Overview of the Energy Sector

9.0 Introduction

The power sector in the province as well as at the national level is currently undergoing a major transformation as it is expecting the dividends to yield from the investments and commitments made over the last few years. This transition is expected to push Pakistan into an energy surplus position as compared to a shortage that has existed for decades. This shows that the provincial and federal governments have finally come to resolve and have aligned their priorities for overcoming the energy crises in the country. Energy crises has had a major adverse impact on the economy, especially during the period 2007 to 2013-14 when the shortfall was at its peak – the position is still of a shortage, however, the deficit is smaller than earlier years. Punjab has been at the worse end of this energy shortage, where industries faced closure due to lack of and excessive cost of power. The process related industry suffered the most, as they had to revert to alternative sources of power generation; cost of which has been at least three times more than that of the grid. In the post 18th Amendment and during the current government’s tenure the province has invested significantly to develop its own power generation capabilities; not only from traditional expensive methods but also exploring solar and renewable energy opportunities.

The Government of Pakistan, simultaneously enhanced efforts for bringing in new power generation plants through the China-Pakistan Economic Corridor (CPEC) agreement. Similarly, realising the sub-optimal energy mix, the aim under the new approach is to have more renewable energy projects which will provide necessary diversification and increased energy security to the sector. However, most of these will take time to mature, and the energy fuel mix for the immediate future will stay the same.

According to the available plans, more than 17,200 MW are expected to be added to the system. In order to meet peak demand about 8,000 MW was to be inducted by the end of June, 2017. Most of this planned increase in capacity is expected to come from Solar and Wind Projects, 3,600 MW R-LNG based projects, and functioning of the hydropower projects at Tarbela and Neelum- Jhelum.

Whereas, significant progress has been made in the generation sector, strengthening of the transmission and distribution sectors is equally critical. One of the key problems faced by the power sector is the network overload; which not only hinder the power transfer capability but also add to wastage of electricity through increased losses. The constraints on transmission networks have also led to severe power evacuation problems resulting in inability to utilize the full potential of the most efficient power generation points. Thus, huge investments and managerial capacity building of NTDC is required in order to fully benefit from the addition of this extra generation capacity by June of 2017. Similarly, a multitude of issues affect the performance of the DISCOs that need to be addressed. The efforts of the government has shown some early results, with duration and frequency of load shedding going down considerably in 2015-16 as compared to 2013. Some of this has also been helped by a stark decline in the price of furnace oil. This has also led a decrease in the cost of generation. The average basket price of generation fell from Rupees 10.59 to Rupees 9.84 per MV between 2013 – 2015.

The US$ 46 billion agreement under the CPEC includes around US$ 33.8 billion of investments in various energy projects. Under the CPEC agreement, US$ 15.5 billion worth of coal, wind, solar and hydropower projects will add 10,400 MW of energy to the national grid. A cooperation on developing nuclear energy is also expected, that will result in significant generation capacity and lowering the cost of energy.

Table 1 below provides demand and supply analysis in NTDC system, actual and projected till 2021. As the generation plans mature, it is expected that beyond 2018, the country will have surplus capacity as well as capability. The result of this is already evident as the load shedding duration reduced from 12 hours in 2013 to 6 hours in 2016 in the urban areas. Similarly, load shedding in the industrial sector reduced from 12 hours to 4 hours over the same period. Rural areas have also witnessed relative reduction in their load shedding hours. However, installed capability is only half the solution, there must be an upgradation of the transmission and distribution systems to sustain this new enhanced generation capacity.
A similar trend of demand and supply can be observed for the Punjab. Between the years 2011 to 2016, the deficits have averaged at around 3,700 MW per year, with the maximum deficit observed in 2012, when demand exceeded supply by 4,991 MW. However, it is projected that by 2018 this shortfall will be completely met.¹

Moreover, in order to meet the distribution needs of this expanded capacity, 3 new grid stations at 500 KV level will be added by June 2017. A fourth 500 KV grid station will also be added by 2020. At 220 KV level, 8 new grid stations with a cumulative transformation capacity of 5,750 MVA will be added in the system. Moreover, one overloaded 500KV grid station will be strengthened, while six such grid stations at 220 KV level will be improved by 2019-2020. More specifically for Punjab, Nishat Power Limited and Nishat Chunian Power Limited are facing power evacuation problems since commissioning due to constraints in LESCO grid system.

