying depths i) above coal zone ii) within the coal zone iii) below the coal zone. The quality of water is saline having electric conductivity of water upto 4000-5000m.mho/cm
Gene
eral Geology of Block IV

The geology of the Thar Coal fields area is not easy to comprehend as the area is mostly covered by sand dunes. The nearest exposed outcrop is of granite basement rock found at a distance of 145 km at NagarParkar. The basement rocks also contain subordinate rhyolite and metamorphic rocks.

The Thar coal fields is all covered by sand dunes, which extends to an average depth of over 79m. the extensive drilling for coal in the area shows that the coal bearing strata of Paleocene-Eocene sediments overlie uncomfortably over the Precambrian basement rocks of igneous composition which are exposed at Nagarparkar.

Stratigraphic sequence on the Coalfield

<table>
<thead>
<tr>
<th>Formation</th>
<th>Age</th>
<th>Lithology</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dune Sand</td>
<td>Recent</td>
<td>Sand, silt and Clay</td>
<td>36 to 79 meters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Unconformity</strong></td>
<td></td>
</tr>
<tr>
<td>Alluvial deposits</td>
<td>Sub recent</td>
<td>Sandstone, siltstone, claystone molten.</td>
<td>55 to 127 meters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Variable)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Unconformity</strong></td>
<td></td>
</tr>
<tr>
<td>Bara Formation</td>
<td>Paleocene to Early</td>
<td>Claystone, Shale, Siltstone, Sandstone, Coal,</td>
<td>+75 m</td>
</tr>
<tr>
<td></td>
<td>Eocene</td>
<td>and carboniferous claystone</td>
<td>(variable)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Unconformity</strong></td>
<td></td>
</tr>
<tr>
<td>Basement Complex</td>
<td>Pre-Cambrian</td>
<td>Gray and pink granite Quartz diorite</td>
<td>-----</td>
</tr>
</tbody>
</table>

Coal

The sonalba Block IV contains coal beds of variable thickness range from less than 0.3 m to 20.20meters. the maximum number of coal seams encountered is 12, 16 and 31. The cumulative
thickness of the coal bed ranges from 10.74 meters to 33.45 meters. Claystone is invariably forms the roof and floor rock.

The coal is brownish black to grayish black in color. It is poorly cleated to well cleated and compact. It contains scattered resin globules throughout. The quality of coal is better where percentage of clay is less.

- **Chemical Composition (As received)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture%:</td>
<td>43.24%</td>
</tr>
<tr>
<td>Ash%:</td>
<td>6.56%</td>
</tr>
<tr>
<td>Volatile Matter%:</td>
<td>29.04%</td>
</tr>
<tr>
<td>Fixed carbon%:</td>
<td>21.11%</td>
</tr>
<tr>
<td>Sulphur%:</td>
<td>1.34%</td>
</tr>
<tr>
<td>Heating value Btu/lb:</td>
<td>6391 Btu/lb</td>
</tr>
</tbody>
</table>

  Rank of Coal is Lignite B

**Reserves**

- Measured = 684.09 million tons
- Indicated = 1711.28 million tons
- Inferred = 176.14 million tons

**Total= 2571.51 million tons**
Block-VIII

Location and accessibility

- Serial. No:- 40L/6
- Name/Blocks: Block-VIII, Khario Ghulam Shah
- Area (Sq-Km): 100 Sq.Km.
- Latitude: 24°37’00”N and 24°42’23”N
- Longitude: 70°22’30”E and 70°28’30”E

Relief, Topography, and Climate

Since Block-VIII is a part of Thar Desert, the topography of the terrain covering this Block is generally similar to the topography of the whole Tharparkar district. This is characterized by typical aeolian deposits. The whole area is covered by numerous longitudinal sand dunes stabilized by herbs and shrubs, with intervening narrow and broad valleys, both trending NE-SW. Besides inter-dune valleys, there are flat tracts of land present at several locations in Thar Desert as well as in Block-VIII. Fullgrown trees are found scattered through these tracts of flat and slightly undulating surfaces. The dunes are longitudinal, ranging in relief from tens of meters to hundreds of meters. In Block-VIII, the highest point (Veri Wari Bhit, about 3 km NW of the village Ade Jo Tar that lies right on the road passing through the Block in the E-W direction) and the lowest altitude (along flat surfaces in between the dunes) are 140.82 m and 45.72 m respectively, with a relief of 95 m in the area.

