Power Generation Projects in Punjab (Pakistan)
Punjab derives its name from the five rivers namely Sutlej, Beas, Ravi, Chenab and Jhelum passing through it. Punjab is inhabited by 100 million people, and 60 per cent of its population, living in rural areas, largely depends on agricultural pursuits. It is located between 27° – 40° to 34° – 01° north latitudes and 69° – 20° to 75° – 20° east longitudes. The people of Punjab are warm hearted and hard working. Literacy rate in Punjab is 46.6%. Nature has gifted Punjab with four distinct weather seasons and a lot of sunlight, ideal for agricultural growth. Average peak temperature in summer season varies from 40°C – 45°C.

Punjab Irrigation Canal System is the world’s largest contiguous 23712 miles long canal system. Major crops are wheat, rice, cotton and sugar cane. The Province also produces Textiles, Hides, Skins, Sports Goods, Fans, Electric appliances and Surgical Instruments. Punjab is also rich in minerals like Rock Salts, Gypsum, Iron, Coal and Gas.

Energy is an important need of any economy. The sector has a direct impact on GDP growth and per capita income. All economic sectors are directly dependent upon the availability of energy in the form of power or fuel.

Punjab consumes 67% of the total electricity generation in Pakistan. At present, there is a demand-supply gap of about 4000 MW which is increasing at a rate of 6-8% per annum. The significant gap between the demand and supply of energy, coupled with rapid population and GDP growth provides an ideal opportunity for private investment in the energy sector.


Punjab Power Development Board (PPDB) provides one window facility in this sector. Punjab Power Development Company-a Government sector corporate entity is also established to implement power projects in public as well as public-private-partnership mode.

Investors are invited to participate in the development of power generation projects based on any type of technology.
POWER SECTOR IN PAKISTAN

The generation, transmission distribution & retail supply of electricity in Punjab is undertaken by Pakistan Power Electric Company (PEPCO) with significant contribution to generation from various independent Power Producers (IPP’s). Water and Power Development Authority (WAPDA) is now developing hydropower stations and water resources only. Under PEPCO one (1) Transmission Company, four (4) Generation Companies and nine (9) Distribution Companies are operating in Pakistan. Following five (5) Distribution Companies in Punjab are established to distribute and sell electricity to consumers:-

i    LAHORE ELECTRIC SUPPLY COMPANY (LESCO)
ii   ISLAMABAD ELECTRIC SUPPLY COMPANY (IESCO)
iii  FAISALABAD ELECTRIC SUPPLY COMPANY (FESCO)
iv   GUJRANWALA ELECTRIC POWER COMPANY (GEPCO)
v    MULTAN ELECTRIC POWER COMPANY (MEPCO)

INSTALLED CAPACITY In Pakistan total installed capacity is 22668 MW which has a hydel-thermal mix ratio of 35:65. At present, 28 IPPs are operating with a capacity of 8508 MW, which have been implemented on BOO basis under the private Power Generation Policies by Government of Pakistan (GOP).

ELECTRICITY GENERATION 2010-11
Generation 94,653 GWh

- Hydel: 33.60
- Gas: 27.30
- Oil: 35.10
- Imported: 0.30
- Nuclear: 3.60
- Coal: 0.10

Source: Hydro Carbon Development Institute of Pakistan

AN OVERVIEW OF THE POWER SECTOR PAKISTAN
The total electricity generation capacity available in Public and Private Sectors is insufficient to meet the power demand. The demand/supply gap is expected to increase in future. A table below indicated the future power requirement of the country up till year 2030.

**INDICATIVE FORECASTED DEMAND AND SUPPLY**

<table>
<thead>
<tr>
<th>Year</th>
<th>Power Sector-Electric Power Demand (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>17328</td>
</tr>
<tr>
<td>2010</td>
<td>22353</td>
</tr>
<tr>
<td>2013</td>
<td>35413</td>
</tr>
<tr>
<td>2016</td>
<td>44903</td>
</tr>
<tr>
<td>2019</td>
<td>72169</td>
</tr>
<tr>
<td>2022</td>
<td>101478</td>
</tr>
</tbody>
</table>

**Power Sector-Electric Power Demand (2007-2030) Pakistan**
Following are the most relevant players for the development of power projects operating under Federal Government and Provincial Governments;

1. **WAPDA** - Water and Power Development Authority was established in year 1958 as Federal entity and deals with the Generation, Transmission, Distribution and retail supply of electricity. This integrated system is now unbundled and WAPDA is now responsible for the development of hydel power generation and water resources only.

2. **PEPCO** - Pakistan Electric power Company has been established as transition company to deal with power sector transmission, distribution and sale by establishing corporate entities. These entities are one (1) National Transmission and Dispatch Company (NTDC), four (4) generation companies and nine (9) Distribution Companies. Central Power Purchase Agency under NTDC is mainly responsible for power purchases from the generation companies.

3. **NEPRA** - National Electric Power Regulatory Authority has been established under the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997 and acts as regulator to protect the interest of consumer and companies providing electric power services. NEPRA issues generation license to the power generation company and also determine the tariff.

4. **PPIB** - Private Power Infrastructure Board established by Federal Government to provide one window facilitation for the implementation of power projects under policies announced by the Government of Pakistan.

