Report and Recommendation of the President to the Board of Directors

Project Number: 41903
October 2007

Proposed Equity Investment and Guarantee
Islamic Republic of Pakistan: Daharki Power Project

In accordance with ADB's public communications policy (PCP, 2005), this abbreviated version of the RRP excludes confidential information and ADB's assessment of project or transaction risk as well as other information referred to in paragraph 126 of the PCP.

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 3 October 2007)

Currency Unit	–	Pakistan rupee/s (PRe/PRs)
PRe1.00	=	$ 0.0164
$1.00	=	PRs60.74

ABBREVIATIONS

ADB	–	Asian Development Bank
BOO	–	build-own-operate
CCPP	–	combined cycle power plant
COD	–	commercial operations date
DSCR	–	debt service coverage ratio
ECA	–	export credit agency
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
EPC	–	engineering, procurement, and construction
FKPCL	–	Fauji Kabirwala Power Company Limited
FPCDL	–	Foundation Power Company Daharki Limited
IPP	–	independent power producer
IRR	–	internal rate of return
KESC	–	Karachi Electric Supply Corporation Limited
MTDF	–	Pakistan's Medium Term Development Framework (2005–2010)
NEPRA	–	National Electric Power Regulatory Authority
NTDC	–	National Transmission and Dispatch Corporation
PPA	–	power purchase agreement
PPIB	–	Private Power and Infrastructure Board
WAPDA	–	Water and Power Development Authority

WEIGHTS AND MEASURES

BTU (British thermal unit)	–	unit of thermal measure
CF (cubic feet)	–	unit of cubic measure
MMCF (million cubic feet)	–	1,000,000 CF
MMCFD (million cubic feet of gas per day)	–	1,000,000 CF per day
km	–	kilometer
km^2	–	square kilometer
kV (kilovolt)	–	1,000 volts
kWh (kilowatt-hour)	–	1,000 watt-hours
MW (megawatt)	–	1 million watts
GWh (gigawatt-hour)	–	1 million kilowatt-hours

NOTES

In this report, "$" refers to US dollars.

Vice President	L. Jin, Operations Group 1
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I. THE PROPOSAL

1. I submit for your approval the following report and recommendation for an equity investment of up to $2,750,000, or 25% of the issued share capital, in the holding company[1] of Foundation Power Company Daharki Limited, whichever is lower; and a guarantee in a principal amount of up to $44,000,000 plus interest, in favor of the lenders to the holding company; in each case for developing the Daharki 171MW combined cycle gas fired power plant (Daharki Power or the Project). The design and monitoring framework is in Appendix 1.

II. RATIONALE, SECTOR PERFORMANCE, PROBLEMS, AND OPPORTUNITIES

2. Pakistan faces an acute shortage of power. In addition, private investment in the power sector is hampered e.g. by concerns over investment returns and previous Government attempts to reduce tariffs agreed with independent power producers (IPPs). As a result, scarce indigenous fuel resources that could be used for power generation are lying idle, and much-needed increases in generation capacity are delayed. The Project will play an important part in addressing these issues, both in its own right and as an example for others.

3. ADB has worked closely with the Government's Private Power and Infrastructure Board (PPIB) to identify which of several power projects being considered would benefit most from assistance provided via ADB's non-sovereign financing window and match ADB's priorities for power and private sector development in Pakistan. Given the excellent working relationship between Fauji Foundation and ADB in three previous projects,[2] Fauji Foundation asked ADB to invest in the Project. The Project received concept clearance in February 2007[3] and a mandate agreement was signed in March 2007. Due diligence missions were fielded in March and June 2007.

A. Electricity Demand–Supply Gap

4. Despite wide-ranging power sector reforms, Pakistan has one of the lowest levels of per-capita power consumption in the world (413kWh). This compares with 497kWh in the Philippines and 1,414kWh in Thailand. Only 55% of Pakistan's population has access to electricity from the national grid. The remainder of the population uses kerosene, wood, and other bio-fuels for lighting, cooking, and heating. A growing population and a thriving economy mean that demand for electricity is always accelerating. Pakistan's electricity consumption increased at a compound average growth rate of 6.8% from 2001 to 2006, with faster rates of growth among residential, commercial, agricultural and industrial users. The average annual growth in electricity demand, at 8.3% per annum, exceeds recent economic growth rates of about 6%. Continued strong economic growth is expected to increase annual per capita consumption of electricity (see Appendix 2 for further details on Pakistan's power sector).

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[1] To be registered in a jurisdiction acceptable to ADB.

[2] ADB. 1989. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Fauji Fertilizer Company Limited*. Manila. ($30 million Investment Loan (IL), $20 million Complimentary Loan (CL); fully repaid); ADB. 1993. *Report and Recommendation of the President to the Board of Directors on a Proposed Equity Investment and Loan to Fauji Oil Terminal and Distribution Company Limited*. Manila. ($1 million equity, $19 million IL, $11.8million CL; equity fully divested and all loans fully repaid); and ADB. 1996. *Report and Recommendation of the President to the Board of Directors on a Proposed Equity Investment and Loan to Fauji Kabirwala Power Company Limited*. Manila. ($5 million equity, $32 million IL, $65 million CL; $9.7 million IL and $16 million CL outstanding). Both are expected to be fully repaid by December 2009. ADB's equity will also be divested then).

[3] Updated to reflect the addition of a guarantee and re-cleared 12 May 2007.

5. However, the supply of power has not kept pace with demand. Total current installed power generating capacity in Pakistan amounts to 19,450MW, resulting in a capacity shortfall of 428MW by the end of 2006 and 1,329MW in 2007. To cope with expected growth in electricity demand, it is estimated that Pakistan will need to add about 2,000MW of new capacity each year to avoid power shortages. Without this addition, there could be a supply shortfall of 15% within 2 years (Table 1). The country is already experiencing severe disruptions in power supply, which are expected to worsen. Measures to ration consumption are already being taken, such as forcing shops and industries to close early. Such measures will have a direct negative effect on economic growth.

Table 1: Power Demand and Supply Projections, 2006–2010
(MW)

Year	Domestic	Commercial	Agriculture	Industrial	Others	Total Demand	Firm Supply[a]	Demand-Supply Gap	Gap as % of Demand
2006	7,199	1,216	1,763	5,891	1,035	15,500	15,072	428	0
2007	7,585	1,251	1,820	6,481	1,086	16,600	15,271	1,329	8
2008	8,127	1,312	1,893	7,252	1,159	17,900	15,688	2,212	12
2009	8,737	1,354	1,979	8,181	1,243	19,600	16,704	2,896	15
2010	9,531	1,408	2,079	9,267	1,341	21,500	18,584	2,916	14

MW = megawatt.
[a] Present generation plus planned additions.
Sources: Planning Commission and Private Power Infrastructure Board, Government of Pakistan. 2006.

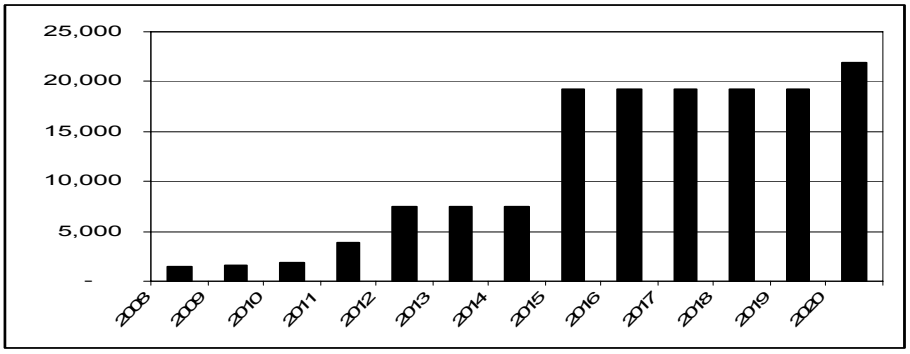
B. Lack of Indigenous Resources for Power Generation

6. Diesel or furnace oil-fueled generation plants are the easiest and quickest power plants to commission because both types of fuel are available on international markets and can be imported. However, reliance on imported diesel or furnace oil increases dependence on external supplies, adds to the generation cost (compared with hydropower and gas), and has significant environmental impacts. The Government's Medium Term Development Framework (MTDF), 2005–2010 has therefore identified low-cost energy generation through indigenous resources (gas, hydropower, wind and coal) as a key method of increasing power generation in Pakistan.

7. However, because extraction of Pakistan's significant domestic coal resources is complex and at an early stage, domestic coal-fired power generation is considered to be up to a decade away. Wind power can supply only a limited amount of future electricity generation, leaving hydropower and gas as the mainstays of domestic energy resources.

8. Hydropower, which currently represents about 6,499MW (33.4%) of total installed generation capacity in Pakistan (almost all of it in the public sector), is the main indigenous future source of energy, with over 30 projects in the pipeline. Nevertheless, the lead time for development, the often complicated and controversial cross-border water usage agreements, and the political, social, and environmental impacts of large dams, push additional large-scale hydropower generation potential well into the future, 2012–2015 at the earliest (Figure 1).

Figure 1: Cumulative Planned Hydropower Generation Capacity Additions, 2007–2020
(MW)



MW = megawatt.
Sources: Government of Pakistan's *Least-Cost Generation Plan* and Asian Development Bank analysis.

9. While some 75% of current thermal power generation in Pakistan is based on natural gas, any new gas fired-power generation is constrained by the limited remaining domestic gas resources. Pakistan's major gas field, Sui, from which gas is piped to all major cities and to existing gas-fired power plants and industries, is about 70% depleted, and at current utilization rates gas availability cannot be guaranteed beyond 2011. This severely limits the potential for new power plants using Sui gas. In the private sector, most planned independent power producers (IPPs) that will begin by firing on gas are expected to switch to diesel or fuel oil once the gas runs out, which will increase the cost of generation, raise tariffs, and have negative environmental impacts. While importation of liquefied natural gas (LNG) is seen as medium-term way of diversifying the fuel mix, and an LNG import terminal is being planned near Karachi, the transportation costs of the LNG will also add to generation costs.

10. The discovery of a deep well in Pakistan's second largest gas field, the Mari gas field, near the city of Sukkur in Sindh province, has made it possible to plan for additional gas-fired power supply. The Mari gas has relatively low energy content (measured in British thermal units [BTUs]), which makes it unsuitable or uneconomic for most purposes, except for power generation (since turbines can be configured to run on low-BTU gas). Two plants have been planned: Daharki Power, which is the subject of this financing, and the 134MW Star Power plant, which is also under preparation. Until these plants are operational, this gas will continue to lie idle.[4]

C. Private Sector Involvement in Power Generation in Pakistan

11. The Government recognizes the benefits of encouraging private sector participation in the power sector, both through privatization of state-owned entities and through enabling the private sector to undertake greenfield power generation. The Government has issued private-sector-friendly policies on thermal power generation, in 1994, 1998, and 2002, and on hydropower generation in 1995 and 2002. These policies were designed to create the conditions to encourage the private sector to construct, own, and operate power generation and transmission assets. To facilitate such investments, the PPIB was created in 1994 under the Ministry of Water and Power. As a result of the Ministry of Water and Power's efforts, a number of IPPs were commissioned under build-own-operate (BOO) arrangements in the late 1990s, and about 30% of the country's thermal capacity is now owned and operated by the private

[4] Daharki Power is the more advanced of the two and the sponsors of Star Power are closely monitoring its progress.

sector. One of these projects, the Fauji-Foundation-led 151MW Fauji Kabirwala gas-fired power plant (Fauji Kabirwala), was set up under the first private power policy of 1994 and received ADB nonsovereign financing (footnote 2).

1. Mixed Results in Implementing Policies

12. However, during the late 1990s and early years of the new millennium, the Government attempted to lower tariffs previously agreed with the early IPPs, in order to reduce the amount of government finance allocated to the purchase of electricity. This was driven by the Government's inability to meet its general financial obligations. This conflict effectively halted the development and implementation of further IPPs. After a delay of about 7 years with no new investment in IPPs, the Government embarked on a renewed initiative to promote private sector investment in infrastructure, especially in power generation (and resolved its previous differences with the earlier IPPs). This approach also reflected the development priorities set out in Pakistan's Medium Term Development Framework (MTDF). The revised power policy of 2002 (the 2002 policy) was designed to address issues raised by existing and potential investors.

2. Key Investor Issues

13. Notwithstanding the Government's efforts, impediments to IPP development remain (and almost all planned new IPPs have been badly stalled). A key issue is the question of adequate investment returns for the risk taken. A recent analytical news piece explicitly pointed out that "In the private sector, potential investors have been put off by the unrealistically low tariff offered by [the Water and Power Development Authority] WAPDA".[5] WAPDA, or more specifically its unbundled transmission and distribution company, the National Transmission and Dispatch Corporation (NTDC), is the state-owned power off-taker for all of Pakistan (except Karachi).

14. Under the 2002 policy, the tariff paid by NTDC to the IPPs includes a component reflecting a return on the equity invested. This return component is determined by the National Electric Power Regulatory Authority (NEPRA). In recent tariff determinations (e.g., for Orient Power in December 2005, Saif Power in June 2006, and ARL Power in November 2006), NEPRA has allowed a rate of return on equity in Pakistan rupee terms of 15%. This rate is (i) significantly lower than the returns offered under 1994 policy, which ranged from 17% to 19%; and (ii) lower than the returns that can be currently achieved in other types of general equity investments. In view of these lower-than-expected returns, potential investors, particularly international investors, have, to a large degree, opted out of investing further in IPPs in Pakistan. For example, Globeleq, a major investor in power plants in developing countries, was approached in 2006 with regard to both Daharki Power and Orient Power, but did not invest in either, as the projected returns were below its corporate hurdle rate for equity investments.

