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Patron: Akhlaq Ahmad
Editor: Noor Al Huda
Asst. Editor: Abdul Munim

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GE FD160, MCCB fitted in ingenious EPESOL panel.

Just a fold away...!

GE Spain factory visit by **KE & EPESOL**

Panels by EPESOL **rocking** Systems

EPESOL joins advanced **automation club**

Technical **Training** **K-Electric** gets trained

Field **Services** traverses **extra miles**

From the Desk of **CEO**

Akhlaq Ahmad

As years pass by, so do the anxiety and anticipation of what has been achieved and what is the target. EPESOL in the preceding months regathered itself and poised for new horizons. Since the inception of EPESOL; the human resource development of engineers, in the light of latest research undergoing across the globe, has been one the major areas in focus. Pushing it further we offered extensive training programs to various utilities of Pakistan including a visit to GE factory in Spain. We are committed to continue our efforts to participate in bringing modern technology in Pakistan, not in terms of products but locally matured expertise and reduced dependency on foreign engineering support. This, in fact, is the only way to bring true benefits to the nation, a debt to payback to the engineering community. In addition China Pakistan Economic Corridor has become talk of the town. CPEC, a part of China's larger One Belt, One Road (OBOR) project, has going to have a colossal impact on our economy. However we need to emphasize the need of involving local engineering industry in this project and transfer the benefits to the nation on grass root level in real and tangible financial terms. I dare to state that the only way to fight the battle of quality, in the interest of Pakistan, versus quantity, in the interest of investors, is through producing technically rich human resource which, in fact, is the part of EPESOL's mission. We need your valued support and guidance to win this battle in the interest of nation.

A Scribe by the **Editor**

Noor Al Huda

6th issue of EPETribune is in your hands and hopefully it will meet your expectations as always. In this issue we have included a technical article featuring analysis of cost of electric energy generation in PEPCO system in Pakistan for last six financial years. We hope that through your feedback it will prove expository. You will read in succeeding pages some major developments in recent months such as augmentation of our corporate head office and launching of our new website and in addition some important official meetings and visits to the factories of our principals in Spain. Pakistan, at moment, is undergoing some important developments in the geopolitical sphere. One such important event is commencement of China Pakistan Economic Corridor, also known as CPEC, and it includes development of energy and infrastructure projects across the country. For a developing country like ours successful completion of this corridor may prove to be a piece of good fortune bringing country wide economic growth and prosperity provided that we set aside all our differences and work hard to reach to the finishing line without any distractions. Let's pray to Almighty that He gives us strength and unity of purpose to work diligently for our beloved motherland. Ameen!

You can always drop your feedback and suggestions regarding this newsletter at epetribune@epesol.com.

Cost Analysis of Electricity Generation

IN PEPCO SYSTEM IN PAKISTAN AS PROCURED BY CPPA (G) FROM FY 11-16

Engr. Noor Al Huda.

Team Lead. Design & Consultancy
EPESOL (Pvt.) Ltd.

1. INTRODUCTION

Present electric power system of Pakistan is geographically bifurcated into two sub-systems. First, called the K-Electric system, deals with port city of Karachi only, and the second, called the PEPCO system, with the rest of the country. Both K-Electric and PEPCO systems are supervised by the Government of Pakistan through a single ministry, Ministry of Water and Power (MoWP), and regulated by a single regulator, National Electric Power Regulatory Authority (NEPRA). Electric power generation, transmission and distribution in K-Electric system is managed by a single private sector utility, K-Electric, whereas for the PEPCO system the story is altogether different. For this system, electric power is generated by Water and Power Development Authority (WAPDA) in public sector by hydroelectric dams; by Pakistan Atomic Energy Commission (PAEC) in public sector by nuclear power plants; by Pakistan Electric Power Company (PEPCO) in public sector through its Generation Companies (GENCOs) by thermal power stations; by the private sector called Independent Power Producers (IPPs), Small Power Producers (SPPs) and Captive Power Plants (CPPs); and the same is also imported from Iran. This electric power is then transmitted from generation centres to load centres by a single transmission and despatch company, National Transmission and Despatch Company Limited (NTDCL), in public sector, and finally it reaches to the consumers through ten distribution companies in public sector called LESCO, GEPCO, FESCO, IESCO, MEPCO, PESCO, TESCO, SEPCO and QESCO geographically divided in the four provinces and FATA. In the PEPCO system, commercial affairs related to electric power purchase from generators and sale to the distributors are managed by a separate agency in public sector called Central Power Purchase Agency (Guarantees) Limited or CPPA (G).

Pakistan has been undergoing through a critical juncture of its history since last two decades where energy crisis in conjunction with financial crisis have tarnished the growth in all spheres of life. Less power generation, transmission and distribution system constraints, poor load management, electricity theft and non-payment of dues by consumers coupled with political interventions have so far managed to remain daunting tasks for the energy managers to overcome resulting in prolonged outages and extra load shedding hours in both rural areas and urban centres hampering the pace of progress. Affairs of our national power system as managed by a plethora of public and private sector companies, agencies and boards are so convoluted and obscure that generally it is near to impossible to analyse its various parameters and say something about the same with absolute certainty.