Rain-fall is very scanty, and only comes in monsoon during the months of June to September. But there can be several years in a row completely without rains. The annual average rainfall ranges between 200 mm to 300 mm. Rain-fall being so rare and terrain so dry, porous and permeable, no regular drainage pattern could have developed in the area. Even heavy downpour is immediately absorbed into the sands of Thar. The temperatures in summer range between 30°C and 35°C, whereas during winter they range from 16.4°C to 22.6°C.
ISOPACH MAP SHOWING CUMULATIVE COAL THICKNESSES OF DRILLED BOREHOLES, BLOCK VIII KHARIO GHULAM SHAH, THAR COALFIELD
ISOPACH MAP SHOWING OVERBURDEN THICKNESSES OF DRILLED BOREHOLES, BLOCK-VIII, KHARIO GHULAM SHAH, THAR COALFIELD
Water Resources

Surface water
Owing to very little rainfall and dry hot climate coupled with sandy desert land, virtually no traditional resources of surface water such as rivers, lakes, dam reservoirs exist in Tharparkar District. People have dug large pits in the impervious clays at certain localities that are filled during the occasional rains, particularly in the monsoon season, which can serve the needs of the population and livestock for potable water for a few months. However, according to Records of Geological Survey of Pakistan, vol.115, 2002, the possible sources of surface water for use in the proposed power plants could be: (i) Left Bank Out Drain (ii) Jamrao Canal and (iii) the marshy land area in the Rann of Kutch.

Groundwater
According to the hydrogeological investigations carried out by GSP (Records of Geological Survey of Pakistan, 2002, vol.115) a number of water wells that produce brackish water are present in the flat low-lying inter-dune playas. Some tube wells are also present. According to them drilling of boreholes has revealed the presence of three aquifers at variable depths: first above the coal zone, second within the coal zone and third beneath the coal zone.

Aquifers Above Coal Zone
A vertical zone about 80 m thick above the coal zone contains a number of aquifers; one at the contact of Dune sand and Sub-recent is almost persistent throughout the Thar coalfield at a depth of 50 to 90 m from the surface.
Water Level Contours of Shallow Aquifer in Block-VIII
General Geology & Stratigraphy of Thar Coalfield

The stratigraphic sequence that is encountered in the area and the lithology of its various units are as follows:

<table>
<thead>
<tr>
<th>Formation</th>
<th>Age</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dune Sand</td>
<td>Late Pleistocene to Recent</td>
<td>Sand, silt and Clay</td>
</tr>
<tr>
<td>Sub-Recent deposits</td>
<td>Pleistocene</td>
<td>Sandstone, siltstone</td>
</tr>
<tr>
<td>Bara Formation (Coalbearing)</td>
<td>Mid Paleocene to Early Eocene</td>
<td>Claystone, Shale, Siltstone, Sandstone and Coal</td>
</tr>
<tr>
<td>Basement Complex</td>
<td>Pre-Cambrian</td>
<td>Gray and pink granite</td>
</tr>
</tbody>
</table>

A Generalized Subsurface Stratigraphic Succession is Shown in following Figure (Ref. GSP IR No. 629)
Chemical Composition (as received)

- Moisture 49.57%
- Ash 7.78%
- Sulphur 1.44%
- Fixed Carbon 18.10%
- Volatile Matter 24.32%
- Heating Value 5302 Btu/lb

Cumulative Reserves

- The method used for calculation of reserves is that of Circular No.891 of USGS:
  
  - Measured reserves 882.81 million tonnes
  - Indicated reserves 2131.36 million tonnes
  - Inferred reserves 21.68 million tonnes
  - Total Reserves 3035.85 million Tonnes
Block –IX

Location and Accessibility

- Serial Number  40L/6 (Toposheet)
- Name/Block  Block-IX, Katan
- Area  100 sqkm
- Latitude  24°30’25”N and 24°35’55”N
- Longitude  70°26’20”E and 70°30’30”E

The approach to this Block is through Mithi, a town situated at a distance of 380 km from Karachi via Thatta-Badin metalled road. The town of Mithi can also be reached via an alternate route, that is, Hyderabad-Mirpurkhas - Naukot-Nagarparkar road. Then, from Mithi onwards to Block-IX, a distance of about 74 km is covered towards east on the main metalled road that leads to Nagarparkar, an important town lying in the southeast near border with India.