15. Another impediment is the potential sharing of interest cost savings. Under the same 2002 policy tariff regime, the interest cost is passed straight on by the investor to the power purchaser. Any savings achieved by the investors, either through a refinancing once the project is completed, or through upfront negotiations with the finance providers (commercial banks), are also passed straight through. While this is intended to benefit the Government and the consumers, because it is not shared with the investors or project developers, it offers no incentive for investors to negotiate with lenders to obtain the lowest cost of financing possible.

[5] Husain, Irfan. 2007. A Dark Future. *Khaleej Times*. Karachi (5 July).

The full pass-through of savings is therefore somewhat counter-productive. This has been recognized by both NEPRA and PPIB, but the issue has not yet been resolved.[6]

16. Such issues continue to hamper IPP negotiations, with the result that IPPs totaling over 600MW that were expected to have reached financial close by now (and thus would have been able to start construction) have been delayed. Overall, projects in the pipeline totaling over 1,400MW are experiencing delays. Only one of the five IPPs that were in PPIB's pipeline in March 2006 and were expected to have been closed and begun construction by now has actually done so (Orient Power, a 225MW oil/gas-fired plant), and only after significant delays, largely because of investor reluctance over returns. Meanwhile, in the other projects, including Daharki Power, investors have been looking at other ways of improving equity returns. During such delays, consumers are deprived of potential additional electricity, which negatively impacts economic growth and development. The holding company structure proposed for the Project will help to address these concerns about investor returns.

D. ADB's Operations in the Power Sector in Pakistan

3. Public Sector

17. ADB is the major source of external investment in the energy sector in Pakistan, having provided about one third of the total finance from external sources. WAPDA has been the largest borrower, receiving $1.575 billion in 13 public sector loans. The remainder of ADB's public sector financing was to the Karachi Electric Supply Corporation (KESC) before it was privatized (these loans were primarily for generation expansion projects and to a lesser degree for transmission and distribution upgrades, as well as for privatization). ADB's nonlending activities have provided a total of $14.2 million for 27 technical assistance (TA) projects. The projects have covered tariff rationalization and integration, management information systems, power generation coordination, thermal power plant maintenance, institutional strengthening and restructuring, and privatization. ADB has worked closely with the Government on a road map for change in the power sector. Based on this road map, ADB's indicative public sector program for power could reach $1.5 billion during 2006–2009 (Appendix 3).

4. Private Sector

18. ADB has also been closely involved in the power sector in Pakistan through its Private Sector Operations Department (Appendix 4). It has made loans and investments to Fauji Oil Terminal Company, an oil terminal with a handling capacity of over 10 million tons of fuel oil and high-speed diesel (footnote 2); Fauji Kabirwala, one of the first IPPs under the 1994 power policy (footnote 2); and the New Bong Escape Project, an 84MW run-of-the-river hydropower plant and the first hydropower IPP in Pakistan under the 1995 hydropower policy.[7] Most recently, ADB approved a $150 million loan to KESC for its post-privatization rehabilitation, upgrade, and expansion. Support for further energy-related projects, especially using indigenous resources, is envisaged as a key component of ADB's near-term Pakistan non-sovereign operations.

[6] Both NEPRA and PPIB claim that a decision has been taken to share interest cost savings between investors on the one hand and the Government and consumers on the other. NEPRA and PPIB agree that this should be divided in the ratio of 60:40, but differ on whether the investors or the Government and consumers should receive the 60% share.

[7] ADB. 2005. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Laraib Energy Limited for the New Bong Escape Hydropower Project in the Islamic Republic of Pakistan.* Manila.

III. THE PROPOSED PROJECT

A. Impact and Outcome

19. The outcome of the Project will be that Pakistan's power consumers will receive additional low-cost power, generated from local gas with no other economic use, and adequate return for the Project's investors. Specifically, the Project will have the following impacts:

(i) **Narrowing the Electricity Demand-Supply gap.** The Project will increase net electricity generation capacity by some 171MW (about 13% of Pakistan's current demand–supply gap). As a base-load plant, it will contribute to more than this share in terms of actual electricity output. This will help reduce the constraints on economic growth caused by power shortages.

(ii) **Promoting efficient management of natural resources.** The low-cost, low-BTU domestic gas has no other economic application, and its use by the Project, will have several positive economic effects. First and most important, it will exploit an otherwise idle resource. Second, it will enable low-cost generation through lower transportation costs (as the plant will be built near the gas field). This gives the Project an advantage over imported LNG or other types of fuel and piped gas from the Sui field. Third, it will help reduce Pakistan's exposure to volatile international oil prices through continued imports of fuel oil and diesel, the only viable short-term alternatives to gas as fuel for power generation.

(iii) **Supporting private sector investment.** To sustain Pakistan's current high economic growth rates, the MTDF estimates that 7–8% of annual GDP (about $81 billion between 2005 and 2010) needs to be invested in infrastructure. Of this, the Government is able to invest only about 1.5%. The Government (with ADB's strong support) has been implementing reforms to encourage public private partnerships for the provision of infrastructure. It is of paramount importance that the private sector is supported and encouraged to invest in IPPs. As the first gas-fired IPP to reach financial closure under the 2002 policy, the Project will set a benchmark for other IPPs and encourage domestic and international investors to again look at power generation as an attractive investment opportunity.

B. Project Description

1. Overview and Timeline

20. The Project consists of a 171MW combined cycle low-BTU gas-fired power plant in Daharki, District Ghotki, Sindh province, in Pakistan. It is expected to be a base load plant with 100% dispatch because of its low-cost tariff. The sponsor, the Fauji Foundation, received a Letter of Interest to develop the Project using a BOO structure under the 2002 policy from the PPIB in August 2004. The feasibility study by the Project's technical consultants, Fichtner GmbH, was completed in July 2005. Fauji Foundation filed its tariff petition with NEPRA in January 2006 and, following public hearings in August 2006, NEPRA notified the determined tariff in October 2006. An engineering, procurement and construction (EPC) contract for the main aspects of the project was signed in February 2007. The Project is expected to reach financial closure by fourth quarter of 2007, and is expected to reach its commercial operations date by the fourth quarter of 2009.

2. Configuration and Main Components

21. The plant will have one gas turbine of 121.5MW, one heat recovery steam generator, and one steam turbine of 62.8MW. A 15-km gas transmission pipeline will be built to supply gas to the Project complex, and power from the Project will be evacuated to NTDC's 220kV Daharki-Rohri transmission line.[8] Housing for staff will also be constructed on the Project's premises.

3. Sponsors and Ownership

22. Fauji Foundation will act as sponsor for the Project and will directly own between 51% and 75% (it may allocate residual stakes up to its 75% shareholding to its controlled subsidiaries) of the equity. It will also counterguarantee the financial obligations of the holding company that are proposed to be guaranteed by ADB (see below under ADB's Equity Investment and Guarantee).

23. Fauji Foundation was established as a charitable trust in 1954, and operates on a self-sustaining basis, channeling about 80% of the profits from its commercial ventures into welfare programs for ex-servicemen and their eligible dependents, about 7% of the country's population.

24. Fauji Foundation's portfolio includes ventures in fertilizer production, power generation, petroleum product distribution, cement production, grains and sugars, and services, among others. Its earnings from operations in FY2006 were PRs3.3 billion, on an asset base of PRs44.3 billion.

25. Fauji Foundation has prior experience of owning, managing and operating a low-BTU gas-fired combined cycle power plant in Pakistan. It is the largest owner (45.33%) of Fauji Kabirwala, established in 1997 in collaboration with El Paso Energy International and ADB, which also provided a loan to the project (footnote 2). Another international power company, Globeleq, bought El Paso's shares (as part of an acquisition of all of El Paso's non-domestic power assets) in 2006 and Globeleq has a shareholding of 42.17%. ADB retains a minority equity interest of 12.5%. The plant is well managed. In addition to Fauji Kabirwala, Fauji Foundation has also been a sponsor in two other ADB-supported projects, Fauji Fertilizer Company Limited and Fauji Oil Terminal Company Limited (footnote 2).

C. Environmental and Social Safeguard Policy Aspects

1. Environmental Safeguards

26. Plants such as Daharki Power that operate only on natural gas and do not use such alternate fuels as residual furnace oil or diesel are among the most environmentally-friendly thermal power options available. An environmental impact assessment (EIA) has assessed the environmental impact of the construction and operation of the Project in relation to both Pakistani legislation and World Bank guidelines applicable to new thermal power plants. The required no-objection certificate from the Sindh Provincial Environmental Protection Agency, granted on 10 February 2007, followed public hearings in Karachi and Daharki. The local administration supported the Project and there was no adverse public reaction.

[8] This transmission line will be financed by the second tranche of ADB's multitranche financing facility for Power Transmission Enhancement approved in December 2006 (ADB. 2006. *Report and Recommendation of the President to the Board of Directors on a Proposed Multitranche Financing Facility to the Islamic Republic of Pakistan for Power Transmission Enhancement.* Manila). This was confirmed to the due diligence mission by NTDC.

27. The Project will be constructed in an area of unproductive saline land. No sensitive habitats with high ecological value were found during the field survey and no adverse impacts are expected as a result of project operations. As the site is close to a water canal, no ground water will be mined (as is common practice for power plants), thus avoiding possible negative impacts on subsurface aquifers. Similarly, the impact on surface water bodies is expected to be slight because of the Government's requirement that wastewater be treated appropriately, consistent with local environmental standards, before discharge.

28. The EIA concludes that the more significant impacts of the Project are expected to be on noise and ambient air quality. The detailed plant design will contain appropriate technical measures to comply with relevant noise standards. To assess ambient air quality, an air pollutant dispersion calculation was carried out. The initial estimates showed that the expected impacts on ground level concentrations for nitrogen oxide, sulfur oxide, and particulate matter of 10 micrometres or less in aerodynamic diameter will be minimal and no statutory limit values (as prescribed by the Sindh Provincial Environmental Protection Agency) will be exceeded.

29. An environment management plan has been prepared to ensure that the environmental disturbances associated with the construction and operational phases of the Project will be handled in a way that is consistent with ADB environmental guidelines. Fauji Kabirwala, based on the same technology and managed under the same arrangements as the Project, has plant emissions and effluents that are well within the prescribed standards (all Pakistan's provincial environmental protection agencies follow national environmental quality standards that are based on World Bank guidelines for acceptable noise, pollution and effluent discharges). The EPC contract has strict penalties for non-compliance with prescribed environmental standards for noise emissions and effluent discharges. The Project has been classified as category B. The summary initial environmental examination is in Appendix 6.

2. Social Safeguards

30. The Project is classified as B for involuntary resettlement, as four families have been displaced from land that has been sold to Fauji Foundation by the previous landowner through a negotiated settlement. The families, comprising 17 individuals, had been living as agricultural laborers on the land in housing provided by the previous landowner. The employment opportunities of the households will remain unaffected as they will continue to work the lands of the landowner and others. Agreement has been reached with the elders of the adjacent village, Mitho Lakhan, for the families to be relocated to that village. The affected families were provided with sufficient cash assistance to allow them to relocate and construct proper replacement housing. The due diligence report is in Appendix 7.

31. The Project site does not affect any indigenous peoples. Consequently, the Project is classified as category C under the ADB *Policy on Indigenous Peoples* (1998).

IV. ADB EQUITY INVESTMENT AND GUARANTEE

A. Justification

1. The Project is Consistent with ADB and Government Strategies

32. The proposed assistance is fully in line with ADB's country and sector strategies, as well as with the Government's strategic intentions. ADB's most recent country strategy and program update reports that "ADB views itself as one of Pakistan's strategic development partners for

infrastructure development," with power as one of the main areas of support. It also notes that "the emphasis on lending for economic infrastructure will be continued, which is consistent with the high priority attached to it in the Government's medium-term development framework."[9] The report clearly mandates ADB to promote the role of the private sector as a driver of investment, growth, and employment. Among ADB's focus sectors for private sector operations, power and energy infrastructure feature prominently.

33. As part of its public sector program, ADB has a strong energy sector focus in Pakistan. Work on the enabling environment, reform, and regulations have created the right conditions for further public sector investment, as well as more private sector participation. In the short term, ADB is helping the Government conduct energy sector analyses; capacity building; and project identification, development, and implementation. Over the medium term, ADB is supporting large infrastructure development projects in renewable energy and power transmission and distribution.

34. The energy sector is a core operational sector under ADB's medium-term strategy II.[10] Catalyzing investments through increased private sector participation in ADB's developing member countries is identified in the medium-term strategy II as one of the five strategic priorities. ADB's energy sector strategy[11] designates the following as two of the most important operational priorities: (i) reducing poverty by, among other things, creating energy infrastructure for sustainable economic growth; and (ii) promoting private sector involvement by restructuring the energy sector and creating an enabling environment for private investors, especially in generation. In particular, the strategy strongly encourages ADB interventions to increase private sector participation in the energy sector to take advantage of the higher operational efficiencies that private operators can achieve and to meet the large capital requirements.

35. ADB is also fully engaged with the private power subsector in Pakistan, through loans and investments made since 1996. This includes the successful[12] Fauji Kabirwala Project and more recently, the $150 million loan to the KESC as well as the loan to New Bong Escape, Pakistan's first hydropower IPP (footnote 8). ADB is currently considering several other power financing opportunities in Pakistan, particularly in projects with low environmental impact (such as run-of-the-river hydropower schemes, wind power, and biogas).