5. **PPDB** - Punjab Power Development Board has been established through enactment of Provincial Assembly which provides one window facility for implementation of projects in the Province.

6. **PPDCL** - Punjab Power Development Company Limited has been established as a corporate entity by the Punjab Government for the development of power projects in public sector or Joint Venture mode.
Pakistan has a population of about 180 million and only 50% people have access to electricity resulting in a large and growing domestic power market.

Per capita energy consumption is increasing at 6-8% per annum.

There is a demand-supply gap of about 4000 MW which is increasing at a rate of 6-8% per annum.

Government of Pakistan provides protection against political force majeure and changes in law.

A concessionary duties and taxes regime has been announced by Government of Pakistan for the power sector.

An independent Regulator for power sector is operating for grant of licenses and tariff determination.

Hydel and coal resources are available in Punjab. The Government of Pakistan (GOP) guarantees the performance of the power purchaser.

Small and large size power projects are ready for implementation.

High rate of return on equity is ensured.

Dedicated power projects for Industrial Estates are backed by Punjab Government guarantee.

Good cost-effective technical manpower is available in the power sector.
• Government of Pakistan has been introducing Policies for Power Generation Projects to mitigate the power shortage in the country from time to time.

• Pakistan has successfully attracted private sector in power generation and world renowned power sector players are already operating in Pakistan.

• Government of Pakistan introduced “The Policy for Power Generation Projects, 2002” which is latest one and still in the field.

• Under the Policy 2002, the provinces are authorized to develop their own policy or follow GOP Policy for development of power generation projects in public sector, private sector and public-private-sector mode.

• The Constitution of Pakistan also empowers the provinces to construct power projects, lay transmission lines and distribute the energy for use within the province.

• Punjab Government announced its policy for power generation projects in the year, 2006 (revised in 2009) in line with GOP Policy, which provides adequate frame work for the development of power projects in private sector, public sector and public-private-partnership mode (JV).


• Financial and Fiscal incentives available under GOP Policy are also available for power projects developed under Punjab Power generation Policy 2006 (Revised 2009).

• Project under the Punjab Power Generation policy may be developed in private sector, public sector or joint venture mode.
PPDB FUNCTIONS

- Apex body in Punjab for the implementation of Power Generation Policy.
- Punjab Power Development Board (PPDB) provides One-Window facility to promote private sector participation in power generation in Punjab.
- Process solicitation of projects and entertain un-solicited proposals for establishing private power projects.
- Issues Letter of Interest (LOI) and Letter of Support (LOS) to the private sponsors on behalf of Government of Punjab.
- Play key role in implementation of private power projects based on all technologies.
- Assist private investor in obtaining consents and licenses from the various agencies.
- To assist the regulatory authority NEPRA in determination of tariff for power projects.
- Assistance in finalization of Implementation Agreement (IA), Power Purchase Agreement (PPA) Coal Supply Agreement (CSA) and Water Use Agreement WUA.
- Provide support to WAPDA and all others stakeholders.
FISCAL INCENTIVES

• Customs duty at the rate of 5% on the import of plant and equipment not manufactured locally.
• No levy of sales tax on such plant, machinery and equipment for power generation projects.
• Exemption from income tax including turnover tax and withholding tax on imports.
• Repatriation of equity along with dividends is freely allowed, subject to the prescribed rules and regulations.
• Parties may raise local and foreign finance in accordance with regulations applicable to industry in general. GOP approval may be required in accordance with such regulations.
• GOP will guarantee the terms of executed agreements including payment terms.

FINANCIAL INCENTIVES

• Permission for power generation companies to issue corporate registered bonds.
• Permission to issue shares at discounted prices to enable venture capitalists to be provided higher rates of return proportionate to the risk.
• Permission for foreign banks to underwrite the issue of shares and bonds by the private power companies to the extent allowed under the laws of Pakistan.
• Non-residents are allowed to purchase securities issued by Pakistani companies without the State Bank of Pakistan’s permissions and subject to the prescribed rules and regulations.
• Abolition of 5% limit on investment of equity in associated undertakings.
• Independent rating agencies are operating in Pakistan to facilitate investors in making informed decisions about the risk and profitability of the project company’s Bonds/TFCs.
• The Policy is applicable for the development of all types of technologies such as Hydel, Coal, Biomass, Solar and Wind.
• Projects may be developed on Raw sites and where feasibility study is not available.
• Concessions in duties/tax regime announced by Government of Pakistan are applicable for projects developed under the Policy.
• Standard format of Power Purchase Agreement (PPA), Implementation Agreement (IA) and Water Usage Agreement (WUA) are available.
• Capacity payment charges (CPP) up to 90% for hydel projects.
• Water use charges @ Rs.0.15/Kwh (1.578 US Cents/Kwh) are payable on the actual energy generated.
• Dispersal of power is allowed in 3 modes
  (i) Sale to utility company (WAPDA/DISCO),
  (ii) Sale to local area by establishing distribution network,
  (iii) Sale to dedicated industry (Self Utilization)
• Use of Government land is allowed in two modes:
  (i) Lease.
  (ii) Equivalent Equity participation.
• Projects may be developed in private Sector/JV mode.
• Mode of investment for Hydropower project is normally “Build, Own, Operate and Transfer” basis (BOOT) with concession period of 30 Years.
• Mode of investment for thermal is normally “Build, Own and Operate” basis (BOO) with concession period of 30 years.
• The Punjab Power Generation Policy, 2006 envisages entertaining un-solicited and solicited proposals.