Relief & Topography

Since Block-IX is a part of Thar Desert, the topography of the terrain covering this Block is generally similar to the topography of the whole Tharparkar district. This is characterized by typical aeolian deposits. The whole area is covered by numerous longitudinal sand dunes stabilized by growing herbs and shrubs, with intervening narrow and broad valleys, both trending NE-SW. Besides inter-dune valleys, there are flat tracts of land present in Block-IX, just as at several locations in rest of Thar Desert. Full-grown trees are found scattered over these tracts of flat and slightly undulating surfaces. The dunes are longitudinal, ranging in relief from tens of meters to hundreds of meters.

Water Resources

Surface Water

Owing to very little rainfall and dry hot climate coupled with sandy desert land, virtually no traditional resources of surface water, such as rivers, lakes, dams, reservoirs exist in Tharparkar District.

People have dug large pits in the impervious clays at certain localities that are filled during the occasional rains, particularly in the monsoon season, which can cater to the needs of the population and livestock for potable water for a few months.

However, according to Records of Geological Survey of Pakistan, vol.115, 2002, the possible sources of surface water for use in the proposed power plants could be: (i) Left Bank Out Drain (ii) Jamrao Canal and (iii) the marshy land area in the Rann of Kutch. Left Bank out Drain is a channel which has been constructed to drain about 4000 cusecs of saline water to the sea from the waterlogged lands in Sindh. This drain passes by the Thar coalfield at a distance of 120 km. This saline water could be channelized to the proposed power plants where it can be used for
various purposes except drinking. Besides, there is another source of water, again about 120 km away, the Jamrao Canal, which is an irrigation canal originating from Sukkur barrage that can supply fresh drinking water to the area. The marshy lands of Rann of Kutch towards the south, only 35 km away, can also become a substantial source of water, though very saline.

**Groundwater**

According to the hydro-geological investigations carried out by GSP (Records of Geological Survey of Pakistan, 2002, vol.115) a number of water wells that produce brackish water are present in the flat low-lying inter-dune playas. Some tube wells are also present. According to them drilling of boreholes has revealed the presence of three aquifers at variable depths: first above the coal zone, second within the coal zone and third beneath the coal zone.

**Aquifers above coal zone**

A vertical zone about 80 m thick above the coal zone contains a number of aquifers; one at the contact of Dune sand and Sub-recent is almost persistent throughout the Thar coalfield at a depth of 50 to 90 m from the surface. The water bearing horizons are medium to coarse sand ranging in thickness from 3.35 to 41.27 meters. The data showed that water bearing horizon consists mostly of dune sand and Sub-recent deposits. The water quality is mostly brackish but in some wells it is slightly saline. Also, it was sweet in three wells. The depth to water table varied from 50 to 90 meters from the surface. Water column varies between 0.61 to 7.62 meters.

**Aquifers within coal zone**

Two to three aquifers composed of sand, varying in thickness from 2.24 to 68.74 meters, occur within the coal zone. The sand is medium to coarse grained and gritty.

**Aquifer occurring below coal zone**

An aquifer ranging in thickness from 5.50 m to 47 meters was found to occur ubiquitously at a depth of about 200 meters. It is mainly composed of coarse, gritty, quartzite sandstone. A compressor test was also conducted to determine the quality as well as quantity of water. This showed that the water was saline with a production rate of 8,000 to 9,000 gallons per hour. Most of the tube wells installed in this area were fed by this aquifer.
Columnar Section of Drilled Borehole KTN-GT-01, Block –IX Katan, Thar Coalfield, Sindh, Pakistan

**LEGEND**

- Dune Sand
- Sub Recent
- Granite Wash
- Bara Formation
- Coal
- Diory Grain
- Weathred Granite
- Granite

**KTN-GT-01**

- **Dune Sand**: Light grey, loose and friable, very fine to fine grained, sub-angular to sub-rounded, well sorted to moderately sorted, few Fe, Mg grains observed.