36. Since Daharki Power will be the first gas-only IPP to reach financial closure under the 2002 policy, ADB's support will send a strong signal to potential local and foreign investors and thus help provide impetus to the Government's plans to expand electricity generation capacity to meet the growing energy deficit. ADB's equity participation will also enhance the governance profile of the Project.

2. The Project has Important Demonstration Effects for Further Investment in the Sector

37. One of the main reasons why there have been no new international investment in IPPs in Pakistan in the last 7 years is the low return offered to shareholders under government

[9] ADB. 2005. *Pakistan: Country Strategy and Program Update (2006–2008)*. Manila.
[10] ADB. 2006. *Medium-Term Strategy II (2006–2008)*. Manila.
[11] ADB. 2000. *Energy Review of the Energy Policy of the Asian Development Bank*. Manila.
[12] ADB. 2002. *Project Completion Report on the Fauji Kabirwala Power Company Limited in the Islamic Republic of Pakistan.* Manila. The PCR rated the Project as *successful* because of its strong operational performance. The overall financial internal rate of return on the project was estimated at 17%, and for ADB's equity, if realized, almost 23%). The project has been, and continues to be, in full compliance with all stipulated covenants. It has a strong debt repayment track record and at present is risk-rated *good* (RR-2).

policies, including the 2002 policy. The enhanced returns are likely to make both this Project and other similar projects significantly more appealing to investors. By providing the guarantee, ADB is helping to set a precedent for future power sector financings in Pakistan, highlighting the need for an adequate risk-reward structure. This may lead either to (i) replications of leveraged holding company structures, and/or (ii) a realization among policy makers the balance between risks and rewards needs to be adequately addressed.

38. At the same time, this structure, which is routinely used in international utility financing, but represents a significant market innovation in Pakistan, will enable the Project to go ahead (and therefore to address the looming power deficit) in spite of customary time lags in policy formulation and implementation, and without additional cost to the Government or the consumers. Upon learning of the guarantee structure, Fauji Foundation's original joint venture partner, Globeleq, indicated renewed interest (although shortly thereafter this was overtaken by its decision to make an overall exit from Asia, which precluded any further investment).

B. Corporate Governance, Accounting, Auditing, and Reporting

39. Both the holding company and the project company will have the same governance structure, and ADB will have the right to representation on the respective boards of directors in proportion to its shareholding. In addition, for minority protection and ADB policy compliance, ADB will have veto rights over a number of major decisions affecting the companies. Fauji Foundation and ADB have agreed to explore the possibility of appointing independent directors to the boards, in anticipation of a potential future public listing. The boards will meet bi-monthly during the project implementation phase and quarterly thereafter. Through its board memberships, ADB will be able to monitor closely FPCDL's progress vis-à-vis agreed-upon milestones and the financial model. The holding company will be required to follow international financial reporting standards, and the project company will adhere to generally accepted accounting standards in Pakistan. Both companies will be audited by accounting firms acceptable to ADB.

C. Project Performance Monitoring and Evaluation

40. Both as a shareholder and as a guarantee provider, ADB will require the holding company to provide comprehensive reports that detail: (i) progress in the implementation of the Project, (ii) the operating cost structure and operating performance, and (iii) the achievement of estimated returns. Appendix 1 provides the performance indicators.

D. Project Review

41. The Project will be reviewed regularly as per standard ADB portfolio management and Project evaluation practice, including a project completion report (following the completion of the Project envisaged in April 2009) and annual reviews.

E. Documentation

42. Standard documentation for a transaction of this kind will be prepared, including a subscription agreement, a shareholders' agreement, a put option agreement, a guarantee, a counterguarantee and such other agreements as may be necessary.

F. Compliance with ADB Investment Limitations

43. This investment will represent 1.26% of the total ADB nonsovereign portfolio and will increase ADB's exposure to the "Conventional Energy Generation" sector from 12.58% to 13.67%. It will increase ADB's non-sovereign portfolio exposure to Pakistan from 8.14% to 9.28%.

44. The proposed equity investment and the proposed ADB guarantee each constitute exposure to the holding company. Since the amount of the investment and the guarantee combined exceeds 25% of the total value of the assets of the holding company, the exposure limits set by applicable ADB policy[13] for a single financing recipient would be exceeded. However, since the guarantee undertakings of ADB (which constitute approximately 95% of the net exposure of ADB to the transaction) are in turn counterguaranteed by Fauji Foundation, and the obligations of Fauji Foundation under its counterguarantee are secured, Management considers that this strongly mitigates the risks inherent in such exposure. The proposed assistance complies with all other ADB prudential exposure limits.

G. Anticorruption Measures: Combating Money Laundering and the Financing of Terrorism

45. Fauji Foundation was advised of ADB's *Anticorruption* Policy (1998, as amended to date) and policy relating to the *Combating of Money Laundering and the Financing of Terrorism* (2003). Consistent with its commitment to good governance, accountability, and transparency, ADB will require the holding company and the project company to institute, maintain, and comply with internal procedures and controls following international best practice standards for preventing corruption or money laundering activities or the financing of terrorism. Further, the holding company and the lenders of the guaranteed loan to the holding company will covenant with ADB to refrain from engaging in such activities. Such obligations will be contained in the ADB investment and guarantee documentation. The investment and guarantee documentation between ADB, Fauji Foundation, and the holding company will further allow ADB to investigate any violation or potential violation of these undertakings.

V. ASSURANCE

46. Consistent with the Agreement Establishing the Asian Development Bank, the Government will be requested to confirm that it has no objection to ADB's proposed assistance. No funding will be disbursed and the guarantee will not be effective until ADB receives such confirmation.

VI. RECOMMENDATION

47. I am satisfied that the proposed financing would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve

(i) an equity investment of up to (a) $2,750,000 or (b) 25% of the issued share capital in the holding company of Foundation Power Company Daharki Limited, whichever is lower;

(ii) a guarantee in a principal amount of up to $44,000,000 plus interest, in favor of the lenders to the holding company;

[13] ADB. 2007. *Review of Prudential Exposure Limits for Nonsovereign Operations.* Manila.

in each case for developing the Daharki Power Project, and on terms and conditions which are substantially in accordance with those set forth in this report; and

(iii) a waiver of the single exposure limit as specified in para 97.

Haruhiko Kuroda
President

8 October 2007

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanism
Impact		
1. Economic Growth		
• Economic development in Pakistan less constrained by deficient power supply	• Pakistan avoids a slowdown in economic growth from the current 8% due to unavailability of electricity.	• Government and ADB statistics
2. Efficient Natural Resources Management		
• Pakistan is less exposed to volatile international oil product prices for its power fuel procurement exposure	• Pakistan's currently idle indigenous gas/fuel resources are more efficiently utilized	• Government and ADB statistics
3. Private Sector Development		
• Domestic and international commercial investors demonstrate greater appetite for private investment in power generation projects in Pakistan	• Private investment in power generation increases from the current 39% of total installed capacity to 42% by 2010 • The offshore shareholding and guarantee structure is replicated and/or the Government revises the equity return component in the tariff	• Government and ADB statistics
Outcome		
• Pakistan's power consumers receive additional lower-cost power, generated from local, otherwise unusable, gas, with adequate returns generated for the Project's investors	• As a base-load plant, the Project has a continuously high dispatch rate of 90%. • The expected IRR on ADB's equity investment remains above 15% in US dollar terms • The net average tariff/kWh from the Project is lower than for plants running on imported fuel for the same time period	• Government and ADB statistics • Project reporting
Outputs		
A 171MW base-load power plant running on indigenous gas financed using a guarantee structure that is innovative for Pakistan.	• Pakistan's net electricity generation capacity increases by 171MW on commissioning	• NTDC reporting • Project reporting
Activities with Milestones		
• Financial closure by fourth quarter 2007 • Construction start immediately after financial close		

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanism
• Commissioning 24 months after construction start, by fourth quarter 2009.		

ADB = Asian Development Bank, GDP = gross domestic product, Government = Government of Pakistan, kWh = kilowatt-hour, MW = megawatt, NEPRA = National Electric Power Regulatory Authority, NTDC = National Transmission and Despatch Company.

POWER SECTOR IN PAKISTAN

A. Sector Framework and Reform

1. The power sector in Pakistan, which encompasses the generation, transmission, and distribution of electricity, is regulated by the National Electric Power Regulatory Authority Act, 1997. The National Electric Power Regulatory Authority (NEPRA), which was constituted as an independent entity, is exclusively empowered under the act and related rules to regulate all facets of the power sector, including the electricity tariffs charged by the Karachi Electric Supply Corporation (KESC). NEPRA is thus empowered to (i) grant licenses for generation, transmission, and distribution; (ii) approve tariffs, rates, and charges across the sector; (iii) establish uniform industry performance via codes and standards; and (iv) enforce the above. NEPRA, although mandated as an independent entity, is governed by a chairman and four members, all of whom are appointed by the Government of Pakistan with the members recommended by, and representing, provincial interests.

2. Power sector policies and related legislative frameworks are developed and implemented by the Government via the Ministry of Water and Power. The Government initiated the process of power sector reforms and restructuring in the early 1990s on the advice of the World Bank. The reforms, developed in various stages and through different initiatives, are reflected in several policies, including the 1994 power policy, the 1995 hydropower policy, the 1995 transmission line policy, the 1998 power policy, and the 2002 power policy (the policy under which the Daharki Power Project is being developed). These were designed, to a large extent, to attract private sector participation in the restructured power sector. The Government is also unbundling the Pakistan Water and Power Development Authority (WAPDA) into various independent entities. The broad objectives of these policies have been to: (i) bring efficiencies across the entire sector via competitive generation, transmission, and distribution with appropriate independent regulatory oversight; (ii) rationalize prices and subsidies; and (iii) encourage private capital formation and investment to meet growing electricity demand. The privatization of KESC was a key element in this ongoing program.

3. The power sector continues to be in transition and is today semi-privatized and fairly well regulated. The sector has historically been characterized by very significant Government control through the WAPDA and KESC monopolies (which function as vertically integrated utilities encompassing generation, transmission, and distribution) and by significant inefficiency, with losses in excess of 25%, and an inability to meet demand. This has changed over the last decade, at least in terms of outright government control, and Pakistan today enjoys significant private-sector-led generation through 21 independent power producers (IPPs), 19 of which were sanctioned under the 1994 power policy,[1] and which together represent more than 30% of total generation capacity. With ADB's active assistance[2], KESC was privatized in late 2005 and to date remains the only vertically integrated private sector entity in charge of the majority of its generation and all of its transmission and distribution. As of December 2006, some 40% of Pakistan's installed generation capacity was owned by the private sector (through the IPPs and KESC). This percentage is likely to increase, with planned privatizations of Jamshoro Power Company and a secondary public offering of Kot Addu Power Company. The evident success in attracting private sector investment into power generation was not without difficulties, and most IPPs, especially those under the 1994 power policy, ended up in contract disputes with the

[1] Hub Power Company, a 1,292MW power plant, was actually under development prior to the 1994 power policy and was commissioned in 1997.

[2] ADB. 2000. *Technical Assistance to the Islamic Republic of Pakistan for the Support of Privatization of Karachi Electric Supply Corporation*. Manila.

Government and WAPDA, some of which were acrimonious. These disputes were largely driven by significant overcapacity in the mid- to late 1990s (the exact opposite situation to today) and consequent tariff implications. Notwithstanding this discord, these disputes were ultimately settled amicably, with minimal adjustments to the contracts. The terms of the contracts, although renegotiated, were ultimately honored, which provides a degree of comfort in the present investment environment.

4. Significant power sector reforms supported by multilateral development banks are underway with the aim of unbundling WAPDA's power wing into many discrete generation and distribution units, and by placing WAPDA's transmission assets into a single corporatized entity, the National Transmission and Dispatch Company Limited (NTDC). NTDC was incorporated in 1998 and is responsible for power transmission in all of Pakistan, apart from the areas served by KESC. NTDC, which operates transmission lines of 66, 132, 220 and 500 kVs now assumes the additional function of acting as the single buyer of wholesale generation from many companies including IPPs (but excluding KESC) for onward transmission and sale to eight distribution entities. These companies include the Lahore, Gujranwala, Faisalabad, Islamabad, Multan, Peshwar, Hyderabad and Quetta Electric Supply Companies, most commonly known as DISCOs. It is likely that the power from Daharki Power will be evacuated by NTDC to the Hyderabad DISCO. At present a "singly buyer–single seller" model is being put in place, which the Government hopes, as more investment flows into the power sector, will evolve into a "multiple buyer–multiple seller" regime where generators and distributors can contract directly.

B. Tariff Structure

5. The retail tariff regime in Pakistan is based on different classes of consumers, (e.g., residential, industrial, and commercial) and graduated.[3] It includes significant cross subsidies. NEPRA is responsible for determining tariffs under its Tariff Standards and Procedures Rules, 1998 which specify standards by which tariffs are set, and procedures by which they are adjudicated. These standards are sufficiently broad to allow discretion and thus enable the development of various tariff regimes. Tariff determinations are based on the principle of recovering prudently incurred costs and returns on the applicant's rate base, applicable on a case-by-case basis. They contain automatic quarterly increases to reflect changes in fuel costs or purchased power costs, in addition to macroeconomic indexation of costs. NEPRA's tariffs become effective once they are officially notified by the Government in its official gazette.