UN-SOLICITED (RAW SITES)

• The proposal for which feasibility studies are not available could be developed for Power Generation and are classified as un-solicited proposal/raw sites.

• The process includes invitation of Expression Of Interest through press, registration and pre-qualification. The highest ranking sponsor is issued Letter Of Interest (LOI) authorized to carry out feasibility studies within 9-12 months.

• Tariff will be negotiated between sponsor and power purchaser and approved by NEPRA.

• Letter Of Support (LOS) will be issued for a period of twelve months to execute agreement (IA, PPA and WUA) and to achieve financial close.

SOLICITED PROPOSAL

• Proposals will be solicited from investors for project for which feasibility is available.

• Process of selection involves invitation of competitive bidding through electronic and print media.

• Competitive bidding process will involve pre-qualification, issuance of RFP, bidding, evaluation and award.

• Lowest bidder in terms of tariff is selected, who will get tariff approved from NEPRA.

• Letter Of Support (LOS) will be issued for a period of twelve months to execute agreement (IA, PPA and WUA) and to achieve financial close.
ELECTRICITY TARIFF

- NEPRA has already announced upfront tariff for Wind Project and is in the process of determination of upfront tariff for small hydropower projects and coal.

- Tariff is designed to include operating expenses, fuel cost, debt retirement, and return on equity.

- Return on equity is 17% for hydropower projects, 15% for thermal projects and 20% on coal power projects which is calculated over life of the implementation agreement starting from construction date.

- For BOOT projects, the equity portion is allowed to be redeemed and project is to be transferred to Government of Punjab against notional payment of Rs. 1 only. For BOO projects, there should be no redemption of equity.

- Loan may be allowed to be indexed with reference to benchmark interest rate such as KIBOR for local loan or LIBOR for foreign loan and variation in Pakistan rupees to US$.

SOVEREIGN GUARANTEE

- Government of Pakistan sovereign guarantee is available to power projects provided that power purchaser is a Federal Government entity and that tariff is determined by NEPRA.

- Punjab Government guarantee is available for those projects only where bulk supply power is supplied to Management Companies of Industrial Estates under Industries and Commerce Department Punjab.
• Punjab has over 500 million tons of coal deposits along with a readily available technical and skilled manpower. Punjab Mines and Minerals Department has identified sites and proposed configuration for power generation from Punjab coal with fifty (50) MW, hundred (100) MW and two hundred (200) MW Power plants.

• Punjab has over 317 low hydropower sites mostly under 50 MW with a cumulative generation potential of over 600 MW on canals and barrages. Others big size hydropower projects are also available.

• Punjab lies in an area of one of the highest solar radiation (insolation) in the world. The average daily radiation (insolation) amounts to 5-7kWh/m2/day and with the sun shining a good 6-8 hours daily, 18-25 MJ/M2 of daily energy is available.

• Wind is another great avenue for meeting Punjab’s energy needs. Kalar Kahar corridor, which is around 10-20km wide and 250km long, has been identified as wind corridor by National Renewable Energy Laboratory of the US Department of Energy with a wind power density at 50 m of over 800 W/m-sq.

• Under the Punjab Power Generation Policy 2006 (amended 2009) and Policy for Power Generation Projects 2002 announced by the Government of Pakistan, investors are invited to participate in the development of power generation projects of any type of technology.
PPDCL FUNCTIONS