- **Sub Recent**: Mix lithology, Silty, sandy, and clayey at places. Oxidized, iron concretion, yellowlimotic staining.

- **Bara Formation**: Mainly medium gray to dark blackish or gray claystone, coally, carby, in between coal seams.

- **Coal**: Brownish black, massive, resin globules present, pyrite grains at places.

- **Weathred Granite**: Dirty white to greyish grey, medium to coarse quartz grains abundant, few very coarse quartz grains, green color due to orthoclase altered into kaolin, rare black mafic grains at places.
Isopach Map Showing Cumulative Coal Thicknesses of Drilled & Previously Drilled Boreholes, Block-IX, Katan, Thar Coalfield, Sindh, Pakistan
Isopach Map Showing Overburden Thicknesses of Drilled & Previously Drilled Boreholes, Block-IX, Katan, Thar Coalfield, Sindh, Pakistan
Cross Section along line N-N’ of Drilled Borehole of Block –IX, Katan
Thar Coalfield, Sindh, Pakistan

Chemical composition (as received)
- Moisture: 48.60%
- Ash: 5.92%
- Sulphur: 0.96%
- Fixed Carbon: 15.73%
- Volatile Matter: 29.03%
- Heating Value: 5561.35 Btu/lb

Cumulative Reserves
- The total coal resources of Block-IX (100 sq.km area) according to USGS are as follows:
  - Measured Resources: 661.84 million tons
  - Indicated Resources: 2048.00 million tons
  - Inferred Resources: 152.41 million tons
  - Total Resources all categories: 2862.25 million tons

- The total coal resources of Block-IX (100 sq.km area) according to JORC are as follows
  - Measured Resources: 852.90 million tons
  - Indicated Resources: 1411.47 million tons
  - Inferred Resources: 400.28 million tons
  - Total Resources all categories: 2664.65 million tons
Block – X

Location and Accessibility

- Serial Number: 40L/6 (Toposheet)
- Name/Block: Block-X, Mithrio Sumra
- Area: 100 sqkm
- Latitude: 24°30'00"N and 24°36'00"N
- Longitude: 70°06'00"E and 70°13'00"E

The approach to this Block is through Mithi, a town situated at a distance of 380 km from Karachi via Thatta-Badin metalled road. The town of Mithi can also be reached via an alternate route, that is, Hyderabad-Mirpurkhas-Naukot- Nagarparkar road. Then, from Mithi onwards to Block-X, a distance of about 74 km is covered towards east on the main metalled road that leads to Nagarparkar, a significant town lying in the southeast Pakistan near to the border with India.

Relief & Topography

Since Block-X is a part of Thar Desert, the topography of the terrain covering this Block is generally similar to the topography of the whole Tharparkar district. This is characterized by typical aeolian deposits. The whole area is covered by numerous longitudinal sand dunes stabilized by growing herbs and shrubs, with intervening narrow and broad valleys, both trending NE-SW. Besides inter-dunal valleys, there are flat tracts of land present in Block-X, just as at several locations in rest of Thar Desert. Full-grown trees are found scattered over these tracts of flat and slightly undulating surfaces. The dunes are longitudinal, ranging in relief from tens of meters to hundreds of meters.

Water Resources

Surface water

Owing to very little rainfall and dry hot climate coupled with sandy desert land, virtually no traditional resources of surface water, such as rivers, lakes, dams, reservoirs exist in Tharparkar District. People have dug large pits in the impervious clays at certain localities that are filled during the occasional rains, particularly in the monsoon season, which can cater to the needs of the population and livestock for potable water for a few months. However, according to Records of Geological Survey of Pakistan, vol.115, 2002, the possible sources of surface water for use in the proposed power plants could be: (i) Left-Bank-Out Drain (ii) Jamrao Canal and (iii) the marshy land area in the Rann of Kutch.