6. Average end-user tariffs for eight ex-WAPDA DISCOs and KESC are depicted in Table A2.1.

Table A2.1: Average Electricity Tariffs, 2001–2006
(Paisa/ kWh)

Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**CAGR** (%)
DISCOs	299	373	395	384	N/A	N/A	6.6
KESC	406	454	472	500	543	587	7.6

CAGR = compound average growth rate, KESC = Karachi Electric Supply Corporation, DISCOs = ex-WAPDA distribution companies.
Source: KESC and NEPRA Annual Report 2005.

[3] Tariffs are charged on a tier basis. The first tier is 100 kwh; next is 300 kwh, 700 kwh and then so on. As the Kwh consumption increases, so does the tier or slab rate.

7. In order to grant greater financial independence to the newly formed generators and DISCOs (spun out of WAPDA), and to reduce tariff subsidies to WAPDA in fiscal year (FY) 2006, the subsidy requested by WAPDA was $1.316 billion. The Government recently announced an unanticipated 10% electricity tariff increase. At present the end tariff charged by DISCOs is heavily subsidized, based on WAPDA's overall generation cost. This, coupled with high transmission and distribution losses (primarily because of underinvestment in the network, resulted in an increasing financial burden for WAPDA as well as for the DISCOs). The gravity of the situation can be seen in the number of days payable to IPPs (which sell power to WAPDA through NTDC, which has of late been two months. The recent tariff increase has been welcomed by IPPs and by industry participants including commercial financiers which see this as a first step by the Government to make WAPDA solvent in advance of its eventual privatization, which has been on hold since 2000.

C. Electricity Demand

8. Pakistan's electricity consumption grew at a compound average growth rate (CAGR) of 6.8% from 2001 to 2006, and amounted to 67,603 gigawatt-hours (GWh) at the end of 2006. This growth is being driven across all classes of consumers (except bulk supply/other) but especially by commercial, agricultural, industrial and domestic or residential consumers, which registered CAGRs of 11.3%, 10.1%, 6.7% and 6.2% respectively, in the same time period. Consumption has continued to grow on the back of recent annual economic growth rates of over 7%, and similar growth rates in electricity demand are expected to continue in the near future based on projections for continued strong economic growth and higher rates of per capita electricity consumption.

9. Table A2.2 illustrates Pakistan's electricity demand and growth rates.

Table A2.2: Breakdown of Electricity Demand, 2001–2006
(GWh)

Class	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**CAGR** (%)
Domestic	22,765	23,210	23,624	25,846	27,601	30,720	6.2
Commercial	2,774	2,951	3,218	3,689	4,080	4,730	11.3
Industrial	14,349	15,141	16,181	17,366	18,591	19,803	6.7
Agriculture	4924	5,607	6,016	6,669	6,988	7,949	10.1
Public Lighting	213	212	244	262	305	353	10.6
Other	3,559	3,501	3,373	3,658	3,762	4,048	2.6
Total	**48,584**	**50,622**	**52,656**	**57,490**	**61,327**	**67,603**	**6.8%**

CAGR = compound average growth rate, GWh = gigawatt-hour.
Source: Pakistan Energy Yearbook 2006.

D. Electricity Supply

10. Total installed power generating capacity in Pakistan amounts to 19,450 MW, of which 11,369 MW is provided by WAPDA (58.4%), 5,833 MW by IPPs (30%), 1,756 MW by KESC (9%), 30 MW by AJK Hydro Electric Board (0.2%), and the remaining 462 MW by Government-owned nuclear power plants (2.4%). Hydroelectric generation capacity represents about 6,499 MW, or 33.4% of total installed generation capacity.

11. Table A2.3 describes the breakdown of installed capacity.

Table A2.3: Breakdown of Installed Capacity
(MW)

Description	Total	Thermal	Hydro	Nuclear
WAPDA	11,369	4,900	6,469	
AJK	30		30	
IPPs	5,833	5,833		
KESC	1,756	1,756		
Nuclear	462			462
Total	**19,450**	**12,489**	**6,499**	**462**
Percent	**100**	**64.2**	**33.4**	**2.4**

IPP = independent power producer, KESC = Karachi Electric Supply Corporation, WAPDA = Water and Power Development Authority.
Source: Pakistan Energy Yearbook 2006.

E. Electricity Supply and Demand Projection

12. The PPIB is an important institution in the power sector in Pakistan. Set up in 1994, PPIB acts as a "one-window" operation to facilitate private investment in IPPs under the national power and hydropower policies. Given the enormous power requirements and Government's policy for encouraging private sector participation in power generation, PPIB is expected to play an important part in mobilizing investments into new thermal and hydropower generation, as it did in the mid and late 1990s.[4]

13. Against 19,450 MW of installed capacity in Pakistan, the firm supply at the end of 2006 was 15,072 MW. By comparison, peak demand for 2006 was 15,483 MW, which resulted in a deficit of about 411 MW. Assuming no additional capacity is added, PPIB forecasts the following relationship between peak demand and firm supply for the next 7 years (Table A2.4).

Table A2.4: Firm Supply Versus Peak Demand Projections, 2007–2013
(MW)

Year	Firm Supply[a]	Peak Demand	Surplus / (Deficit)
2007	15,091	16,548	(1,457)
2008	15,055	17,689	(2,634)
2009	15,055	19,080	(4,028)
2010	15,055	20,584	(5,529)
2011	15,055	22,205	(7,150)
2012	15,055	23,953	(8,899)
2013	15,055	25,840	(10,785)

MW = megawatt.
[a] Includes KESC's generation capacity.
Source: Private Power Infrastructure Board.

[4] PPIB has facilitated investments in over 15 IPPs with a combined installed capacity of 5,577 MW under the 1994 and 1998 power policies

14. This growing power deficit will particularly affect large urban centers such as Karachi, Lahore, Faisalabad, Sialkot, and Rawalpindi. These cities are home to most of Pakistan's industrial assets, including most small and medium-sized enterprises, and contribute over 35% of the country's GDP. Recognizing the gravity of the situation, the Government, through WAPDA's Power and Energy Planning wings and PPIB, has developed several long-term electricity demand load projections and new supply options. Daharki Power features prominently in these projections because of its low-cost generation and base load status. In order to meet growing demands and to use Pakistan's significant water resources, especially in the northern part of the country, WAPDA has developed a least-cost generation expansion plan, which emphasizes indigenous sources of energy, primarily hydropower (and in some cases coal), in line with the Government's power sector policies. However, uncertainty remains about the pace of this overall generation expansion, given the numerous delays experienced to date. Investment in hydropower IPPs is expected to gain momentum now that the arrangements for New Bong Escape Hydro Power Plant (part-financed by ADB) [5] have been finalized. Nevertheless, concerns about the speed of capacity addition remain. Table A2.5 shows Pakistan's power demand projections relative to planned capacity additions by WAPDA, IPPs and KESC. This is estimated to represent the best case scenario from a capacity addition point of view, as it assumes that all capacity additions will occur as planned, in the next 5 years.

Table A2.5: Peak Demand, Firm Supply, and Projected Capacity Additions, 2007–2011
(MW)

Item	2007	2008	2009	2010	2011
A. Supply					
Firm supply	15,091	15,055	15,055	15,055	15,055
B. Generation Expansion Plan					
WAPDA – least cost generation expansion					
Malakand-III Hydro	81	81	81	81	81
Pehur Hydro	18	18	18	18	18
Allai Khwar Hydro		121	121	121	121
Khan Khwar Hydro		72	72	72	72
Duber Khwar Hydro		130	130	130	130
Keyal Khwar Hydro		130	130	130	130
Golen Gol Hydro		106	106	106	106
Jinnah Low Head Hydro		96	96	96	96
Taunsa Hydro				120	120
Gas Turbine Ghakkar #1 (gas)				220	220
Independent Power Producers (IPPs)					
New Bong Escape Hydro					84
Rajdhani Hydro					132
Kotli Hydro					100
Gulpur Hydero					100
Orient Combined Cycle (gas/oil)		225	225	225	225
Attock Refinery Limited Combined Cycle (oil)		150	150	150	150
Gulf Power– under fast track (oil)		179	179	179	179
Eastern Power– under fast track (oil)		150	150	150	150
Fauji Power Company Daharki (captive gas)			**175**	**175**	**175**
Western Power– IPP expansion (gas/oil)			161	161	161
Muridke Combined Cycle (gas/oil)			225	225	225
ENGRO Combined Cycle (gas)			150	150	150
Bhikki Combined Cycle (gas/oil)			225	225	225
Warda Power Project (oil)			200	200	200
Green Power Project (gas)			205	205	205

[5] ADB, 2005. *Report and Recommendation of the President on a Proposed Loan to Laraib Energy for the New Bong Escape Hydropower Project in the Islamic Republic of Pakistan*. Manila.

Item	2007	2008	2009	2010	2011
Japan Power – IPP expansion (oil)			101	101	101
Kohinoor Power – IPP expansion (oil)			143	143	143
Atlas Power Project (oil)			225	225	225
NIshat Chinian Power Project (oil)			200	200	200
NIshat Power Project (oil)			200	200	200
Star Combined Cycle (captive gas)				134	134
Saif Power Project (gas/oil)				225	225
KAPCO Expansion (oil)				400	400
Gujranwala Power (oil)				200	200
HUBCO Expansion (oil)				225	225
UCH Power II (captive gas)				450	450
Faisalabad ICB Project (gas)				400	400
Chichoki Mallian ICB Project (gas)				350	350
KESC					
KTPS Combined Cycle (gas) expansion	45	220	220	220	220
BQTPS Combined Cycle (gas) expansion		525	525	525	525
Nuclear					
Chashma Nuclear #2				325	325
C. Total Projected Capacity	15235	17,258	19,468	22,517	22,933
D. Projected Demand					
Peak demand	16,600	17,689	19,080	20,584	22,205
Surplus/(deficit)	(1,365)	(431)	(388)	1,933	728

BQTPS = Bin Qasim Thermal Power Station, ICB = International Competitive Bidding, IPP = Independent Power Producer, KAPCO = Kot Addu Power Company Limited, KESC = Karachi Electric Supply Corporation, KTPS = Korangi Thermal Power Station, MW = megawatt, WAPDA = Pakistan Water and Power Development Authority.
Sources: Private Power and Infrastructure Board (PPIB) website, WAPDA annual reports, PPIB's latest presentation to Prime Minister of Pakistan on Power Status Update, Asian Development Bank estimates.

ADB'S PUBLIC SECTOR ASSISTANCE FOR PAKISTAN IN THE POWER SECTOR

1. Since the start of operations of the Asian Development Bank (ADB) in Pakistan in 1968, total public sector lending in areas of energy and power has amounted to about $3.8 billion, of which $3.2 billion has been to the power subsector and $0.6 billion to the natural gas and petroleum subsectors. Of the lending to the power subsector (Table A3.1), 64% has been directed to generation (39% hydropower, 25% thermal power) and the remaining 36% to transmission and distribution (T&D).

Table A3.1: Asian Development Bank Lending to the Power Subsector in Pakistan

Loan No.	Project	Amount ($ million)	Date Approved
0099-PAK	Power Generation, Transmission and Distribution	14.3	12 Oct 1972
0100-PAK	Power Generation, Transmission and Distribution	12.2	12 Oct 1972
0150-PAK	Power Generation, Transmission and Distribution (Supplementary)	6.8	22 Nov 1973
0151-PAK	Power Generation, Transmission and Distribution (Supplementary)	2.2	22 Nov 1973
0168-PAK	Mangla Hydropower	3.9	17 Dec 1973
0169-PAK	Mangla Hydropower	12.8	17 Dec 1973
0181-PAK	Sui-Karachi Gas Pipeline	29.7	14 Mar 1974
0187-PAK	Sui-Karachi Gas Pipeline (Supplementary)	23.5	06 Aug 1974
0200-PAK	Tarbela Hydropower	34.0	28 Nov 1974
0201-PAK	Tarbela Hydropower	13.0	28 Nov 1974
0230-PAK	Gas Turbine Generation	22.0	26 Aug 1975
0332-PAK	Tarbela Hydropower (Supplementary and Extension)	38.0	15 Dec 1977
0390-PAK	Pipri Thermal Generation	35.0	22 Dec 1978
0391-PAK	Pipri Thermal Generation	25.0	22 Dec 1978
0505-PAK	Load Despatch and Transmission	67.0	22 Dec 1980
0516-PAK	Pipri II Thermal Generation	55.0	23 Jun 1981
0561-PAK	Rural Electrification Sector	35.0	15 Dec 1981
0578-PAK	Pipri II Thermal Generation (Supplementary)	29.0	29 Jul 1982
0601-PAK	Tarbela Hydropower Extension (Units 9 and 10)	29.0	23 Nov 1982
0660-PAK	Guddu Combined Cycle	83.4	06 Dec 1983
0661-PAK	Guddu Combined Cycle	57.5	06 Dec 1983
0701-PAK	Tarbela Hydropower Extension (Units 11 and12)	137.2	25 Oct 1984
0702-PAK	Tarbela Hydropower Extension (Units 11 and 12)	31.8	25 Oct 1984
0760-PAK	Tarbela Units 13 and 14 and 500 kV Transmission	117.8	28 Nov 1985
0824-PAK	WAPDA Tenth Power (Sector)	150.0	18 Dec 1986
0925-PAK	KESC Fifth Power (Sector)	100.0	24 Nov 1988
1073-PAK	WAPDA Eleventh Power	215.0	20 Dec 1990
1143-PAK	WAPDA Twelfth Power (Sector)	125.0	13 Dec 1991
1144-PAK	WAPDA Twelfth Power (Sector)	125.0	13 Dec 1991
1314-PAK	KESC Sixth Power (Sector)	100.0	22 Sep 1994
1315-PAK	KESC Sixth Power (Sector)	100.0	22 Sep 1994
1424-PAK	Ghazi Barotha Hydropower	300.0	16 Jan 1996
1807-PAK	Energy Sector Restructuring Program	300.0	14 Dec 2000
1808-PAK	Energy Sector Restructuring Program	50.0	14 Dec 2000
1809-PAK	Capacity Enhancement in the Energy Sector	5.0	14 Dec 2000
2178-PAK	Infrastructure Development Project	25.0	18 Aug 2005
2286-PAK	Renewable Energy Development Sector Investment Program	500.0	13 Dec 2006
2287-PAK	Renewable Energy Development Sector Investment Program	10.0	13 Dec 2006
2289-PAK	Power Transmission Enhancement Investment Program	790.0	13 Dec 2006
2290-PAK	Power Transmission Enhancement Investment Program	10.0	13 Dec 2006
	Total	**3,820.1**	

PAK = Pakistan.
Source: Asian Development Bank.