The main problem is the constraint in the capacity of three feeders which connect Bhai Pheru and Sarfraz Nagar Grids. In case one line is out, the remaining two get overloaded and trip, resulting in a complete shutdown. In 2015 alone, Nishat Power faced 14 shutdowns while since its operation Nishat Chunian has faced 45 shutdowns. This issue needs to be resolved as the private sector in partnership with the federal government is in the process of adding more projects (see table 2).

Table 1: Supply & Demand in NTDC System, MW per year

<table>
<thead>
<tr>
<th>June of 30th</th>
<th>Installed Capacity (MW)</th>
<th>Actual /Planned Capability (MW)</th>
<th>Actual/Projected Demand (MW)</th>
<th>Surplus/[Deficit] MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012(A)</td>
<td>12,320</td>
<td>18,940</td>
<td>(6,620)</td>
<td></td>
</tr>
<tr>
<td>2013(A)</td>
<td>13,577</td>
<td>18,827</td>
<td>(5,250)</td>
<td></td>
</tr>
<tr>
<td>2017(P)</td>
<td>24,643</td>
<td>20,106</td>
<td>3,316</td>
<td>(3,710)</td>
</tr>
<tr>
<td>2018(P)</td>
<td>32,312</td>
<td>24,440</td>
<td>25,140</td>
<td>(500)</td>
</tr>
<tr>
<td>2019(P)</td>
<td>34,018</td>
<td>26,663</td>
<td>26,436</td>
<td>224</td>
</tr>
<tr>
<td>2020(P)</td>
<td>38,740</td>
<td>29,059</td>
<td>27,725</td>
<td>1,334</td>
</tr>
<tr>
<td>2021(P)</td>
<td>41,950</td>
<td>33,776</td>
<td>29,082</td>
<td>4,694</td>
</tr>
</tbody>
</table>


Thus, in total, some 8,303 MW of generation capacity will be added by Punjab in the next 5 years. However, on average the existing distribution system already has a 50 percent overload. Once this new capacity is installed, the distribution system will not be able to cope with this additional supply. Hence, there is a strong need for the provincial government to advocate for investments in the distribution networks.

9.1 Energy Space of the Punjab post 18th Amendment

Punjab is currently the biggest consumer of energy in the country and it consumes 68 percent of the demand. The historic and present level of power supply gap has seriously damaged its economic growth, and the Punjab Growth Strategy 2018 estimated that resolving energy issue alone will add 2 percent to GDP growth. However, along with the 18th Amendment to the Constitution of Pakistan and the decisions made at the Council of Common Interest (CCI), the opportunity now exists to develop power projects and thereby participate more actively in the effort to reduce the existing energy gap. The Punjab Government has been extremely proactive in not only developing new power projects but also instituting demand side management and energy conservation measures to address the issues of the sector. The institutional structure put in place to implement energy initiatives in the Punjab now include:

**Punjab Power Development Board (PPDB):** It provides a single window facility to promote and encourage private Independent Power Producers (IPPs) for the development of power generation projects. This has really opened-up the facilitation and policy space in the Punjab’s power sector.

**Punjab Power Development Company (PPDCL):** The company has been set up for the development of projects on fast track basis in the public sector. The company is registered with the SECP and has been a key addition to the energy
institutions are even more pronounced. In Punjab, 27.59 percent of the 5,291 11 KV feeders and just over 13 percent of the distribution transformers are significantly overloaded. Due to overload in Lahore and Multan, the line losses are much higher than target. In Lahore, the line losses are around 14.1 percent against a target of 11.75 percent and in Multan the line losses are 15.5 percent.

**Punjab Power Management Unit (PPMU):** PPMU has been set up to plan, procure and implement the ADB funded Renewable Energy Projects of Punjab in the public sector. This includes programmes such as solarisation at schools and basic health facilities.

**Directorate of Power Projects (DoPP):** DoPP has been set up for the development of non-commercial / model renewable energy projects in the public sector in the Punjab. These once established will be handed over to the concerned public sector entity or community for operation and maintenance.