- Punjab Power Development Company Limited (PPDCL) is corporate entity owned Government of Punjab registered with Security Exchange Commission of Pakistan (SECP)
- PPDCL is pre-dominantly governed by professionals from private sector to ensure better co-ordination with investors.
- PPDCL is mandated to develop power projects in public sector and public-private-partnership/JV mode.
- PPDCL exclusively deals/interacts with the prospective investors both national and international for tapping energy potential of the province.
- PPDCL has initiated coal power projects including dedicated coal power projects near eight (8) Industrial Estates backed by payment guarantee of Government of Punjab.
- PPDCL has also initiated hydropower projects.
- PPDCL being Government entity can manage expeditiously, consents and licenses from the various agencies for PPP projects.
# PROFILE OF 120 MW TAUNSA HYDRO POWER PROJECT
(Feasibility Study Completed)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name</th>
<th>Unit</th>
<th>Quantities</th>
</tr>
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<tr>
<td>1</td>
<td>Capacity</td>
<td>MW</td>
<td>120</td>
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<td>2</td>
<td>Annual Generation</td>
<td>Gwh (Million Kwh)</td>
<td>675</td>
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<td>3</td>
<td>Plant factor</td>
<td>%age</td>
<td>64</td>
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<td>4</td>
<td>Rated output/discharge per machine</td>
<td>MW/m$^3$/s</td>
<td>24.74/462</td>
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<td>5</td>
<td>Max./Min./rated water head</td>
<td>m</td>
<td>9.2/3.5/6.0</td>
</tr>
<tr>
<td>6</td>
<td>Total Discharge</td>
<td>m$^3$/sec</td>
<td>2310</td>
</tr>
<tr>
<td>7</td>
<td>Turbine Type</td>
<td>Bulb Type</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Number of Turbines/generators</td>
<td>set</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Rated power of generator</td>
<td>MW</td>
<td>24</td>
</tr>
<tr>
<td>10</td>
<td>Rated voltage of generator</td>
<td>KV</td>
<td>11</td>
</tr>
<tr>
<td>11</td>
<td>Power factor of generator</td>
<td></td>
<td>0.90</td>
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<td>12</td>
<td>Total construction period</td>
<td>months</td>
<td>48</td>
</tr>
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<td>13</td>
<td>Gross investment</td>
<td>USD Million</td>
<td>394</td>
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<tr>
<td>14</td>
<td>Investment per kW</td>
<td>USD/kW</td>
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<tr>
<td>15</td>
<td>EIRR</td>
<td>%</td>
<td>12.04</td>
</tr>
<tr>
<td>16</td>
<td>ENPV</td>
<td>10$^5$USD</td>
<td>10222</td>
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<tr>
<td>17</td>
<td>Benefit-cost ratio</td>
<td></td>
<td>1.28</td>
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<td>20</td>
<td>Levelized electricity tariff 30 years</td>
<td>US cent/Kwh</td>
<td>9.003</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>Taunsa Barrage Muzaffargarh</td>
<td></td>
</tr>
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</table>
Project Background
In an attempt to ease power shortage and alleviate dependence on thermal power in Pakistan, great emphasis has been laid on the possibility of building low-head hydropower stations making use of the existing barrages and canals. Taunsa Hydropower Station is listed as the third in development sequence.

Location and access of Project Area
Taunsa Hydropower Station would be built adjacent to the existing Taunsa Barrage on the Indus River, in Muzaffargarh, Punjab. It is about 30km southeast of Taunsa town. It is 120km from Multan, where there is airport. There are road and railway leading to the project area. The nearest town is Kot Addu, 10km southeast of the site. From project area, it is about 420km to Lahore and 750km to Karachi. The road from Multan to project is asphalt paved and is generally about 7m wide. Generally speaking, the project area is easily accessible.

Geographical Location of Taunsa Hydropower Project
Taunsa barrage was designed for a flood discharge of 28,300m3/s. However, greater than expected retrogression downstream of the barrage has necessitated construction of a subsidiary weir at 280m downstream of the barrage to raise water level, reduce water head difference, and decrease erosion on the downstream riverbed. Two irrigation canals, Muzaffargarh (235m3/s) and Taunsa-Panjnad (397m3/s), take water from left side of the barrage while the other two canals, Dera Ghazi Khan (410m3/s) and Kachhi (170m3/s), take water from the right side. The proposed Taunsa hydropower project is located on the right side, where there are D.G. Khan Canal and Kachhi Canal.

Feasibility Studies
Water and Power Development Authority (WAPDA) completed conceptual planning of the Taunsa HPP in 1985 and subsequently updated by GTZ- German agency for International Development in 2000. Recently Punjab Power Development Board- an organization to provide one window facility to private sector for the development of power projects has got completed detailed feasibility studies of 120MW Taunsa HPP.

Meteorology
The highest monthly mean temperature of the project area is about 44.1°C and the lowest monthly mean temperature is about 18.0°C; the annual precipitation ranges from 83.0mm to 513mm and the annual mean precipitation is about 208mm; the mean annual wind speed ranges from 0.87m/s to 2.21m/s; and the mean annual relative humidity is 56.5%.

Flood
The flood season ranges from May to September in each year. The maximum flood peak is observed at 27,000m3/s in 2010, and the minimum flood peak is observed at 5,300m3/s in 2004.
Land Acquisition and Resettlement

Land acquisition areas of this project consist of permanent and temporary land acquisition. The permanent land is 59.05hm², while the temporary is 166.72hm². Punjab Government will provide full support for land acquisition and resettlement.

Assessment of Environmental Impact and Measures

Taunsa hydropower project will not influence irrigation and drinking water of the downstream after implementation of the project. According to preliminary analysis of environmental protection, there are no key environmentally restricted factors during construction period as well.

Dispersal of Power: Project will be developed as on Grid facility and will feed the National Grid

Business Plan to undertake the project

Project may be undertaken in Joint Venture (JV) mode after selection of sponsor. The investor would sign a Development Agreement with Punjab Government entity, Punjab Power Development Company Limited (PPDCL) and carry out feasibility study at his own cost. Following the approval of feasibility study by panel of experts, the project JV partner will be selected through competitive process wherein sponsor will have first right of refusal. Special Purpose Vehicle (SPV) will be created in Pakistan after a Joint Venture Agreement between selected partner and PPDCL. SPV will finalize Power Purchase Agreement, Implementation Agreement and Coal supply Agreement. With the respective entity. Thereafter SPV will achieve financial close and proceed ahead for implementation of the project.