2. Pakistan's most recent country strategy and program update (2006–2008)[1] supports a strategic focus on energy sector reforms to bring clarity on the roles and responsibilities of all stakeholders including the Government, the regulator, and the private sector in generation, transmission, and distribution of electricity. It highlights clearly the strong role that the private sector must play in developing the energy sector, particularly power, and for attracting investment to meet growth demands and improve sector efficiencies. Table A3.2 provides nonlending support from ADB to the power subsector.

Table A3.2: Asian Development Bank Nonlending to the Power Subsector in Pakistan

Loan No.	Project	Amount ($)	Date Approved
0101-PAK	Mangla Hydropower	150,000	17 Dec 1973
0118-PAK	KESC Generation and Transmission Feasibility Study	200,000	02 Jul 1974
0222-PAK	Thermal Power Plants Maintenance	150,000	15 Dec 1977
0411-PAK	Power Development & Tariff Study	350,000	27 Aug 1981
0525-PAK	KESC-SITE Combined Cycle	50,000	08 Jul 1983
0704-PAK	Gas Development (Sari, Hundi and Nanpur Gas Fields)	275,000	13 Sep 1985
0728-PAK	Operational Strategy Study of PGCL	250,000	12 Dec 1985
0763-PAK	Oil and Gas Development	75,000	12 May 1986
0835-PAK	Tariff Study on WAPDA/KESC Integration	450,000	18 Dec 1986
0869-PAK	Karachi Electric Supply Corporation Power Expansion	75,000	06 Apr 1987
0894-PAK	Technical Services for the Office of the Directorate General (Gas)	266,000	25 Aug 1987
0900-PAK	Southern Gas Transmission and Distribution	350,000	07 Sep 1987
1078-PAK	Second Oil and Gas Development	315,000	01 Dec 1988
0900-PAK	Southern Gas Transmission and Distribution (Supplementary)	90,000	14 Mar 1990
1447-PAK	Power and Institutional Study	788,000	20 Dec 1990
1448-PAK	Development of a Management Information System for WAPDA	415,000	20 Dec 1990
1512-PAK	Program for Safe Repair and Operation of the Gas Processing Plants Belonging to the Sui Southern Gas Company	100,000	15 Apr 1991
1616-PAK	Hydrocarbon Sector Strategy Study	600,000	20 Nov 1991
1618-PAK	Financial Restructuring and Management Strengthening of SSGC	860,000	03 Dec 1991
1619-PAK	Environmental, Safety and Efficiency Improvement of SSGC's Operations	680,000	03 Dec 1991
1625-PAK	Power Generation Coordination Improvement and Tariff Training	585,000	02 Jan 1992
1655-PAK	KESC Organizational and Financial Restructuring Study	75,000	13 Jan 1992
2162-PAK	KESC Restructuring and Privatization Study	300,000	22 Sep 1994
2163-PAK	Demand Side Management Study	90,000	22 Sep 1994
2525-PAK	Power Efficiency Project	850,000	16 Jan 1996
2594-PAK	Natural Gas Import Study	600,000	26 Jun 1996
2809-PAK	Private Hydropower Policy Study	100,000	11 Jun 1997
3409-PAK	Capacity Building of the National Electric Power Regulatory Authority	1,000,000	06 Mar 2000
3502-PAK	Support for Privatization of Karachi Electric Supply Corporation	1,000,000	22 Sep 2000
3711-PAK	Restructuring the Gas Sector	1,000,000	29 Aug 2001
4130-PAK	Institutional Capacity Building of the National Transmission and Dispatch Company Limited	600,000	30 Jun 2003
4425-PAK	Renewable Energy Development	550,000	05 Nov 2004
4500-PAK	Capacity Building of the Alternative Energy Development Board	150,000	17 Dec 2004
4610-PAK	Operational Support to the Office of Energy Advisor	150,000	14 Jul 2005
4635-PAK	Support for Infrastructure Investments	150,000	18 Aug 2005
4665-PAK	Power Transmission Enhancement	500,000	04 Oct 2005
4881-PAK	Renewable Energy Policy Formulation	800,000	01 Dec 2006
	Total	14,989,000	

KESC = Karachi Electric Supply Corporation, PGCL = Pak Gulf Construction (Pvt) Ltd, SSGC = Sui Southern Gas Company Ltd, WAPDA = Pakistan Water and Power Development Authority
Source: Asian Development Bank.

[1] ADB. 2005. *Pakistan: Country Strategy and Program Update (2006–2008)*. Manila.

ADB'S ASSISTANCE TO PRIVATE SECTOR IN PAKISTAN

($ million)

Investment / Loan No	Date Approved	Company	Equity					Comp Loan	Combined
			LOE	Investment	Underwriting	OCR	Total		
7254/2329	29-May-07	KESC Post Privatization Rehabilitation, Upgrade and Expansion	0.000	0.000	0.000	150.000	150.000	0.000	150.000
7222	21-Nov-05	New Bong Escape Hydro Power	0.000	0.000	0.000	37.300	0.000	0.000	37.30
7190/3709	19-Dec-03	SME PCG Facility [a]	0.000	0.000	0.000	0.000	0.000	0.000	65.000
7166	7-Dec-00	Pakistan Export Finance Guarantee	0.000	2.000	0.000	0.000	2.000	0.000	2.000
7126/1434	23-Apr-96	Fauji Kabirwala Power Co. Ltd.	0.000	5.300	0.000	32.000	37.300	65.000	102.300
7114/1395	10-Oct-95	Pakistan Industrial Leasing Corp. Ltd. III	0.000	0.000	0.000	15.000	15.000	0.000	15.000
7113/1394	10-Oct-95	Orix Leasing Pakistan Ltd. III	0.000	0.000	0.000	20.000	20.000	0.000	20.000
7112/1393	10-Oct-95	National Development Leasing Corp. Ltd. IV	0.000	0.000	0.000	15.000	15.000	0.000	15.000
7111/1392	10-Oct-95	Atlas BOT Lease Co. Ltd. II	0.000	0.000	0.000	10.000	10.000	0.000	10.000
7093/1255	30-Sep-93	Fauji Oil Terminal and Distribution Co. Ltd.	0.000	1.000	0.000	19.000	20.000	11.800	31.800
7086	13-Aug-92	PAK Asian Fund	0.000	2.600	0.000	0.000	2.600	0.000	2.600
7080/1135	26-Nov-91	Pakistan Industrial Leasing Corp. Ltd. II	0.000	0.000	0.000	8.000	8.000	0.000	8.000
7079/1134	26-Nov-91	Pakistan Industrial and Commercial Leasing	0.000	0.000	0.000	5.000	5.000	0.000	5.000
7078/1133	26-Nov-91	Orix Leasing Pakistan Ltd. II	0.000	0.000	0.000	10.000	10.000	0.000	10.000
7077/1132	26-Nov-91	National Dev. Leasing Corp. Ltd. III	0.000	0.000	0.000	10.000	10.000	0.000	10.000
7076/1131	26-Nov-91	Crescent Investment Bank	0.000	0.000	0.000	10.000	10.000	0.000	10.000
7075/1130	26-Nov-91	Atlas BOT Lease Co. Ltd.	0.000	0.000	0.000	5.000	5.000	0.000	5.000
7074/1129	26-Nov-91	Asian Leasing Corp. Ltd. II	0.000	0.000	0.000	7.000	7.000	0.000	7.000
7017/0856	28-Jun-91	Pakistan Industrial Leasing Corp. Ltd.	0.000	0.208	0.000	0.000	0.208	0.000	0.208
7066	13-Dec-90	Atlas BOT Investment Bank Ltd.	0.000	0.920	0.000	0.000	0.920	0.000	0.920
7062	4-Dec-90	Pakistan Venture Capital Ltd.	0.000	1.160	0.000	0.000	1.160	0.000	1.160
7057	13-Sep-90	International Asset Management Co.	0.000	0.030	0.000	0.000	0.030	0.000	0.030
7056	13-Sep-90	Pakistan Investment Fund Inc.	0.000	0.000	4.320	0.000	4.320	0.000	4.320
7017/0856	27-Aug-90	Pakistan Industrial Leasing Corp. Ltd.	0.000	0.227	0.000	0.000	0.227	0.000	0.227
7050-C/1008	26-Apr-90	Asian Leasing Corp. Ltd.	0.000	0.000	0.000	0.000	0.000	2.000	2.000
7049-C/1007	26-Apr-90	Orix Leasing Pakistan Ltd.	0.000	0.000	0.000	0.000	0.000	5.000	5.000
7027-C	8-Mar-90	National Development Leasing Corporation Ltd. II	0.000	0.000	0.000	0.000	0.000	5.000	5.000

Investment / Loan No	Date Approved	Company	Equity						
			LOE	Investment	Underwriting	OCR	Total	Comp Loan	Combined
7050/1008	21-Dec-89	Asian Leasing Corp. Ltd.	0.000	0.000	0.000	3.000	3.000	0.000	3.000
7049/1007	21-Dec-89	Orix Leasing Pakistan Ltd.	0.000	0.000	0.000	5.000	5.000	0.000	5.000
7047/1003	19-Dec-89	Fauji Fertilizer Co. Ltd.	0.000	0.000	0.000	30.000	30.000	20.000	50.000
7042/0989	21-Nov-89	Pioneer Cement Limited	0.000	3.500	0.000	11.500	15.000	21.100	36.100
7034/0958	25-Apr-89	Pakistan Synthetics Ltd.	0.000	1.200	0.000	4.300	5.500	0.000	5.500
7027/0913	27-Oct-88	National Dev. Leasing Corp. Ltd. II	0.000	0.000	0.000	15.000	15.000	0.000	15.000
7003/1393	29-Sep-88	National Dev. Leasing Corp. Ltd.	0.000	0.165	0.000	0.000	0.165	0.000	0.165
7017/0856	10-Nov-87	Pakistan Industrial Leasing Corp. Ltd.	0.000	0.575	0.000	2.000	2.575	0.000	2.575
7011/0814	9-Dec-86	National Dev. Leasing Corp. Ltd.	0.000	0.000	0.000	5.000	5.000	0.000	5.000
7009	9-Dec-86	National Dev. Finance Corp. and Bankers Equity Ltd.	5.000	0.000	0.000	0.000	5.000	0.000	5.000
7010/0809	4-Dec-86	Cherat Cement	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7003/1393	13-Dec-84	National Development Leasing Corp. Ltd.	0.000	0.420	0.000	0.000	0.420	0.000	0.420
7002	20-Dec-83	Bankers Equity Ltd.	2.000	0.000	0.000	0.000	2.000	0.000	2.000
		Total	7.000	19.305	4.320	429.1	422.425	129.9	654.625

BOT = build-own-transfer, LOE = line of equity, OCR = ordinary capital resources, KESC = Karachi Electric Supply Corporation, SME PCG = small and medium enterprise partial credit guarantee.

[a] Approved but not signed.

Source: Asian Development Bank.

REFERENCE TARIFF CALCULATION TABLE
Foundation Power Company (Daharki) Ltd

Dependable Capacity: 171 MW
Capacity Factor (CF): 60%
Electricity Generated at CF of 60%: 898 GWH

	Variable Charge (PRs/kWh)				Capacity Charge (PRs/kW/hour)										Total	
Year	Fuel	Variable O&M[c] Local	Variable O&M Foreign	Total	Fixed O&M Foreign	Fixed O&M Local	Insurance	Financing Cost on Working Capital	Return on Equity	Return on Equity for Construction Period	Withholding Tax @75%	Loan Repay-ment	Interest Charges	Total	Fixed Cost at 60% Plant Factor PRs/kWh	Cents/ kWh
1	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.3066	0.7787	1.6481	4.9284	8.2140
2	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.3491	0.7363	1.6481	4.9284	8.2140
3	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.3974	0.6879	1.6481	4.9284	8.2140
4	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.4525	0.6329	1.6481	4.9284	8.2140
5	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.5151	0.5702	1.6481	4.9284	8.2140
6	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.5865	0.4989	1.6481	4.9284	8.2140
7	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.6677	0.4177	1.6481	4.9284	8.2140
8	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.7601	0.3252	1.6481	4.9284	8.2140
9	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.8654	0.2199	1.6481	4.9284	8.2140
10	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236	0.9852	0.1001	1.6481	4.9284	8.2140
11	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
12	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
13	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
14	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
15	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
16	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992

	Variable Charge (PRs/kWh)				Capacity Charge (PRs/kW/hour)										Total	
Year	Fuel	Variable O&M[c] Local	Variable O&M Foreign	Total	Fixed O&M Foreign	Fixed O&M Local	Insurance	Financing Cost on Working Capital	Return on Equity	Return on Equity for Construction Period	Withholding Tax @75%	Loan Repay-ment	Interest Charges	Total	Fixed Cost at 60% Plant Factor PRs/kWh	Cents/ kWh
17	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
18	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
19	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	02943	0.0206	0.0236			0.5627	3.1195	5.1992
20	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
21	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
22	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
23	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0:0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
24	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
25	2.0019	0.0306	0.1492	2.1816	0.0699	0.0699	0.0574	0.0271	0.2943	0.0206	0.0236			0.5627	3.1195	5.1992
Levelized Tariff (1–25 Years)				2.1816	**0.0699**	**0.0699**	**0.0574**	**0.0271**	**0.2943**	**0.0206**	**0.0236**	**0.3602**	**0.3745**	**1.2974**	**4.3440**	7.2400

kWh = kilowatt-hour, O&M = operation and maintenance.