**Punjab Energy Efficiency and Conservation Agency (PEECA):** PEECA will be looking at the demand side management activities and encourage efficiency and conservation measures.

**Punjab Power Policy:** A power policy for the Punjab was initially established in 2006 (Punjab Power Policy 2006) but progress was slow against the policy objectives. The policy was then revised in 2009 but project development was still slow. However, with a much larger institutional support the 2009 policy implementation has now gained significant momentum and many projects are now in progress or near completion. Under the governments existing plans, the target is to add a total generation of around 17,000 MW at a cost of around PKR 2 trillion over the next 10 years.

**Punjab’s Energy Resources:** The large to medium hydro power resources in the Punjab have already been utilized or are still under development. Thus, further projects of large scale are probably not feasible at present. The remaining area is a relatively flat terrain along with major rivers. However, the irrigation canals and barrages within its territory provide an opportunity for low-head hydro projects. Similarly, the province does not have oil or gas reserves that can be used as a natural source of energy generation. While there are coal reserves in four districts the seams are too thin and deep to be feasible for a power plant. Similarly, the opportunities via wind are low as there are no major wind corridors. Thus, the real opportunity lies in utilising the solar energy and small hydro power plants. For the coal and gas based plants, the fuel will have to be imported.

**Energy Distribution Network in the Punjab:** Out of the 10 DISCOs nationwide, Punjab is home to five, namely LESCO, GEPCO, FESCO, MEPCO and IESCO. DISCOs have constraints in their network which restrict their ability to supply power from their 132 KV network to 11 KV system. Such constraints have not been highlighted effectively till date, however, in fact are more damaging as the generation capacity available is not being supplied to the end-consumers. Table 3 below shows that all of the five companies in the Punjab have a high degree of overload on transformers resulting in frequent tripping and damage to the system resulting in loss of power. The position in Multan is the worst followed by Lahore at 132 KV level.

**Table 3: Distribution Overload Situation in the Punjab**

<table>
<thead>
<tr>
<th>DISCOs / 132 KV Level</th>
<th>Total No. Grid Stations</th>
<th>Total No. of Power Transformers</th>
<th>Total Capacity of Power Transformers (MVA)</th>
<th>No. of Power Transformers Overloaded (Above 80%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IESCO</td>
<td>78</td>
<td>168</td>
<td>4,48</td>
<td>65</td>
</tr>
<tr>
<td>GEPCO</td>
<td>52</td>
<td>149</td>
<td>3,800</td>
<td>78</td>
</tr>
<tr>
<td>LESCO</td>
<td>89</td>
<td>226</td>
<td>6,610</td>
<td>105</td>
</tr>
<tr>
<td>FESCO</td>
<td>62</td>
<td>146</td>
<td>3,984</td>
<td>95</td>
</tr>
<tr>
<td>MEPCO</td>
<td>96</td>
<td>201</td>
<td>5,106</td>
<td>131</td>
</tr>
</tbody>
</table>

Source: DISCOs

At the 11 KV level the problem areas are even more pronounced. In Punjab, 27.59 percent of the 5,291 11 KV feeders and just over 13 percent of the distribution transformers are significantly overloaded. Due to overload in Lahore and Multan, the line losses are much higher than target. In Lahore, the line losses are around 14.1 percent against a target of 11.75 percent and in Multan the line losses are 15.5 percent.

Institutional Re-structuring: Historically, electricity as a subject was dealt by the Power Wing of Irrigation and Power Department in the Punjab. The Power Wing primarily dealt with regulatory aspects of electricity distribution, consumer and supplier disputes, and safety aspects of electrical installations at public and private buildings. On creation of energy
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9.2 Key Initiatives by the Punjab Government

Energy Department, Government of Punjab is currently undertaking following projects in IPP mode and public sector to bridge the supply demand gap for electricity in Punjab:

Power wing has the following functions:

1. The Administrator of Electricity Act, 1910 & Electricity Rules, 1937 and provincial offices of inspection established under the Section 38 of the NEPRA Act, 1997 regarding enforcement and violation of DISCO’s instructions in respect of matters connected with metering, billing, collection of tariff and other connected matters.