Punjab Government Share: 20-25% by PPDCL & remaining by JV Partner

Total Investment: US$ 394 million

Capitalization: The total capitalization of the project company will be around $394 million. This will be funded with debt and equity at an agreed ratio amongst the partners. The minimum equity requirement under law is 20% of the capitalization.

Loan: To be negotiated but with primary responsibility of arrangement residing with the majority investor i.e. JV partner.

Brief Description about the Project (Including viability, market potential return on investment, tenure of cooperation etc): Developed infrastructure, efficient and skilled human resource with enormous industrial growth rate has made the Punjab as most lucrative business destination. The regulation allows an annual rate of return of 20% in USD terms, net of all taxes, based on equity investment made. So, the tariff will include operational costs, Water use charge, debt repayment plus 20% return on equity.

Tenure of the project: 30 years.
## PROFILE OF FIVE (5) HYDRO POWER PROJECTS
(Feasibility Study Completed)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Description</th>
<th>LCC</th>
<th>Khanki Barrage (KB)</th>
<th>Qadirabad Barrage</th>
<th>UCC</th>
<th>QB Link</th>
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<tbody>
<tr>
<td>1</td>
<td>Capacity (MW)</td>
<td>7.55</td>
<td>14.09</td>
<td>23</td>
<td>3.58</td>
<td>7.68</td>
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<td>2</td>
<td>Annual Generation (Gwh)</td>
<td>43.61</td>
<td>38.34</td>
<td>54.53</td>
<td>17.19</td>
<td>52.59</td>
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<td>3</td>
<td>Plant factor (%)</td>
<td>65.94</td>
<td>31.06</td>
<td>27.06</td>
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<td>4</td>
<td>Rated water head (m)</td>
<td>3.57</td>
<td>2.62</td>
<td>3.68</td>
<td>2.39</td>
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<td>5</td>
<td>Total Discharge m³/s</td>
<td>240</td>
<td>600</td>
<td>700</td>
<td>170</td>
<td>450</td>
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<td>6</td>
<td>Turbine Type</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>Number of Turbines/generators</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
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<tr>
<td>9</td>
<td>Total construction period (Years)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>10</td>
<td>Gross investment US$ million</td>
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<td>11</td>
<td>EIRR (%)</td>
<td>24.29</td>
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<td>12.93</td>
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<td>12</td>
<td>FIRR (%) Public</td>
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<td>9.17</td>
<td>8.83</td>
<td>14.68</td>
<td>18.98</td>
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<tr>
<td>13</td>
<td>FIRR (%) PPP-mode</td>
<td>17.48</td>
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<td>18.86</td>
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<td>14</td>
<td>Levelized Tariff Public C/Kwh</td>
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<td>14.15</td>
<td>9.40</td>
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<td>15</td>
<td>Levelized Tariff PPP mode C/Kwh</td>
<td>10.08</td>
<td>18.69</td>
<td>19.19</td>
<td>12.73</td>
<td>9.32</td>
</tr>
</tbody>
</table>

- **Horizontal double regulated Kaplan Pit Turbine**

**Power Generation Projects in Punjab (Pakistan)**
1. **LCC (Lower Chenab Canal RD 0+000) Near Wazirabad District Gujranwala**

   Project is conceived by utilizing water head available at the head regulator of Lower Chenab Canal off taking from Khanki Barrage.

   **Location:** The Hydropower project site (N 32° 24’ 06'', E 73° 58’ 13'’) lies on the left side Khanki Barrage on river Chenab and is located about 20 km south west from the city of Gujrat. The Project area is predominantly flat.

   **Access:** The project is accessible through Wazirabad-Saroki Road from main GT Road near city of Wazirabad.

   **Dispersal of Power:** This power project will supply power to nearest 132 kV Wazirabad Grid Station located at 20 km distance by constructing a 33 kV line.

   **Feasibility Study:** Completed in September, 2011.

2. **Khanki HPP on Barrage Near Wazirabad District Gujranwala (14MW)**

   This Hydropower Project is conceived by utilizing head difference between the pond level upstream of the Khanki Head Works and the river bed downstream of the head works.

   **Location:** The hydropower power site (N 320 25’ 00.69'', E 730 57’ 52.21'’) lies on right side of Khanki Barrage on River Chenab located about 20 km south west from the city of Gujrat. Site is predominantly flat.

   **Access:** The project is accessible through Wazirabad-Saroki Road emanating from main GT Road near city of Wazirabad.

   **Meteorology:** The climate of the project area is sub-tropical continental. Mean monthly temperature in June rises to a highest value of 32.1oC and falls to the lowest value of 11.6oC in January.

   **Dispersal of Power:** This power project will supply power to nearest 132 kV Wazirabad Grid Station located at 20 km distance by constructing a 33 kV line.

   **Feasibility Study:** Completed in September, 2011.

3. **Qadirabad Barrage Near Ali Pur Chatta District Gujranwala (23MW)**

   This Hydropower Project is conceived by utilizing head difference between the pond level upstream of the Qadirabad Barrage on River Chenab and the river bed downstream of the Barrage.

   **Location:** The hydropower power site (N 320 19’ 52.24’’, E 730 41’ 34.83’’) lies on the right side of Qadirabad Barrage on River Chenab and exists at the boundary of Gujranwala and Mandi Bahauudin districts of the Punjab Province. The Project
area is predominantly flat.