[a] Capacity charge based on a capacity factor of 60%. Used only in computation of the levelized tariff.

[b] Actual capacity charge payable to the company, regardless of dispatch by NTDC.

[c] Operation and maintenance.

[d] Procedure for levelization of tariff: (i) calculate the present value of yearly tariff at year one by using 10% discount rate, and (ii) calculate the annuity payments over the life of the project using the same 10% interest rate.

Source: www.nepra.org.pk

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

A. Introduction

1. The proposed Daharki Power Project (the Project) consists of a 171 MW combined cycle low-BTU gas-fired power plant in Daharki, District Ghotki, Sindh Province, in Pakistan, and is expected to be a base load plant with 100% dispatch because of its low cost. The Project will use a dedicated gas supply from Mari gas fields. It will be the first natural-gas-only plant developed under the Government's 2002 power policy and will be undertaken according to a 25-year build-own-operate (BOO) structure. A feasibility study by Fichtner GmbH was completed in July 2005. The Sindh Environmental Protection Agency (SEPA) provided no objection clearance for the Project on 10 February 2007, based on the environmental impact assessment (EIA) prepared in 2005.[1]

2. This summary initial environmental examination (SIEE) has been prepared for the Asian Development Bank (ADB) in line with its environmental and social safeguard policies, and the information disclosure requirements for an environmental category B project. The SIEE is based on the EIA and supplementary information.

3. Only four families, comprising 17 individuals, living as agricultural laborers on the land acquired by Fauji Foundation[2] on a willing buyer–willing seller basis, will be affected by the transaction. Agreement has been reached with the adjoining village that the displaced families will be allowed to relocate to the village. The families will continue their occupation as agricultural laborers on new lands acquired by the landowner in the immediate vicinity. There are no indigenous peoples living in the surrounding area.

4. ADB's review of the Project covered environmental, health and safety and social information submitted by Fauji Foundation, the National Transmission Distribution Corporation (NTDC), site visits by an ADB mission to the project site in March 2007, and discussions with Fauji Foundation, Mari Gas Company Limited (MGCL), and NTDC officials.

B. Project Description

1. Technical Features

5. Fauji Foundation is the sponsor for the Project and has prior experience owning, managing and operating a low-BTU gas-fired combined cycle power plant in Pakistan. It is the largest shareholder in Fauji Kabirwala Power Plant,[3] established in 1997 with El Paso Energy International and ADB (which provided a loan to the project). In addition to Fauji Kabirwala, Fauji Foundation has also received funding from ADB for two other projects, Fauji Fertilizer Company Limited[4] and Fauji Oil Terminal and Distribution Company Limited.[5]

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[1] Fichtner GmbH. EIA Report. 2005.

[2] Fauji Foundation was established as charitable trust in 1954, and operates on a self-sustaining basis, channeling approximately 80% of the profits from commercial ventures into welfare programs that serve ex-servicemen and their eligible dependents.

[3] ADB. 1996. *Report and Recommendation of the President to the Board of Directors on a Proposed Equity Investment and Loan to Fauji Kabirwala Power Company Limited* Manila.

[4] ADB. 1989. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Fauji Fertilizer Company Limited.* Manila.

[5] ADB. 1993. *Report and Recommendation of the President to the Board of Directors on a Proposed Equity Investment and Loan to Fauji Oil Terminal and Distribution Company Limited*. Manila.

6. The plant will consist of (i) one gas turbine of 121.5 MW, (ii) one heat recovery steam generator, and (iii) one steam turbine of 62.8 MW. A 15-km gas transmission pipeline will be built to supply gas to the project complex, and power from the Project will be evacuated to NTDC's 220 Kv Daharki–Rohri transmission line. Housing for staff will be constructed on the Project's premises.

7. The Project will be implemented under an engineering, procurement and construction (EPC) contract, combining detailed design, construction and supply and installation of equipment and commissioning. The EPC contract was awarded to Doosan Heavy Industries & Construction Co Ltd. in February 2007. Construction is expected to be completed within 24 months of Doosan receiving notice to proceed. Doosan will also provide a 24-month warranty covering power plant, equipment and works from full commissioning of the Project.

C. Description of the Environment

1. Project Area

8. The project area of 132.44 acres has been acquired from a single landowner. The study area for the EIA covered the land and an area of 1-2 km^2 around the project site. The project site is along Dad Lagari road, about 8.5 km south of the city of Daharki.

D. Physical Environment

1. Physiography and Soil

9. The topography of the area is generally flat. The soil is generally alluvial in nature and is composed of alternating layers of silty clay and clay.

2. Climate

10. The climate of the project area is arid subtropical, characterized by hot summers and mild winters. The closest meteorological observatory is at Rohri, Sukkur District, about 110 km from the site. May, June, and July are the hottest months. August and September are hot, with high humidity. The winter months are December, January and February. The mean maximum temperature during summer is 44^oC and the mean minimum is 29^oC. During winter the mean maximum temperature is about 23 ^oC and the mean minimum is 9^oC.

11. The average annual rainfall of the area is 122 mm, with mean annual relative humidity of 52% and a wind speed of 80 km/hr with a north-east prevailing wind direction. Frost is common, and occurs during December and January. Meteorological data are presented in Table A8.1.

3. Air Quality

12. The EIA includes the results of the ambient air quality monitoring measurements were carried out at 10 locations from 29-31 May 2007. Results show that SO_2, NO_2 and CO values are within limits as prescribed by World Health Organization (WHO). However, PM_{10} values are high (173 to 190 ug/m^3) because of the proximity to desert areas. The results of the ambient air quality are shown in Table A8.2. The air emission standards of the World Bank and the Environmental Protection Agency of Pakistan are presented in Table A8.3.

4. Noise Level

13. The project area can be classified as noise-free because of the virtual absence of vehicular traffic, and industrial and commercial activities. One-time noise level measurement was carried out at 10 locations from 29 to 31 May 2007. Noise levels in the project area range from 37.2 dB(A) to 47.8 dB(A) , as presented in Table A8.4.

5. Water Quality

14. The quality of water from hand pumps and tubewells, as well as from the Lower Dahar Wah Canal, was evaluated. Groundwater quality was found to be unfit for drinking purposes because of the presence of an excessive amount of total dissolved solids (TDS), total suspended solids (TSS), calcium and magnesium hardness as calcium carbonate ($CaCO_3$), and ammonia. In case of surface water, the amounts of BOD_5 was 52.8 and chemical oxygen demand was 74 mg/l, both of which are on the high side. The results of the water quality analysis (surface and groundwater) are presented in Tables A8.5 and A8.6. International and national standards for effluent from the thermal power plants are presented in Tables A8.7 and A8.8.

E. Biological Environment

15. In Ghotki District, there are three inland forests, Mirpur Plantation, Sarhad Plantation and Adilpur Plantation, which are located 15 to 20 km from the project site. The main plant species of the plantations are shisham (*Dalbergia sisso*), babul/kikar (*Acacia nilotica*) and bahan (*Populus euphractica*). There is one riverine forest, Rounti Forest, about 20 km from the project site. The main plant species of the forest are babul (*Acacia nilotica*), bahan (*Populus euphractica*), lai (*Tamarix gallica*) and jhoa (*Tamarix dioca*). Other tree species of the area include kandi (*Prosopis specigera*), karir (caparis aphylla), ber (*Zizyphus jujuba*), pipal (*Ficus religosa*), neem (*Azadarachts indica*), pilu (*Salvadora eleoides*), and khabar (*Salvadora percica*). A number of varieties of shrubs and grasses are also very common in the area. The most common shrub is ak (*Calotropis procera*) and the most common grass is kan (*Saccharum spontancum*).

16. The mammal biodiversity of Ghotki District is limited to jackal and wild boar populations. Other species rarely seen in the area include various kinds of deer, particularly chinkara and foxes. Bird species include hawk, kit, crow, parrot, common sparrow, pigeon, tillur, quail, partridge, and water fowl along the river.

17. There are several local trees, wild animals and bird species in the area, but none is endangered. No wildlife sanctuary or game reserve is located in the vicinity of the study area.

F. Socioeconomic Environment

18. The surrounding areas are inhabited by agricultural communities. The population of the study area lives in scattered settlements of Bashirabad and two villages (*goths*), Mitho Lakhan and Sultan/Bachal Lashari. Based on the socioeconomic survey, the estimated population of the study area is 1,400.

19. The Project is classified as B for involuntary resettlement as four families have been displaced from the land (132 acres) that has been sold to Fauji Foundation by the previous landowner through a negotiated settlement. The families, comprising 17 individuals, had been

living as agricultural laborers on the land in housing provided by the previous landowner. The employment opportunities of the households will remain unaffected as they will continue to work the lands of the landowner and others. Agreement has been reached with the elders of the adjacent village, Mitho Lakhan, that families may be relocated to that village. The affected families were provided with cash assistance to allow them to relocate them and construct proper replacement housing.

20. No archaeological, historical and religious sites exist in the project area. However, there are some scattered mosques, graveyards and shrines. No indigenous group of people was identified.

G. Anticipated Environmental Impacts and Mitigation Measures

1. Impacts During Construction

21. Based on supplementary information, 3.8 million cubic feet soil will be required to fill the project site level up to its required elevation (0.2 m above the graded ground elevation). A large quantity of available excavated soil from the erection of plant machinery and other allied works will be reused as filling materials. Additional borrow materials will be drawn from the adjoining poor quality saline areas.

22. Sewage will be generated from construction camps, the contractor's workshop, and the equipment washing yard. Sewer drains will lead to an on-site disposal area for treatment or holding in septic tanks with leach fields. The septic tanks and soak pits will be located at a minimum distance of 300m from water sources, and not in an area with a high groundwater table. All waste from plant drains subject to oil spills will be collected into an oily water separator before being drained into the disposal system. The oil waste will be separated and collected in drums and shipped to disposal areas from where they will be hauled away by local contractors.

23. Dust generated during construction is expected to have some adverse impact on air quality. This problem will be mitigated by wetting the paths of heavy vehicles with water, and controlling the speed and limiting the movement of vehicles. All vehicles and machines will have routine maintenance to reduce engine emissions. Vehicles used to transport construction material will be covered with tarpaulin. Impacts on local communities will be limited as the immediate area is sparsely populated.

24. Noise will be generated during construction. Construction activities will be planned so that simultaneous noisy operations are avoided. Powered mechanical equipment such as bulldozers, air compressors, concrete pumps, excavators, and concrete mixers will only be used with low sound power whenever possible. Silencers or mufflers on construction equipment will be used. Protective devices will be provided to workers to minimize the effects of high noise levels, which will be within with the parameters set out in the World Bank's *Pollution Prevention and Abatement Handbook* (1998).

25. Construction of the plant will require clearing and removal of common vegetation, mainly weeds, bushes and the few trees existing on the project site. Planting of indigenous trees and bushes belonging to the natural types at the site will be undertaken.

26. The general mobility and accessibility of the local residents and their livestock in and around the project area is unlikely to be significantly hindered during construction. A temporary

fence will be installed around the project area to ensure that project activities remain confined within project boundaries.

2. Impacts During Operations

27. All process water and sanitary waste water of the project will be adequately treated before it is discharged to the surface water. Wastewater after treatment will be stored in an evaporation pond, which will be properly lined to ensure that there is no seepage and to safeguard the quality of groundwater. Relevant standards for final disposal of process wastewater effluent streams, including boiler blowdown, cooling tower blowdown, and demineralizer waste, will be strictly observed and monitored.

28. Water leading from oil storage tanks and transformers will first be collected at an oil water connection pit, treated at oily water separator, and then disposed into the evaporation pond. Similarly, storm and rain water will also be collected at the evaporation pond.

29. The air pollutant dispersion calculations indicate that, because of plant operations, the maximum allowable ground level concentrations for NO_x should be 17.2 ug/m^3 , for SO_x 0.2 ug/m^3, and for PM_{10} 6.9 ug/m^3. As the project area is currently devoid of industrial pollution, no significant impacts are envisaged on ambient air quality during operations. Air quality monitoring systems, as well as noise level monitoring, will be set up to meet the Pakistan National Environmental Quality Standards (NEQS) as prescribed under by the National Environmental Protection Act (1997).

30. The plant equipment will need to comply with the project specification standards to meet ambient noise limits. As the noise limits and stack emission standards will not be exceeded, the impact on fauna and flora and adjacent communities will be low. Operation of the facility will result in air and noise emissions that could have an impact on the resting, nesting, and roosting activities of the surrounding flora and fauna. Extensive planting of trees will be carried out inside the power plant area, along the roads and paths along the entire boundary wall of the project area, and in available spaces in the project area, which will mitigate any impacts on flora, and will also improve the aesthetic appearance of the area.