Groundwater

According to the hydrogeological investigations carried out by GSP (Records of Geological Survey of Pakistan, 2002, vol.115) a number of water wells that produce brackish water are present in the flat low-lying inter-dune playas. Some tube wells are also present. According to them drilling of boreholes has revealed the presence of three aquifers at variable depths: first above the coal zone, second within the coal zone and third beneath the coal zone.
Aquifers above coal zone
A vertical zone about 80 m thick above the coal zone contains a number of aquifers; one at the contact of Dune sand and Sub-recent is almost persistent throughout the Thar coalfield at a depth of 50 to 90 m from the surface. The water bearing horizons are medium to coarse sand ranging in thickness from 3.35 to 41.27 meters. The data showed that water bearing horizon consists mostly of dune sand and Sub-recent deposits. The water quality is mostly brackish but in some wells it is slightly saline. Also, it was sweet in three wells.

Geology of Block –X
The Geology of Block-X is generally similar to the geology of the whole Thar Desert. The Block is covered by longitudinal, stabilized sand dunes trending NE-SW.

Columnar Section of Drilled Borehole MTS-03, Block –X Mithrio Sumra, Thar Coalfield, Sindh, Pakistan
Isopach Map Showing Cumulative Coal Thicknesses of Drilled & Previously Drilled Boreholes, Block-X, Mithrio Sumra, Thar Coal field, Sindh, Pakistan
Cross Section Along Line B-B’ of Drilled Borehole of Block-X, Mithrio Sumra, Thar Coalfield, Sindh, Pakistan

Chemical composition (as received)
- Moisture: 48.99%
- Ash: 6.35%
- Sulphur: 1.17%
- Fixed Carbon: 12.50 to 14.0%
- Volatile Matter: 30.00 to 30.60%
- Heating Value: 4840 Btu/lb

Cumulative Reserves
- The total coal resources of Block-X of 100 sq.km area calculated according to USGS circular No. 861 are as follows:
  - Measured Resources: 609.05 million tons
  - Indicated Resources: 1920.56 million tons
  - Inferred Resources: 418.18 million tons
  - Total Resources all categories: 2947.80 million tons
- The total coal resources of Block-X of 100 sq.km area calculated according to JORC are as follows:
  - Measured Resources: 857.80 million tons
  - Indicated Resources: 1265.59 million tons
  - Inferred Resources: 747.23 million tons
  - Total Resources all categories: 2870.62 million tons
Part V

The Proposal

Expectation from Investors

Scope of work for the investment proposal comprises all activities necessary for the following:

- Express interest for design, plan, develop, finance, insure, own, operate and maintain open cast mines/or any other appropriate Mining method
- obtain all necessary permits, licenses, consents and enter into agreements wherever necessary and pay all necessary fees, royalties, local duties
- initiate environment mitigating measures in accordance with the Pakistan Environmental Protection Agency (PEPA) Act, 1997, inter alia, relating to environmental protection, environmental impact and social soundness assessment, and all the requirements of the legislation and environmental guidelines and standards issued under or pursuant to the said Act; details of which can be downloaded from PEPA’s official website www.environment.gov.pk World Bank guidelines may also be referred.
- Settlement of displaced population in accordance with internationally accepted norms
- refilling the used mines to make it to a cultivatable and habitable grade
- Any other scope not included herein but subsequently agreed between sponsors and Government of Sindh

Minning Concessions

Mining Concession Rules 2002 spell out concession award procedure available at our web site www.sindhcoal.gos.pk. The successful applicant will get Exploration License after signing an MOU with SCA. The Exploration license is generally awarded for feasibility studies and is awarded initially for one year extendable on valid grounds, as these are developed blocks and BFS should not take more than a year. The license holders are required to submit Quarterly reports on exploration license granted and Exploration license can be cancelled on failure to observe timelines as agreed between Government and license holder. After completing feasibility study Investor is issued Mining Lease in accordance with Sindh Mining Concession Rules 2002. Government of Sindh offers investment opportunity for Blocks VIII, IX and X, area of all of these blocks is 100 sq Km each. Brief Details of blocks are explained Part IV of this information memorandum. Additional detailed geological and other relevant reports/maps can be consulted at SCA library.

Financing for the Project

Investors are expected to submit credible financing plans for the project including debt /equity financing ratio. At least 25% of the total cost of the project will be through equity.
Mining Technology

RWE study suggests Bucket wheel Excavator to meet economies of scale for Mining in Thar. However, Investors can propose any best Mining Technology available which supports their investment plans and offers maximum benefit in minimum time and which results in lower costs.