**Access:** The project is accessible through Gujrat-Shadiwal road or through RMB of Khanki Headworks

**Meteorology:** The climate of the project area is sub-tropical continental. Mean monthly temperature in June rises to a highest value of 32.1°c and falls to the lowest value of 11.6°c in January

**Dispersal of Power:** This power project will supply power to nearest 132 kV Wazirabad Grid Station located at 22 km distance by constructing a 33 kV line.

**Feasibility Study:** Completed in September, 2011.

4. **Upper Chenab Canal (RD 133+296) Near Bombanwala District Sialkot (3.58MW)**

This Hydropower Project is conceived by utilizing head available at Head Regulator of BRBD Canal off taking at Bombanwala from Upper Chenab Canal.

**Location:** The hydropower site (N 33° 34' 229'', E 91° 60' 68'') exists on right side of fall structure RD 133+296 on UCC and is located about 7.4 km north west of Daska city in Sialkot district. The Bombanwala Ravi Bedian Dipalpur (BRBD) LINK canal takes off from the left side of UCC through Bombanwala regulator. The project area is predominantly flat.

**Access:** The project is accessible through Daska-Wazirabad Road which crosses the cross regulator of UCC at RD 133+296.

**Meteorology:** The climate of the project area is sub-tropical continental. Mean monthly temperature in June rises to a highest value of 39.2°c and falls to the lowest value of 5.1°c in January

**Dispersal of Power:** This power project will supply power to nearest 132 kV Grid Station in Industrial Estate Daska through 12 Km long 11 kV line.

**Feasibility Study:** Completed in September, 2011.

5. **Qadirabad Balloki Link Canal (RD 304+985) District Sheikupura**

This Hydropower Project is conceived by utilizing head available at Head Regulator at RD 304+985 of Qadirabad Balloki Link Canal.

**Location:** The hydropower site (N 33° 34' 229'', E 91° 59' 34'') exists on an un-gated fall structure at RD 304+985 on QB Link in Sheikupura District. The Project area falls in is predominantly flat.

**Access:** The project site is accessible through through Sheikhupura-Faisalabad road which crosses QB Link at RD 271+655.

**Meteorology:** The climate of the project area is sub-tropical continental. Mean monthly temperature in June rises to a highest value of 33.6 °c and falls to the lowest value of 13.2 °c in January.

**Dispersal of Power:** This power project will supply power to nearest 132 kV Warburton Grid Station 16 km long 33 kV line.
Feasibility Study: Completed in September, 2011.

Brief Business Plan to undertake the project.

Mode of Investment: Independent Power Producer, PPP (JV) or Public Sector

Option 1: Power project may be developed as an Independent Power Producer (IPP) for on Grid or off Grid. In later case the energy produced will be supplied to industrial estates. Sponsor of the project will be selected through open competitive process and selected sponsor will complete feasibility study at his own cost. Following approval of feasibility study by Panel of Experts, the sponsor will sign Power Purchase Agreement, Implementation Agreement and Coal Supply Agreement. Thereafter the sponsor will achieve financial close and proceed for implementation of power project.

Option 2: Project may be undertaken in Public-Private Partnership (PPP) - Joint Venture (JV) mode after selection of sponsor. The investor would sign a Development Agreement with Punjab Government entity, Punjab Power Development Company Limited (PPDCL) and carry out feasibility study at his own cost. Following the approval of feasibility study by panel of experts, the project JV partner will be selected through competitive process wherein sponsor will have first right of refusal. Special Purpose Vehicle (SPV) will be created in Pakistan after a Joint Venture Agreement between selected partner and PPDCL. SPV will finalize Power Purchase Agreement, Implementation Agreement and Coal supply Agreement. With the respective entity. Thereafter SPV will achieve financial close and proceed ahead for implementation of the project.

Option 3: May also be undertaken in public sector through loan by lending agencies.

Capitalization:

The total capitalization of the each project varies from project to project. This will be funded with debt and equity. The minimum equity requirement under law is 20% of the capitalization, while the lending institutions require anywhere from 20%-25%.

Punjab Government Share in PPP-mode (JV): 20-25% by PPDCL & remaining by JV Partner

Loan: In case of IPP, loan will be arranged by the sponsor. In case of PPP-mode(JV), primary responsibility of arrangement loan residing with the majority investor and is subject to negotiation between the JV partner.

Brief Description about the Project (Including viability, market potential return on investment, tenure of cooperation etc)

There are no restrictions on capital transfer.. The regulation allows an annual rate of return of 17% in USD terms for hydropower, net of all taxes, based on amount of equity investment. So, the tariff will include cost recovery of fuel, operations costs, debt repayment plus 17% return on equity, on an annual basis.

Tenure of cooperation: 30 years.
ROLE OF PUNJAB GOVERNMENT FOR COAL MINING

According to Constitution of Pakistan, coal/minerals are a provincial subject Provincial. Punjab Mines & Mineral Department is responsible for the development of coal and minerals. The Directorate of Mines has been established for issuing prospective licenses for the development of coal and granting mine lease for the production of coal.