This article is an attempt to analyse the cost of electric power generation, measured and billed in terms of Rs. per kWh, as procured by CPPA (G) from different electric power producers at the point of purchase during the last six financial years (FY11 – FY16) in order to ascertain some insights where our cost of electric energy generation stands. First, a year-wise analysis of cost is carried out and then an analysis is presented based on energy generation by fuel type and finally some conclusions are drawn based on both.

2. YEAR WISE ANALYSIS

- During FY11 the top three sources of electric energy generation were hydel, RFO and gas with percentage contributions in power generation of 35.32%, 34.54% and 25.42% respectively and the per unit cost in rupees per kWh for the three stood at 0.31, 12.32 and 3.47 respectively. The average cost of generations was Rs. 5.45 per kWh of which the major contributors were plants based on RFO. The situation is depicted in fig-1 and fig-2.

During FY12 the top three sources of electric energy generation were RFO, hydel and gas with percentage contributions in power generation of 34.18%, 31.92% and 26.12% respectively and the per unit cost in rupees per kWh for the three stood at 16.18, 0.16 and 4.31 respectively. The average cost of generation was Rs. 7.21 per kWh, higher than FY11 by 32 %, of which the major contributors were plants based on RFO. The situation is depicted in fig-3 and fig-4.

- During FY13 the top three sources of electric energy generation were RFO, hydel and gas with percentage contributions in power generation of 35.15%, 34.02% and 23.41% respectively and the per unit cost in rupees per kWh for the three stood at 16.48, 0.09 and 5.06 respectively. The average cost of generation was Rs. 7.54 per kWh, higher than FY12 by 4.6 %, of which the major contributors were plants based on RFO. The situation is depicted in fig-5 and fig-6.
- During FY14 the top three sources of electric energy generation were RFO, hydel and gas with percentage contributions in power generation of 37.86%, 33.88% and 19.91% respectively and the per unit cost in rupees per kWh for the three stood at 16.37, 0.08 and 5.08 respectively. The average cost of generation was Rs. 7.83 per kWh, higher than FY13 by 3.8 %, of which the major contributors were plants based on RFO. The situation is depicted in fig -7 and fig-8.
- During FY15 the top three sources of electric energy generation were hydel, RFO and gas with percentage contributions in power generation of 33.89 %, 32.92 % and 22.50 % respectively and the per unit cost in rupees per kWh for the three stood at 0.11, 12.97 and 5.28 respectively. The average cost of generation was Rs. 6.26 per kWh, lower than FY14 by 20 %, of which the major contributors were plants based on RFO. The situation is depicted in fig-9 and fig-10.
- During FY16 the top three sources of electric energy generation were hydel, RFO and gas with percentage contributions in power generation of 33.89 %, 29.95 % and 27.86 % respectively and the per unit cost in rupees per kWh for the three stood at 0.10, 7.51 and 5.87 respectively. The average cost of generation was Rs. 4.31 per kWh, lower than FY15 by 31.1 %. This cost is stood at 6-year low level and is attributed to falling oil prices in the international market. The situation is depicted in fig-11 and fig-12.

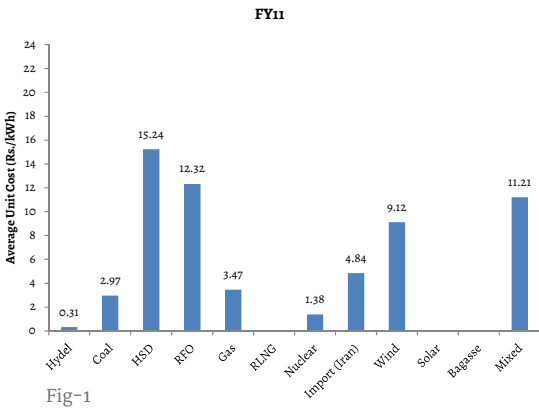


Fig-1

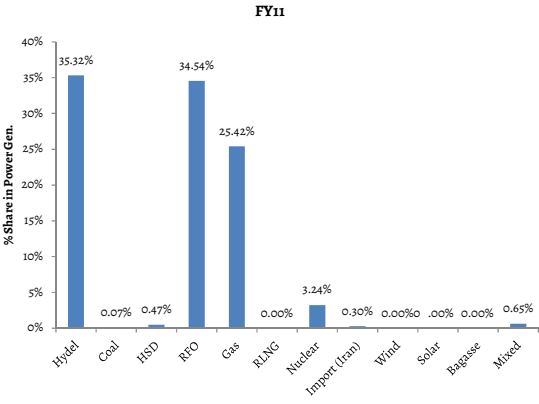
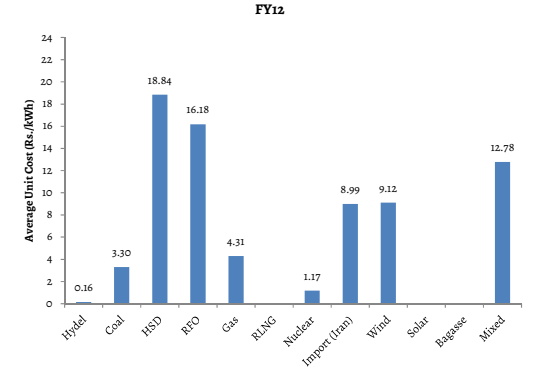