Expected timelines

The investors are expected to provide a firm timeline with three monthly milestone plan. Since these are developed blocks a lot of data is available. Preference will be given to offers which present narrow timelines leading to early completion of DFS and project execution phase.
THE PROPOSAL

Who are eligible to submit proposal

Companies &/or consortiums with corporate profile, sound financial position and capacity to progressively commit equity of a minimum US$ 150 million in the project; possessing the requisite know how and manpower resources with a proven track record of successful execution of similar initiatives; verifiable technical partnership(s) with world renowned mining companies are strongly encouraged to apply. Preference will be given to proposals that offer viable project development plans with shortest possible timelines; and those which involve long-term commitment through re-investments and expansions. The Interested Investors are expected to apply for any one of the offered Blocks in response to this ICB.

Facilitation

Government of Sindh will facilitate and access to information to all investors to consult reports and data available with the Government of Sindh including:

- All geological data/ study for Block VIII, IX and X
- Report by John T. Boyd
- United States Geological Survey studies.
- Any other available report/data.

In addition, the Government of Sindh will also facilitate to get access to all facilities developed / being developed in the area and provide governmental support for seeking all approvals and licenses including those for power generation, if required.
Evaluation Criteria

The proposed formula to evaluate the eligible Investors’ scores is as follows:

**Score of respective Investor** = Financial Strength x 30% + Technical Strength x 35% + ‘Yes’ for Integrated power project 600 MW x 10% + Experience of Power Projects x 15% + Timeliness x 10%

**Financial Strength** = The Investor with highest Net Worth shall be granted score of 100. Score of all other sponsors shall be reduced from 100 as per their Net Worth against the highest Net Worth. For example three sponsors say sponsor A, B, and C may have Net Worth of US$ 500 million, 400 million, and 225 million respectively would get the score of 100, 80 (i.e. 400/500 x 100), and 45 (i.e. 225 / 500 x 100). The investor shall provide following information/documents along with the Project Proposal:

- Details of the extent of the activities (i.e. projects of different nature) and the quantum of investment that the company is looking to invest under this project along with break-down of how much you would invest in what activity?

- What debt to equity ratio is the firm targeting plus what instruments does the firm looking at to raise the financing for the project both: local and international?

- How the company would raise the total finances for the project and what is the history of raising finances of large scale projects, please include details of credit lines (both funded & non-funded), IPOs, GDRs, Corporate Bonds, private placement or any other capital market product that the company has launched? Do mention how much of these issues were under-written and/or over/under subscribed?

- If possible please provide Credit report or Letter of Support from the company’s banks or financial intermediaries

- What other major projects the company is under-taking currently and how was the finance raised for them?

- If the company carried out any projects over-seas then how was the finance raised for them?

- Details of Joint Ventures (JV) if any, along with financial and technological aspects of these JVs.
**Technical Strength** = The Investor with highest current mining capability in terms of annual coal production in tons shall be granted score of 100. Score of all other sponsors shall be reduced from 100 as per their current annual mining capacity in tons. For example three sponsors say sponsor A, B, and C may have an annual mining capacity of 15 million tons, 35 million tons, and 25 million tons. They would beg score of 43, 100, 71 respectively.

'Yes' for Integrated Power Project = A proposal which integrates the proposal for mining with its use in a power plant of 600 MW capacity, to be financed by the sponsors shall be given preference. Investors not agreeing to an integrated mining-power project would not get any score whereas those agreeing to invest in an integrated project will get full 100 on this count.

**Experience of Power Projects** = Investors or a company in investors group having an experience in power projects in terms of MW, either in capacity of (i) project investors having more than 20% share in total equity of the project, or (ii) main EPC contractor or (iii) lead O&M contractor would get score for their experience. The Investor with highest cumulative number of MWs on their credit shall be granted score of 100. Score of all other sponsors shall be reduced relatively from 100 as per their cumulative number of MWs on their credit.

**Proposal bond**

Investors shall have to provide a Bid Security/Proposal Bond in the form of Bank Guarantee equal to US$ 10,000. After ranking of proposals all Proposal Bonds, except that of investors of Top Ranked Proposals, shall be returned.