31. The construction of the plant will provide job opportunities for skilled and unskilled employment to the locals, and lead to improvements in the socioeconomic conditions of the people. Some commercial activities, such as small eateries, a gas station, general stores, workshops, and small warehouses are likely to develop at the site during construction. These activities will benefit the local population.

H. Institutional Requirements and Environmental Management Plan

1. Organizational Structure, Roles, and Responsibilities

32. Fauji Foundation will nominate a project manager who will be responsible for overall construction and operation of the Project. The manager will also supervise and monitor compliance with the contractor’s obligations related to design and construction, as well as with environmental and social requirements. An independent monitoring consultant will act as the external monitoring agency on behalf of Fauji Foundation and will monitor all activities at regular intervals. The consultant will report to the manager on compliance issues.

33. Fauji Foundation will also establish a health, safety, and environmental management unit (HSEM unit) to implement the HSEM policy. To support the unit, three staff (a shift chemist/engineer, a plant operator, and a laboratory/plant chemist) will be employed. The unit will monitor the environmental performance of the contractor as required by SEPA. Environmental training will be carried out for the contactor and construction supervision staff.

34. During project construction, the HSEM unit will monitor compliance with SEPA requirements regarding air emissions, water quality (drinking and surface water quality), noise standards and waste disposal. The effects on the socioeconomic environment will also be monitored by the HSEM unit, considering parameters such as local employment, health and safety of communities and mobility of local women. Table A8.9 presents the environmental monitoring program for the construction and operation phases of the Project. The environment management plan is presented in Table A8.10.

35. The environmental monitoring to be carried out by Independent Monitoring Consultant at the construction stage is estimated at about PRs.2.0 million. The cost for internal monitoring and training to be carried out by Fauji Foundation staff is estimated at PRs. 3.5 million for construction as well as for 2 years' monitoring during the operation stage (PRs. 3.2 million for monitoring and PRs. 0.3 million for training).

I. Public Consultation and Disclosure

36. The Project has been well known to local communities for some time, particularly given the proximity of the Mari gas field complex. Consultations were held with local leaders and with members of the community. The required no-objection certificate from the SEPA was granted on 10 February 2007 and was followed by public hearings in Karachi and Daharki. The local administration supports the project and there has been no adverse public reaction.

J. Findings and Recommendations

37. The Project will have no significant environmental impacts during construction and operations because of the nature of the Project and its site. The Project will install a low NO_x burner to reduce NO_x emissions so they are within the permissible levels of the NEQS.

K. Conclusion

38. The major conclusions on the Project's environmental impacts are as follows. First, it will have no significant environmental impacts. The NO_x emissions by the gas turbine generators can be controlled effectively, and air quality can be maintained within the prescribed standards. Second, it will draw on Fauji Foundation's well-recognized health, safety and environmental procedures to deal effectively with any accidents or disasters during project construction and operation. Third, the Project can deal effectively with any potential environmental impacts, which are well understood and can be mitigated.

Table A6.1: Mean Monthly Temperatures and Humidity

Month	Station Rohri Mean Dry Bulb Temperature 1975–2004 (°C)	Station Rohri Mean Wet Bulb Temperature 1975–2004 (°C)	Station Rohri Mean Relative Humidity 1975–2004 (°C)
January	15.5	10.9	56.9
February	18.0	12.4	51.9
March	23.2	16.2	48.7
April	29.7	19.5	38.7
May	34.3	22.7	37.1
June	35.7	25.8	45.9
Julyy	33.7	26.9	59.1
August	32.2	26.2	62.9
September	30.9	24.6	60
October	27.3	20.4	53.4
November	22.0	16.1	54.7
December	17.0	12.5	59.4
Year	**26.6**	**19.5**	**52.4**

Source: EIA report (Fichtner, 2005).

Table A6.2: Results of Ambient Air Quality Monitored Data

Reference Point	Date	SO_2 (ppb)	NO_2 (ppb)	CO (ppb)	Ambient Particulate Matter (PM_{10}) $\mu g/m^3$
Point 1	29-5-07	39.9	40.9	490	169
Point 5	29-5-07	40.2	42.7	498	173
Point 3	29-5-07	39.3	40.4	484	178
Point 4	29-5-07	38.4	39.7	490	180
Point 6	29-5-07	42.8	44.2	510	175
Point 11	29-5-07	40.7	41.3	504	182
Point 12	29-5-07	40.4	40.8	497	184
Point 7	29-5-07	43.1	46.2	520	190
Point 8	29-5-07	43.7	46.9	528	187
Point 10	29-5-07	41.7	43	510	170

CO = Carbon monoxide, NO_2 = Nitrogen dioxide, SO_2 = Sulfur oxide. ppb = parts per billion.
Sources: EIA report (Fichtner, 2005) and supplementary information.

Table A6.3: Air Emission Standard of World Bank and EPA of Pakistan

Pollutant	World Bank Standard	EPA Standard[e]
NO_2	125[a] (gas fired) 165[a] (diesel fired)	400[a] 600[a]
SO_2	35[b]	500[c]
175 MWe		
PM_{10}	50[d]	

EPA = Environmental Protection Agency, MWe = megawatt electrical, NO_2 = Nitrogen dioxide, PM_{10} = Particulate matter at 10 micrometers, SO_2 = Sulfur oxide.
[a] For combustion turbine units (dry at 15% oxygen) in mg/Nm^3 .
[b] 0.20 metric tons per day (tpd) per MWe of capacity.
[c] Tons per day per plant in unpolluted airsheds.
[d] mg/Nm^3.
[e] Gazette of Pakistan 2000 – National Environmental Quality Standards for Industrial Gaseous Emission.
Source: EIA report, Fichtner, 2005.

Table A6.4: Results of Baseline Noise Level Monitoring Data

Serial No.	Reference Point	Date	Noise Level dB(A)
1	Point 1	29-05-07	37.2
2	Point 5	29-05-07	37.8
3	Point 3	29-05-07	42.5
4	Point 4	29-05-07	44.6
5	Point 6	29-05-07	42.6
6	Point 11	29-05-07	44.5
7	Point 12	29-05-07	39.7
8	Point 7	29-05-07	47.8
9	Point 8	29-05-07	46.4
10	Point 10	29-05-07	44.3

Sources: EIA report (Fichtner, 2005) and supplementary information.

Table A6.5: Laboratory Analysis Report of Surface Water

Serial No.	Parameter	Unit	Result	NEQS Limiting Value
1	pH		8.4	09-Jun
2	Temperature	^{0}C	23	≤3^{0}C
3	BOD_5 at 20^{0}C	mg/l	52.8	80
4	COD	mg/l	74	150
5	TSS	mg/l	128	200
6	TDS	mg/l	120	3,500
7	Grease and Oil	mg/l	0	10
8	Phenolic Compounds as Phenols	mg/l	N.D.	0.1
9	Chloride as Cl^-	mg/l	28	1,000
10	Fluoride as F^-	mg/l	1.2	10
11	Cyanide total as CN^-	mg/l	N.D.	1
12	Anionic Detergents as MBAs	mg/l	1	20
13	Sulphate as SO^{2-}_4	mg/l	34	600
14	Sulphide as S^-	mg/l	0.02	1
15	Ammonia as NH_3	mg/l	4.1	40
16	Pesticides	mg/l	N.D.	0.15
17	Cadmium	mg/l	N.D.	0.1
18	Chromium Trivalent and Hexavalent	mg/l	0.45	1
19	Copper	mg/l	0.12	1
20	Lead	mg/l	N.D.	0.5
21	Mercury	mg/l	N.D.	0.01
22	Selenium	mg/l	N.D.	0.5
23	Nickel	mg/l	N.D.	1
24	Silver	mg/l	N.D.	1
25	Total Toxic Metals	mg/l	0.1	2
26	Zinc	mg/l	0.11	5
27	Arsenic	mg/l	N.D.	1
28	Barium	mg/l	0.01	1.5
29	Iron	mg/l	3.1	8
30	Manganese	mg/l	0.1	1.5
31	Boron	mg/l	N.D.	6
32	Chlorine	mg/l	N.D.	1

BOD_5 = Biochemical Oxygen Demand, COD = Chemical Oxygen Demand, MBA = maltobionamide, NEQs = National Environmental Quality Standards, N.D. = not detected, pH = potential of hydrogen, TDS = Total Dissolved Solids, TSS = Total Suspended Solids.
Note: Sampling Location = Lower Dahr Wah Canal.
Sources: EIA report (Fichtner, 2005) and supplementary information.

Table A6.6: Laboratory Analysis Report of Groundwater

Serial No.	Parameter	Unit	Result	WHO Maximum allowable Guidelines Values
1	pH		8.2	6.5–9.5
2	Temperature	^{O}C	22	
3	Color	TCU	2	15
4	TDS	mg/l	780	1,000
5	TSS	mg/l	2	
6	Taste & Odor	---	Obj-*	Objectionable/unobjectionable
7	Total Hardness as $CaCO_3$	mg/l	136	500
8	Total Coliform	Number/100ml	0	10/1,000 ml
9	E- Coli	Number/100ml	0	0/100 ml
10	Nitrate (asNO^{-}_3)	mg/l	4.2	50
11	Ammonia	mg/l	0.2	
12	Arsenic	mg/l	N.D.	0.01
13	Turbidity	NTU	2	5
14	Calcium Hardness as $CaCO_3$	mg/l	82	
15	Magnesium Hardness as $CaCO_3$	mg/l	54	
16	Chloride	mg/l	106	250
17	Fluoride	mg/l	0.1	1.5
18	Sulphate	mg/l	80	400
19	Iron	mg/l	0.14	0.3
20	Sodium	mg/l	20	200
21	Iodine	mg/l	N.D.	
22	Zinc	mg/l	0.25	5

N.D.= not detected, pH = potential of hydrogen, TDS = Total Dissolved Solids, TSS = Total Suspended Solids, WHO = World Health Organization.
Note: Sampling Location = Lower Dahr Wah Canal.
*Slightly Objectionable.
Sources: EIA report (Fichtner, 2005) and supplementary information.

Table A6.7: Effluents from the Thermal Power Plants (1)

Serial No.	Parameter	Revised Standard[a] (<Into Inland Waters)
1	Temperature or temperature increase[*]	=<3°C
2	pH	6 to 9
3	Biochemical oxygen demand (BOD_5) at 200°C (1)	80
4	Chemical oxygen demand (COD) (1)	150
5	Total suspended solids (TSS)	200
6	Total dissolved solids (TDS)	3500
7	Grease and oil	10
8	Phenolic compounds (as phenol)	0.1
9	Chloride (as Cl^-)	1,000
10	Fluoride (as F^-)	10
11	Cyanide (as CN^-) total	1
12	Anionic detergents (as MBAs) (2)	20
13	Sulphate (SO^{-4})	600
14	Sulphide (S^-)	1
15	Ammonia (NH_3)	40
16	Pesticides (3)	0.15
17	Cadmium (4)	0.1
18	Chromium (trivalent and hexavalent) (4)	1
19	Copper (4)	1
20	Lead (4)	0.5
21	Mercury(4)	0.01
22	Selenium (4)	0.01
23	Nickel (4)	0.5
24	Silver (4)	1
25	Total toxic metals	2
26	Zinc	5
27	Arsenic (4)	1
28	Barium (4)	1.5
29	Iron	8
30	Manganese	1.5
31	Boron (4)	6
32	Chlorine	1

[a] National Environmental Quality Standards for Municipal and Liquid Industrial Effluents (mg/l, unless otherwise defined).

[*]The effluent should result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

Explanations:

(1)Summing minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means for example, that for each one cubic meter of treated effluent the recipient water body should have 10 cubic meter of water for dilution of this effluent.

(2)Modified Benzene Alkyl Sulphate; assuming surfactant as bio-degradable.

(3)Pesticides herbicides, fungicides, and insecticides.

(4)Subject to total toxic metal discharge as at Sr. No. 25.

Source: EIA report, Fichtner, 2005.

Table A6.8: Effluents from Thermal Power Plants (2)
(milligrams per liter, except for pH and temperature)

Parameter	Maximum Value WB Standard [a (1)]
pH	6 - 9
Total suspended solids (TSS)	50
Oil and grease	10
Total residual chlorine	0.2
Chromium (total)	0.5
Chromium (hexavalent)	
Copper	0.5
Iron	1.0
Nickel	
Zinc	1.0
Temperature increase	$\leq 3^{o}C$ [a (2)]

[a] World Bank Group. 1998. Thermal Power: Guidelines for New Plants. In *Pollution Prevention and Abatement Handbook 1998*. Washington, DC (Annex C, page 419, Table 1).

Notes:

(1) The effluent levels presented in the table above should be achieved daily without dilution.

(2) The effluent should result in a temperature increase of no more than 3oC at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance.

Source: EIA report, Fichtner, 2005.