2. Implementation of the Punjab Cinematograph Rules, read with Motion Picture Ordinance relating to the use of electricity and cinematograph apparatus in cinemas.

3. Matters connected with distribution of Power and Distribution companies.

4. Administrative matters connected with electricity duty under the West Pakistan Finance Act, 1964 and rules under it.

5. Regulation, controlling and granting electrical contractors licenses and supervisory competency certificate and other matters connected with regional licensing boards in Lahore, Multan, Faisalabad, Gujranwala, Islamabad and Provincial Licensing Board, Lahore.

6. Investigations into electrical accidents in factories, power houses and other electrical installations.

Establishment of Reconciliation Cell (RC):
Government of Punjab has accorded the RC with the following objectives:

1. Elimination of billing by DISCOs against disconnected, transitioned and ideal connections.

2. Elimination of incorrect billing through defective meters.

3. Elimination of factious billing against the correct meter.

4. Deletion of not related connections.

5. Survey of all disputed connections by Electric Inspectors coordination with the concerned departments and DISCOs.


7. To audit the billing of housing colonies.

8. Creating awareness in the departments to check the inflated bills prior to pre-audit.

9. Compilation of PEPCO receivable on yearly basis and appraise to Finance Department

10. To carry out the survey of streetlight disputed connections in Punjab maintained by District Governments.

11. Monitoring of load factor of each connection.

12. Monitoring and checking of SCARP tube wells connections.
1. 1320 MW, Coal Fired Power Project, Sahiwal being developed in IPP mode by Huaneng Shandong Ruyi.

2. 1180 MW, RLNG based Power Project at Bhikki, being developed in public sector by Quaid-e-Azam Thermal Power Limited, 100% owned by Government of Punjab.


4. 900 MW, Solar Power Plant, at Quaid-e-Azam Solar Park Bahawalpur being developed in IPP mode by Zonergy Ltd.

5. 100 MW, Solar Power Plant at Quaid-e-Azam Solar Park Bahawalpur, being developed in IPP mode by Zorlu Enerji Elektrik.

1320 MW, Coal Fired Power Project, Sahiwal:

- 2x660 MW CFPP by M/s. Huaneng Shandong Ruyi Pakistan Energy Private Limited (HSR)
- All project agreements signed with Federal & Provincial entities (PPA, IA, ICTA, WUA, LSA & Port Handling Agreement)
- Civil and mechanical work at site is in full swing
- Commercial Operation Date (COD) – December 25, 2017
- Expected ahead of schedule completion – June 30, 2017
- Accepted upfront tariff in March 2015 Levelled tariff is Rs 8.1175/KWh
- Overall Project Completion: 89.86%
  - Design: 100% Completed
  - Procurement: 100% Completed
  - Construction: 97% Completed
  - Commissioning: 18% Completed

1180 MW, RLNG based Power Project at Bhikki:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Progress</td>
<td>100%</td>
</tr>
<tr>
<td>Procurement Progress</td>
<td>94.50%</td>
</tr>
<tr>
<td>Construction Progress</td>
<td>79.48%</td>
</tr>
<tr>
<td>Overall Project Progress</td>
<td>81.57%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1180 MW, RLNG based Power Project at Bhikki:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Capacity (Gross)</td>
</tr>
<tr>
<td>Project Capacity (Net)</td>
</tr>
<tr>
<td>Gas Turbine Type</td>
</tr>
<tr>
<td>Project Technology</td>
</tr>
</tbody>
</table>
900 MW, Solar Power Plant, at Quaid-e-Azam Solar Park Bahawalpur

- 9x100 MW SPP at Bahawalpur by M/s. Zonergy Co. Ltd.
- Prioritized CPEC Energy project
- Project financing by China Exim Bank & support by Sinosure assured in February 2015
- 1st CPEC Energy project to inject electricity into the National Grid
- 3x100 MW is transmitting electricity into National Grid
- 6x100 MW regulatory approvals in process

100 MW, Solar Power Plant at Quaid-e-Azam Solar Park Bahawalpur

<table>
<thead>
<tr>
<th>Since Commissioning, QASP 100MW Injected in NTDC grid</th>
<th>280 GWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>In One year QASP 100MW had produced</td>
<td>160 GWh</td>
</tr>
<tr>
<td>Carbon Dioxide avoided Per Year</td>
<td>98,000 Tonnes</td>
</tr>
<tr>
<td>Energy for Approx. Typical Homes</td>
<td>100,000 Nos.</td>
</tr>
<tr>
<td>Saved emission of equivalent approximately Cars</td>
<td>25,000 Nos.</td>
</tr>
</tbody>
</table>

- The Company is being privatized and the transaction advisors are on board.