**Processing fee**

Proposals shall accompany a pay order of PKR 3000/- as non-refundable processing fee in favor of Sindh Coal Authority.

**Selection of Successful Investor**

Investor of the 1st ranked Proposal shall be requested to submit within one month a Performance Guarantee for the value of 500,000 US Dollars. The PG shall be in the form of irrevocable bank guarantee or PG from any AAA rated Insurance Company acceptable to Government of Sindh.

The 1st ranked proposal/firm will be invited to sign the MOU with Sindh Coal Authority and before signing MOU, the firm shall furnish the PG valid for the period of completion of DFS/BFS. The PG shall be returned on completion of DFS.

For Power generation component the investors shall be required to complete all the formalities of PPIB for issuance of LOI.
Notice to Proceed

Once PG is received and MOU is inked the Proposal Bond of successful investors and other investors next in rank shall be returned. After signing of MOU the successful investor shall be issued a Notice to Proceed as per the agreed time line,

Encashment of PG

Progress of Successful Investor shall be monitored by Government of Sindh against the milestones to be agreed in the MOU. Before the deadline proposed by successful investor, if the progress at any given timeline is found to be 30% less than the required, the PG in full amount will be en-cashable.

Timelines

As these are developed blocks, exploration license shall be for one year renewable on valid grounds and based on agreed timelines. However, investors are encouraged to submit their own timelines and deadlines earlier than the deadline given herein. Those timelines and deadline, in case of successful proposal, shall be made part of MOU and the progress shall be monitored against those milestones and the deadline.

Last Date and address for Submission of Proposal

[As per the advertisement]
Proposal Bond (in the form of a Bank Guarantee)
[ON PAKISTAN STAMP PAPER: Mandatory]

Guarantee No.__________________________

Secretary
Coal & Energy Development Department Government of Sindh
Karachi

Date of this Guarantee: He
Amount of this Guarantee US$ 10,000/- (United States Dollars Ten Thousand only)
Validity up to:

THIS GUARANTEE is executed at [---place---] on this [---] day of [---month---] 2011 by:

[--- Name of the issuing Bank ---] having its registered office at [---] (hereinafter referred to as the "Guarantor", which expression shall mean and include its successors, administrators and legal representatives, whether jointly or severally);

In favor of Sindh Coal Authority representing the Government of Sindh in Coal & Energy Development Department, Government of Sindh, Karachi (hereinafter referred to as the "Beneficiary", which expression shall mean and include its successors, administrators and legal representatives, whether jointly or severally).

Considering that our client ____________________________ (hereinafter referred to as the "Investor", which expression shall mean and include its successors, executors, assigns, administrators and legal representatives whether jointly or severally) is submitting in favor of the Beneficiary a proposal (hereinafter referred to as the "Proposal") for a project of developing open cast mines at Thar Block (hereinafter referred to as the "Project") in response to the EOI advertised through print media on Oct 2011 and supplemented by Information Memorandum (the IM) uploaded on website http://www.sindhcoal.gos.pk/ (hereinafter referred to as the "EOI")

On the request of the Investor, we, the undersigned, responsible delegates and representatives of the Guarantor, and make decisions in its name, declare by this instrument (hereinafter referred to as the "Proposal Bond"), that the Guarantor do hereby guarantee unconditionally and irrevocably to pay the Beneficiary up to a sum of US$ 10,000/- (US dollars ten thousand only) in accordance with the following:

1. Immediately upon receipt of the Beneficiary's first written request stating either:
   - that the Investor has withdrawn its Proposal before -----------; or
   - that the Investor has willfully misrepresented while submitting the Proposal; or
   - that the Investor has failed to furnish the Processing Fee and the required Performance Guarantee when invited by the Beneficiary to do so, in accordance with the IM;

Notwithstanding any objection of the Investor or of any other party, the Guarantor shall pay to the Beneficiary the above mentioned amount or any other amount(s) the Beneficiary may demand, provided that such amount(s) shall not exceed the above mentioned amount, by any method of payment which is acceptable to the Beneficiary. The decision of the Beneficiary as to the Investor's default, delay or failure in performance listed above shall be final and unquestionable.