Table A6.9: Environmental Monitoring Program

Project Stage	Parameters	Standards to be Applied	Location	Responsibility Frequency	Duration
A. Air Quality					
Preconstruction	PM_{10}, SO_x, NO_X, CO, HC	USEPA NAAQS WHO Air Quality Guidelines	Four location sites for Power Plant Two points along Project boundary, one for material borrow sites One point for workers camp site	Baseline, once prior to construction	Continuous 24 hours or for a full working day
Construction	PM_{10}, SO_x, NO_X, CO, HC	USEPA NAAQS WHO Air Quality Guidelines	Two location sites for Power Plant One point for workers camp site One point near asphalt plant	Once every three months during construction period	Continuous 24 hours or over one full working day
	PM_{10}	USEPA NAAQS WHO Air Quality Guidelines	One point for each material borrows sites	Once every three months during construction period	Continuous 24 hours or over one full working day

Project Stage	Parameters	Standards to be Applied	Location	Responsibility Frequency	Duration
Operation	PM_{10}, SO_x, NO_X, CO, HC	USEPA NAAQS WHO Air Quality Guidelines	Four location sites for Power Plant One point for each of villages i.e. Mitho Lakhan, Sultan/Bachal Lashari	Quarterly	Continuous 24 hours or over one full working day
	PM_{10}, SO_x, NO_X,	NEQS	Two locations one at Gas and other at Bypass Stack	Monthly	
B. Water Quality					
Pre Construction (Drinking Water)	pH, Odor, Turbidity, TDS, TSS, total, Heavy Matels, coliforms, and faecal coliforms	WHO Drinking Water Quality Guidelines	One sample from each source	Once, about a week before construction starts	
Construction (Drinking Water)	pH, Odor, Turbidity, TDS, TSS, total, Heavy Metals, coliforms, and faecal coliforms	WHO Drinking Water Quality Guidelines	One sample from each source	Each month during construction stage	
Construction Stage (Waste Water)	BOD and COD and other parameters as per NEQS	NEQS	One sample	Monthly	
Construction (Canal Water)	pH, TSS, TDS, Turbidity, BOD, DO, Heavy Metals etc.	NEQS	One sample from each Canal	Monthly	

Project Stage	Parameters	Standards to be Applied	Location	Responsibility Frequency	Duration
Operation (Drinking Water)	pH, Odor, Turbidity, TDS, TSS, total, Heavy Metals, coliforms, and faecal coliforms	WHO Drinking Water Quality Guidelines	One sample from each storage tank	Quarterly	
Operation (Waste Water)	BOD and COD and other parameters as per NEQS	NEQS	One sample from each waste water source	Quarterly	
Operation (Canal Water)	pH, Temperature, TSS, TDS, Turbidity, BOD, DO, Heavy Metals etc.	NEQS	One sample from each point.	Quarterly	
C. Noise Levels					
Preconstruction	Noise levels on dB(A) scale	NEQS	Four location sites for Power Plant One point inside the boundary of Power Plant One point for each material borrows sites One point for workers camp site One point near batching / asphalt plant	Once, one week before start of construction	12- hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged or over one full working day

Project Stage	Parameters	Standards to be Applied	Location	Responsibility Frequency	Duration
Construction	Noise levels on dB(A) scale	NEQS	Six location sites for Power Plant including: One point inside the working area in Project Boundary One point at near by Community One point for material borrows sites One point for workers camp site One point near batching / asphalt plant	Monthly	Readings taken at 15 s intervals over 15 min. every hour, and then averaged
Operation	Noise levels on dB(A) scale	NEQS	Four location sites for Power Plant One point for each of villages i.e. Mitho Lakhan, Sultan/Bachal Lashari	Quarterly	12- hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged or over one full working day
D. Soil					
Construction	Oil and grease	Threshold for each contaminant to be set using USEPA's IRIS database until national standards are established	One sample each fuel and chemical storage sites, camp sites and project site	As per occurrence of spills	Once a month

Project Stage	Parameters	Standards to be Applied	Location	Responsibility Frequency	Duration
Operation	Oil and grease	Threshold for each contaminant to be set using USEPA's IRIS database until national standards are established	One sample each fuel and chemical storage sites, camp sites and project site	Quarterly	

BOD = Biological Oxygen Demand, COD = Chemical Oxygen Demand, CO = Carbon Monoxide, HC = Hydrocarbon, NAAQS = National Ambient Air Quality Standards, NO_x = Nitrogen oxide, PM_{10} = Particulate matter at 10 micrometers, SO_x = Sulfur oxides, TDS = Total Dissolved Solids, TSS = Total Suspended Solids, USEPA-IRIS = United States Environmental Protection Agency-Integrated Risk Information System.
Sources: EIA report (Fichtner, 2005) and supplementary information.

Table A6.10: Environmental Management Plan

Reference/Corresponding EIA Chapter (Fichtner)	Issue/Potential Impact	Action
Chapter 6.1	Air pollution (dust, exhausts, etc.) during construction activities	1. Construction material transport vehicles will be covered with tarpaulins. 2. Limitation on size, weight or axle loads of vehicles using particularly difficult roads, 3. Reduced speeds and limited movement of vehicles. 4. Optimized transportation management to avoid needless truck trips. 5. Routine service and maintenance of vehicles and machines to reduce engine emissions.
Chapter 6.2	Pollution of surface water	1. All liquid materials and lubricants shall be stored in closed containers or barrels in areas surrounded by bunds. 2. Construction materials like bags of cement etc. shall be stored in containers to avoid rinsing out.
Chapter 6.3	Pollution of groundwater	1. Domestic wastewater or other wastewater, like hydrostatic testing water, shall not be allowed to infiltrate the ground; septic tanks shall be used for treatment of domestic water with final treatment in, for example, a wastewater treatment plant. 2. All wastewater shall be collected in tanks, analyzed and, depending to the results, either reused (e.g. for irrigation) or transported to suitable treatment facilities. 3. Good and regular maintenance of all vehicles and machines used on site is mandatory. Vehicle maintenance shall be done in properly equipped service stations. 4. Maintenance and re-fuelling of the construction equipment shall be done away from the excavation and only on sealed and enclosed areas, with careful handling and maintenance, especially of the fuel tanks. 5. On-site storage of fuel, engine oil and lubricants shall be in locked tanks and on sealed and shadow-roofed areas. 6. All wastes generated through the use of fuel, engine oil and lubricants, like drums and containers, shall be collected and disposed of properly.

Reference/Corresponding EIA Chapter (Fichtner)	Issue/Potential Impact	Action
Chapter 6.4	Protection of soil	1. Construction activities limited to designated areas. 2. Refill of excavated soil as far as possible. 3. Reuse of excavated soil (e.g. for road construction).
Chapter 6.5	Protection of flora and fauna	1. Planting of indigenous trees and bushes belonging to the natural type of the site after completion of all construction activities.
Chapter 6.6	Noise	1. Optimized transportation management to avoid needless truck trips; avoidance of truck movements in residential areas of least during night time (22:00–06:00). 2. Recycling of construction waste on site as much as possible, reduces transportation activities. 3. Powered mechanical equipment like bulldozer, air compressor, concrete pumps, excavator, concrete mixer etc. shall only be used with low sound power whenever possible. 4. The building machinery and other equipment shall be well-maintained and serviced regularly during construction works. 5. Building machinery in intermittent use shall be shut down or throttled to a minimum. 6. Silencers or mufflers on construction equipment shall be used. 7. Bulk construction material and excavated soil shall be stored on the same sides as the villagers as an anti-noise barrier wherever possible. 8. Construction activities shall be planned so that parallel noisy operations will be avoided.
Chapter 7.2	Ambient Air Quality	1. Confirmation of air pollutant dispersion calculation under consideration of the plant equipment based on the detailed design.
Chapter 7.3	Protection of Surface Water	1. Treatment of sanitary, waste and process water prior to discharge or further utilization in line with environmental standards. 2. Installation of monitoring equipment at points of discharge.

Reference/Corresponding EIA Chapter (Fichtner)	Issue/Potential Impact	Action
Chapter 7.4	Protection of Groundwater	1. Preparation of a groundwater model. 2. Implementation of a groundwater monitoring system. 3. Liquid wastes shall not be allowed to infiltrate into the ground. 4. Regular inspections of facilities for intercepting leaking and spilled liquids. 5. Hazardous chemicals shall be handled only in appropriate segregated, sealed and bunded areas at site.
Chapter 7.7	Effects of noise on population	1. Equipment will be acoustically shielded as far as possible, if necessary. The mitigation measures have to be revised by a noise assessment and depending on the plant equipment based on the detailed design.

Source: EIA report (Fichtner, 2005).

DUE DILIGENCE REPORT ON SOCIAL SAFEGUARDS

A. The Project

1. The Project consists of a 171MW combined cycle low BTU gas-fired power plant in Daharki, District Ghotki, Sindh province, in Pakistan, and is expected to be a base load plant with 100% dispatch (due to its low cost tariff). The feasibility study by the Project's technical consultants, Fichtner GmbH was completed in July 2005. An engineering, procurement and construction contract for the main aspects of the project was signed in February 2007. The project is expected to reach financial close by August 2007, and is expected to commence commercial operations by September 2009.

2. Fauji Foundation, the Sponsor, was established as a charitable trust in 1954, and operates on a completely self sustaining basis, channeling approximately 80% of the profits from commercial ventures into welfare programs that serve a beneficiary population consisting of ex-servicemen and their eligible dependents. Fauji Foundation has prior experience of owning, managing and operating a low-BTU gas-fired power plant in Pakistan. It is the largest owner of Fauji Kabirwala, established in 1997 with El Paso Energy International and ADB, which provided a loan to the project. In addition to Fauji Kabirwala, Fauji Foundation has also been a partner/borrower in other ADB projects, Fauji Fertilizer Company Limited and Fauji Oil Terminal Company Limited.

3. The Daharki plant will have one gas turbine of 121.5MW, one heat recovery steam generator, and one steam turbine of 62.8MW. A 15 km gas transmission pipeline will supply gas to the Project complex, and power from the Project will be evacuated to NTDC's 220Kv Daharki–Rohri transmission line. A residential colony for staff will be constructed on the Project's premises.

B. Socioeconomic Information and Consultations

4. Ghotki district in Sindh Province ranks among the lowest on social indicators, with the literacy rate at only 29%. The literacy rate is heavily skewed between genders, with 44.2% and 11.85% of male and female population being literate, respectively. While predominantly Moslem, as expected, there are a few Hindu families (*Minghora*). The population comprises *Solongi*, *Maricha*, *Bhatti*, *Shaikh* and *Soomro* households. Being a northern district of Sindh, Ghotki has access to water resources. The sub-canal Mahi Wah, a distributary of the Guddu Barrage, irrigates the area, but land is affected by waterlogging, hence there are high levels of salinity across lands that vary considerably in productive potential. There are natural resources, such as oil and gas, and extractive industries. Crops include maize, sugarcane, cotton, rice, and there are several mango orchards. Not many local people have many employment opportunities in the industries. The crime rate is very high and people, especially the poor, live under the stress of a poor law and order situation (with proximity to the Indus, there are many *dacoits*[1] in the area).

5. The Project is located along Dad Lagari road, about 8.5 km south of the city of Daharki. District Ghotki, Sindh Province. The project area is adjacent to Village (*Goth*) Mitho Lakhan, and comprises 132 acres of saline, low productivity lands acquired from a single landowner.

[1] Traditional bandit families.

6. The Project is classified as Category B under ADB's *Involuntary Resettlement Policy* (1995) as four families will be displaced from the southeast corner of land (132 acres) that has been sold to Fauji Foundation by the previous landowner through a negotiated settlement. The families, comprising 17 individuals, have been living as agricultural laborers on the land in housing (two houses, with rudimentary mud-brick walls and GI sheet-roofs) provided by the landowner.

7. The principal members of the four families who were consulted during the preparation of the EIA, and most recently in May 2007, include Weryam, Haji Gohram, Riaz Ahmad, Muhammad Hassan, Muhammad Anwar, Lal Buksh, Lutuf Ali, Abdul Wahid, and Abdul Latif. During those consultations, they acknowledged that the project was beneficial to the community, but asked that their labor opportunities be protected, and compensation be paid as they had very few assets – particularly as their housing had been provided by the landowner.

8. The Project site does not affect any indigenous peoples. Consequently, the Project is classified as Category C under the Indigenous Peoples policies.

C. Policy Framework, Entitlements, and Income Restoration

9. The legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894 (as amended). Following a national consultative process, a national resettlement policy and related ordnance had been drafted, both of which are being reviewed by the provincial governments. Currently, the Pakistan Environment Protection Agency (EPA) is responsible of both environment and resettlement-related matters. The responsibilities for implementation of resettlement-related matters are delegated to the provincial EPAs; however, formal land acquisition is carried out by the provincial Boards of Revenue and the District Land Acquisition Collectors. The categories of loss covered by the current regulations include land, physical properties, crops, trees, as well as income, and access to livelihood opportunities. Vulnerable groups are given special consideration, including women, children, destitute persons, tribal communities, squatters, persons with usufruct rights, and landless. Emphasis is also placed on consultation with affected persons.

10. Although the laborers will continue to work the new lands of the previous landowner – and there are many similar opportunities for labor on other lands in the immediate area – agreement has been reached with the elders of the nearby village, Mitho Lakhan, that the displaced families can be relocated to that village with residence rights. Although the LAA does not apply to the negotiated settlement between Fauji Foundation and the landowner of the project site, ADB's Involuntary Resettlement Policy requires that appropriate compensation be provided to persons displaced by a project. Recognizing that the families have no assets, Fauji Foundation has agreed to provide assistance to the families displaced by the willing buyer-willing seller based purchase of the land required for the Project. The assistance has been disbursed and is well over the cost of relocation to the nearby village and the construction of accommodation similar to their existing housing.

D. Grievances and Monitoring Mechanism

11. Although there is no basis for formal legal proceedings regarding land acquisition in the case of the Project, those affected will have recourse to hearing of any complaints through the tribal leaders and councils (*sardars*, *jirgas*), and government officials (*Nazim*). As part of its community outreach activities, Fauji Foundation will ascertain that the welfare of the families

who have had to relocate has not been adversely affected by the move, and will report such findings to ADB.