PUNJAB COAL RESERVES

Punjab Mines and Mineral Department has recently completed a study about coal reserves in Punjab through World renowned Consultants M/s Snowden Australia which has confirmed the availability of 500 million ton coal reserves. These reserves are mainly located in four districts namely Jhelum, Chakwal, Khushab and Mianwali. Punjab coal is classified as Sub-bituminous and a heating value ranging from 9472 to 15801 BTU/pound. It has low ash and high sulfur and considered suitable for power generation.

The Salt-Range coal field covers an area of about 260 sq. km between Khushab, Dandot in Chakwal and Jhelum district of the Punjab. Coal seams varies in thickness from 0.3 meter to 1.5 meter with an average thickness of 0.75 meters.

<table>
<thead>
<tr>
<th>Punjab coal quality</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture %</td>
<td>03.20-10.80</td>
</tr>
<tr>
<td>Ash %</td>
<td>12.30-42.2</td>
</tr>
<tr>
<td>Volatile matter %</td>
<td>21.5-38.80</td>
</tr>
<tr>
<td>Fix carbon %</td>
<td>25.70-44.80</td>
</tr>
<tr>
<td>Sulfur %</td>
<td>02.60-10.70</td>
</tr>
<tr>
<td>Calorific value</td>
<td>9472-15801Btu/lb</td>
</tr>
</tbody>
</table>

COAL BASED POWER PROJECTS IN PUNJAB

Punjab Government has identified raw sites for coal based power projects near Industrial states which will supply quality electricity to industrial units each having capacity of 50MW. Another 200MW is also planned near mine mouth in Chakwal District. A coal project of 270MW is also planned near Ghazi Ghat District Muzaffargarh with coal supply from Chamalang Area Balochistan. Both these projects will supply power to National Grid.

PUNJAB COAL SUPPLY ARRANGEMENT

Punjab has established a government owned corporate entity, Punjab Mining Company Ltd and is responsible for the supply of coal for the Power Projects in Punjab.
200-300MW Coal Power Project is planned near Ghazi Ghat in District Muzaffargarh on a coal supply of 1 million Ton per annum from Balochistan Province. The Government of Punjab has signed an MOU with Government of Baluchistan for supply of coal from Chamalang, District Lora lies, Balochistan. Punjab Mining Company (PMC), registered with SECP will be responsible to ensure supply of coal on sustainable basis at site.

| COAL ANALYSIS (Chamalang Balochistan): |
|------------------|------|
| Elements         | %age |
| Fixed Carbon     | 19.4-47.8% |
| Volatile Matter  | 24.9—43.5% |
| Moisture         | 1.1—2.9%  |
| Ash              | 9.1—36.5% |
| Total Sulphur    | 3.0—8.5%  |
| Heating Value Btu / lb | 12500—14357 |

**Location:** The project site is located on right bank of MUZAFFARGARH CANAL, near the north side of the 500KV line, southwest of KARIMDAD QURESHI city, Muzaffargarh, Punjab Pakistan. The plant site is flat with the design elevation and there are no earthworks before construction.

**Access:** The site is located near road joining Muzaffargarh City with DG Khan City. All types of infrastructure including road link, railway, drainage, water availability and communication links are available.

**Coal:** Indigenous coal from Chamalang Balochistan Province.

**Previous Study:** A pre-feasibility study has already been carried out and will be shared with the sponsor of the project during detailed feasibility study.

**Dispersal of Power:** Project will be developed as on Grid facility and will feed the National Grid

**Business Plan to undertake the project.**

Project may be undertaken in Joint Venture (JV) mode after selection of sponsor. The investor would sign a Development Agreement with Punjab Government entity, Punjab Power Development Company Limited (PPDCL) and carry out feasibility study at his own cost. Following the approval of feasibility study by panel of experts, the project JV partner will be selected through competitive process wherein sponsor conducting feasibility study will have first right of refusal. Special Purpose Vehicle (SPV) will be created in Pakistan through a Joint Venture Agreement between selected partner and PPDCL. SPV will finalize Power Purchase Agreement, Implementation Agreement and Coal Supply Agreement.
with the respective entity. Thereafter SPV will achieve financial close and proceed ahead for implementation of the project.

**Punjab Government Share:** 20-25% by PPDCL & remaining by JV Partner

**Total Investment:** US$ 340 million

**Capitalization:** The total capitalization of the project company will be around US$340 million. This will be funded with debt and equity at an agreed ratio amongst the partners. The minimum equity requirement under law is 20% of the capitalization.

**Loan:** To be negotiated but with primary responsibility of arrangement residing with the majority investor i.e. JV partner.

**Brief Description about the Project (Including viability, market potential return on investment, tenure of cooperation etc):** Developed infrastructure, efficient and skilled human resource with enormous industrial growth rate has made the Punjab as most lucrative business destination. The regulation allows an annual rate of return of 20% in USD terms, net of all taxes, based on equity investment made. So, the tariff will include cost recovery of fuel, operations costs, debt repayment plus 20% return on equity. Tenure of the project will be 30 years.