   - Any payments made to the Beneficiary on its request shall be net and free of and without any present or future deductions such as for the payment of any taxes, executions, duties, expenses, fees, deductions or retentions regardless of the nature thereof or the authority levying the same.
The Beneficiary may, if and when and in such manner as the Beneficiary in its sole discretion deems appropriate, grant time or other indulgence to or accept or make any composition or arrangement with the Investor and/or vary, renew, discharge, realize, release, enforce or deal with any other securities, guarantees, obligations, decrees, contracts, or agreements, now or hereinafter made or held by the Beneficiary, and such acts shall not affect in any way whatsoever the Beneficiary's rights under this Proposal Bond, and shall not affect in any way whatsoever the Guarantor's liability hereunder, or discharge the Guarantor from its Obligations under this Proposal Bond.

The Guarantor's obligations as set out in this Proposal Bond shall be continuing obligations and shall not be modified or impaired upon the happening, from time to time, without the Guarantor's assent or otherwise, of any act or omission, or any circumstances or events which would otherwise discharge, impact or otherwise affect any of the Guarantor's obligations contained in this Proposal Bond.

Demands under this Proposal Bond may be made at any time and from time to time in accordance with its terms.

No delay or failure to exercise any right or remedy under this Proposal Bond by the Beneficiary shall constitute a waiver of such right or remedy. No single or partial exercise of any right or remedy shall preclude any other or further exercise thereof or of any other right or remedy. No waiver by the Beneficiary shall be valid unless made in writing.

No set-off, counter claim, reduction, or diminution of any obligation that the Guarantor has or may have against the Beneficiary shall be available to it against the Beneficiary in connection with any of its obligations to the Beneficiary under this Proposal Bond. The Guarantor shall make all payments under this Proposal Bond in United States Dollars and in full, without set-off or counterclaim and free and clear of any deductions or withholdings in immediately available, freely transferable, cleared funds for value on the due date to the Beneficiary, provided that if the Guarantor is required to make any deduction or withholding from such payments under applicable law, it shall pay to the Beneficiary such additional amount necessary to ensure that the Beneficiary receives an amount equal to the amount which it would have received had no such deduction or withholding been made.

The Guarantor hereby declares and confirms that under its constitution and applicable laws and regulations, it has the necessary power and authority, and all necessary authorizations, approvals and consents there under to enter into, execute, deliver and perform the obligations it has undertaken under this Proposal Bond, which obligations are valid and legally binding on and enforceable against the Guarantor under the Laws of Pakistan. Further, that the signatory(ies) to this Proposal Bond are the Guarantor's duly authorized officers.

This Proposal Bond shall be governed by the laws of Pakistan, and shall come into full force immediately upon submission and shall continue in full force and effect until the official closing of the counters of the Guarantor [name of Branch] on ==2012 (the "Expiry Date").

The Guarantor's maximum liability under this Proposal Bond is limited to the sum of US$ 10000/- (US Dollars ten thousand only). This Proposal Bond shall expire at the official closing of the counters of the Guarantor, [name of the Branch] [city], on the Expiry Date. The Guarantor's obligation under this Proposal Bond is limited to payment of claims lodged in writing and presented at the counters of the Guarantor, [name of the Branch] [city], on or before the Expiry Date, following which date, subject to any liability for claims presented on or before the Expiry Date, the Guarantor shall stand fully discharged and released from any and all obligations, claims and liabilities under this Proposal Bond whether or not this Proposal Bond is returned to the Guarantor.
This Proposal Bond is the full and complete understanding between the Guarantor and the Beneficiary in relation to the matters contained herein, and this undertaking of the Guarantor shall not be modified, amended, or amplified in any way by reference to any document, understanding, instrument or agreement referred to therein, and any such reference shall not be deemed to incorporate by reference any document, understanding, instrument or agreement.

We hereby engage with you that the demand raised by the Beneficiary under this Proposal Bond shall meet with due honor upon presentation.

For and on behalf of the Guarantor:

[To be signed by the authorized signatory(ies) of the Bank, Dated and Stamped with the Bank’s Stamp]

[Also to be witnessed by two adult male witnesses, specifying in each case, the full name, Computerized National Identity Card # and address]