100 MW, Solar Power Plant at Quaid-e-Azam Solar Park Bahawalpur

- Zorlu Enerji Elektrik, Turkey is developing 100 MW Solar Power Project in the QA Solar Park, Bahawalpur
- Unprecedented low tariff and unmatched project timelines have been agreed with the Company
- Project Launching ceremony was held on 26th January 2017

Waste to Energy project

LOI has been issued for development of 40 MW Waste to Energy Power Project in Lahore as an Independent Power Producer (IPP). LWMC has indicated that more than 5,000 tons of Solid Waste is produced on daily basis and out of 5,000 tons/day collection, 2,000 tons/day MSW is available for use of proposed Waste to Energy Power Project.

Bio mass based power project

Feasibility is being conducted for establishment of 15-20 MW Bio Mass Thermal Power Plant near Chak Jhumra, Faisalabad.

Wind based power project

LOI for 250 MW wind power plant at Rojhan has been issued to Vestas (a Danish company), interconnection for the project has been approved.

Distributed generation through solar power

- Provision of about 300,000 Solar Home Solutions (SHS) systems to students on merit under the Chief Minister’s Ujaala Program,
- Solar Solutions have been provided for 50 Government Offices as a pilot project for replication in the private sector.
- Energy Department is planning to solarize about 20,000 government schools in Punjab.
Hydro power projects

- There are two large hydro projects (HPP) under counteraction at the border with the province of AJK on Jhelum river under the management of PPIB. The first one is the 720 MW Karot HPP being financed by Commercial Bank of China, China Development Bank, International Finance Corporation and Silk Road Fund. The project developer is China Three Gorges South Asia Investment Limited and the project is expected to become operational in August 2021. The second major hydro project at the border with AJK is the 590 MW Mahl, which is being envisioned in partnership with China International Water and Electric Corporation (CWE) and expected to commence in December 2023.

- 135MW Taunsa Hydro Power Project has been offered as a solicited site to the private sector. Five international companies have submitted their bids which are under evaluation. A special purpose company under the name of Quaid-e-Azam Hydel Power (Pvt.) limited has been approved by the government to manage the private sector led running of the project.

- A study of the hydro power potential from barrages and irrigation canals in the province has identified about 700 possible sites. About 25 feasibility studies have been conducted till date and of the several projects identified, only four projects have progressed to the construction stage, which include those that are managed by PPMU and funded by ADB. These four hydropower projects with a cumulative capacity of 20 MW include: Pakpattan 2.82 MW which has achieved COD, Marala 7.64 MW, Deg outfall 4.04 MW and Chianwali 5.38 MW are near completion.

- A number of small HPP totalling about 200 MW relating to irrigation canals are being processed by PPDB through the private sector. The progress on these however have been quite slow with LOIs issued to 21 small hydro projects in IPP mode and only 3 projects reaching the approval of tariff stage.

- While several incentives have been provided to the private sector to engage in hydro power development and there are clear policy guidelines available, the progress on these projects have been far below expectations. Therefore, it is needed that stronger monitoring and accountability mechanism may be put in place to ensure swift translation of these projects.