**Mode of Cooperation:** Joint Venture mode

**Major Equipment for 2x135MW Coal Power Plant:**
- Two(2) Steam Generating Units each with a minimum capacity of 135 MW, firing coal as main fuel
- Two (2) Condensing steam turbines and condenser,
- Water cooling systems in adequate capacity,
- Two (2) AC generator with fully static excitation system,
- Unit step-up transformer and unit auxiliary transformer,
- Complete systems of electrical and mechanical control and monitoring equipment,
- Power house buildings equipped with appropriate, ventilation and air conditioning systems,
- Central control building to house all the control and monitoring systems of the power plant,
- Coal and ash handling system, including the coal yard,
- Limestone system with the Limestone storage, handling system,
- Service/seal air and process water distribution system,
- Boiler stack,
- All necessary auxiliary plant.
In the wake of power shortage, the Government of Punjab has planned to install Coal Power Plants near eight (8) Industrial Estates for uninterrupted electricity supply to manufacturing units.

### Industrial Estate

<table>
<thead>
<tr>
<th>Industrial Estate</th>
<th>Expected Load by Dec 2014 (MW)</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sundar Lahore</td>
<td>60</td>
<td>95% Completed</td>
</tr>
<tr>
<td>2. Quaid-e-Azam Lahore</td>
<td>50</td>
<td>100% Colonized</td>
</tr>
<tr>
<td>3. Multan-I</td>
<td>50</td>
<td>100% Completed</td>
</tr>
<tr>
<td>4. Multan-II</td>
<td>-</td>
<td>80% Completed</td>
</tr>
<tr>
<td>5. Rahim Yar Khan</td>
<td>-</td>
<td>Construction in Process</td>
</tr>
<tr>
<td>6. Bhalwal</td>
<td>-</td>
<td>Construction in Process</td>
</tr>
<tr>
<td>7. M3 Faisalabad</td>
<td>50</td>
<td>25% Developed</td>
</tr>
<tr>
<td>8. VAC Kharianwala</td>
<td>25</td>
<td>40% Colonized</td>
</tr>
</tbody>
</table>

**Location:** Each project is located in the vicinity of the Industrial Estate, the final selection of the site will be determined in detailed feasibility study.

**Access:** Each site is located near a big city and all types of infrastructure including road link, railway, drainage and communication are available.

**Coal:** Indigenous coal or imported coal as may be determined through feasibility study.

**Previous Studies:** Preliminary study has been carried out for few projects and available information will be shared with the sponsor or JV partner during detailed feasibility study.

**Dispersal of Power:** Project may be developed as off grid or on grid. However two projects at Sunder and M3 Faisalabad will ordinarily be developed as off grid project supplying electricity to industrial estates.

**Brief Business Plan to undertake the project.**

**Mode of Investment:** Independent Power Producer, Joint Venture Mode or Public Sector

**Option 1:** Power project may be developed as an Independent Power Producer (IPP) for on Grid or off Grid. In later case the energy produced will be supplied to industrial estates. Sponsor of the project will be selected through open competitive process and selected sponsor will complete feasibility study at his own cost. Following approval of feasibility study by Panel of Experts, the sponsor will sign Power Purchase Agreement, Implementation Agreement and Coal Supply Agreement. Thereafter the sponsor will achieve financial close and proceed for implementation of power project.

**Option 2:** Project may be undertaken in Joint Venture (JV) mode after selection of sponsor. The investor would sign a Development Agreement with Punjab Government entity, Punjab Power Development Company Limited (PPDCL) and carry out feasibility study at his own cost. Following the approval of feasibility study by panel of experts, the project JV partner will be selected through competitive process wherein sponsor will have first right of refusal. Special Purpose Vehicle
A Special Purpose Vehicle (SPV) will be created in Pakistan through Joint Venture Agreement between selected partner and PPDCL. SPV will finalize Power Purchase Agreement, Implementation Agreement and Coal supply Agreement with the respective entity. Thereafter SPV will achieve financial close and proceed ahead for implementation of the project.

**Option 3:** 50MW Coal Power Project near Industrial Estates Sunder Lahore and M-3 Industrial City Faisalabad will ordinarily be undertaken in public sector.

**Total Investment:** US$ 65 million (each project of 50MW capacity)

**Capitalization:**

The total capitalization of each project company will be around US$ 65 million. This will be funded with debt and equity. The minimum equity requirement under law is 20% of the capitalization, while the lending institutions require anywhere from 20%-25% equity.

**Punjab Government Share in PPP-mode (JV):** 50% by PPDCL & remaining by JV Partner

**Loan:** In case of IPP, loan will be arranged by the sponsor. In case of (JV), primary responsibility of arrangement loan residing with the majority investor and is subject to negotiation between the JV partner.

**Brief Description about the Project (Including viability, market potential return on investment, tenure of cooperation etc)**

The regulation allows an annual rate of return of 20% (Imported Coal) and 17% (Local Coal) in USD terms for coal projects, net of all taxes, based on amount of equity investment made. So, the tariff will include cost recovery of fuel, operations costs, debt repayment plus 20% (Imported Coal) and 17% (Local coal) return on equity, on annual basis. Projects are technical and financially viable.

**Tenure of cooperation:** 30 years.
Please refer all queries to the following:

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