9.2.1 Demand Side Initiatives

Punjab Energy Efficiency and Conservation Strategy

Government of Punjab has set up the Punjab Energy Efficiency and Conservation Agency to carry out the Efficiency and Conservation Program, the program includes the following measures:

- Regulatory initiatives for the appliance standards and EE&C activities in buildings and industries
- Launching of an awareness building and promotional campaign
- Capacity building by creating a cadre of EE&C professionals and training and development
- Implementation of few pilot projects
- Supporting implementation of identified high impact projects

Paying Government Dues

Government of Punjab has completed the pilot project for installation of 1698 AMI meters during FY 2016-17 against the Government connections having maximum consumption/load in series with the existing DISCOs billing meters as check meters for real time monitoring and reconciliation with the DISCOs in Punjab. Government of Punjab has also launched second phase for installation of another 2820 AMI meters. It is expected that all dues will be cleared in due course.
9.2.2 Further Potential of Energy Resources in the Punjab

Punjab has achieved significant milestones in the energy sector, however, a lot of potential remains to be explored. For example, in Hydropower the Punjab Power Development Board has identified various sites having capacity of more than 238 MW at various canals and barrages. The long outstanding political economy hang-up of Kalabagh dam needs to be resolved as it will add another 3,600 MW to the installed capacity.

Punjab is endowed with large amounts of sunlight providing a huge potential for solar energy with a range between 4-6.5 KWH/m²/day of irradiation for most of days during the year. “Power generation through solar radiations is a viable option having lot of potential which can be explored through installation of small solar power projects at public sector buildings. Industries can also be encouraged to install the solar power projects for self-consumption. Further to it, solar power projects to electrify the villages is also an option to focus on (PERI, 2017).”

Punjab has experimented with wind energy potential, however, the wind resources are poor in Punjab. Alternatively, as the scale of livestock and agriculture is huge in the province a significant amount of bio-waste is produced that can be used for biomass energy. PERI (2017) suggests that the total potential for the Punjab through this source is between 3,600MW to 5,400MW.

9.3 Salient Features of the Power Sector Road Map

The Energy Department has recently concluded a study titled ‘Power Sector Road Map 2016-2016 Province of Punjab’ which makes key critical recommendations. The key elements of the Road Map recommendations include:

■ Establish an Energy Planning and Monitoring Unit to undertake the planning, coordination and monitoring of the GOPb power development program. It should be entrusted with overseeing the planning activities of future projects and carrying out a regular review of the ongoing projects.

■ Processing delays are being faced in most projects and the related causes should be analyzed and corrective measures should be taken.

■ With respect to the smaller hydro and solar PV plants being installed, the alternative of feeding the power to the already overloaded distribution networks at 11 or 33 kV should be considered. This strategy would reduce the costs of the power plant evacuation on arrangements as well as the cost of power distribution in the surrounding areas.

■ With respect to hydro power development in irrigation canals and barrages, some generic rules and guidelines should be developed as per discussions with the central design of the irrigation department so that the approval process can be streamlined and delays eliminated.

■ A suitable program for distributed solar for individual homes need to be developed. Subsidies should be replaced by repayment schemes over extended periods and a program of support and follow up established.

■ A clear policy decision should be taken on future proposed coal and RLNG based plant in terms of ensuring cost effective consistent supply of fuel source.

9.4 Conclusion

It is important to understand that Punjab has taken serious measures to encourage investment both private sector and in PPP mode to enhance the generation capacity. However, the regulatory environment is still that there is no assurance that Punjab will reap the full benefits of these investments. The distribution is still being carried out through the central grid and so is the tariff calculation. The Punjab is relying heavily on meeting its energy needs so it could achieve its growth targets by 2018. As presented in the Growth Strategy, meeting energy needs will add 2% to the GDP growth. Moreover, given that majority feeders in Punjab are overloaded, significant new investments are required if this additional generation is to be utilized effectively.

Keeping in view the existing power generation and transmission system, financial constraints and line losses of DISCOs due to theft and other factors. It is suggested that the power generation and distribution licenses should be issued more speedily to SEZ’s and Industrial estates and later on, same should be repeated for the industrial clusters/ semi-formal
sectors so to ensure sustainable and smooth electricity to the industry. In Punjab, most of the industrial estates have heavily invested in their own distribution networks yet they are dependent on DISCOs. By issuing the power generation license to industrial estates and/or permission to purchase bulk electricity directly from NTDC will boost the industrial activities in Punjab.

Moreover, the government is keen to explore the alternative resources of energy in the province. These, especially the solar potential should be explored more rapidly to allow greener production of energy.