Fig-2



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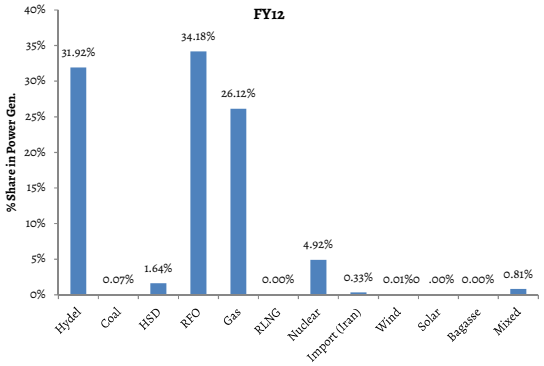

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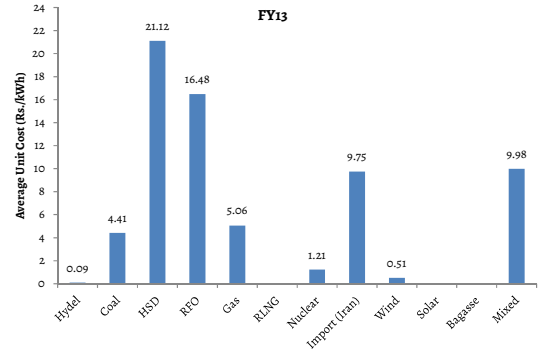


Fig-5

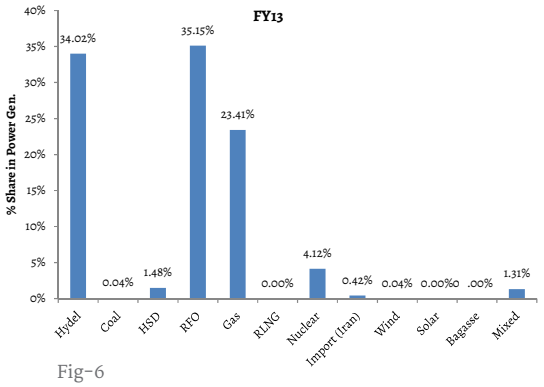


Fig-6

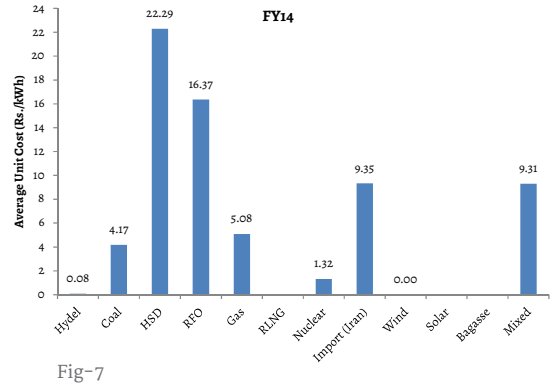


Fig-7

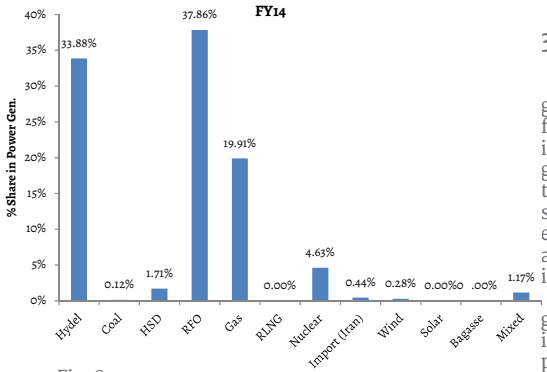


Fig-8

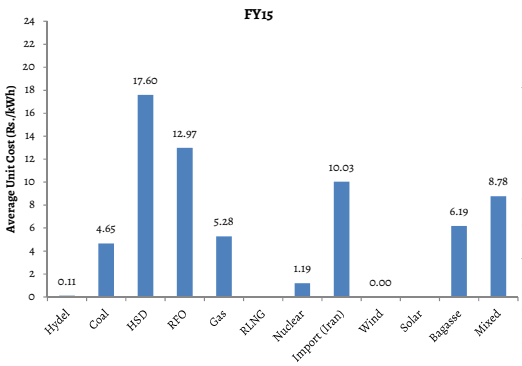
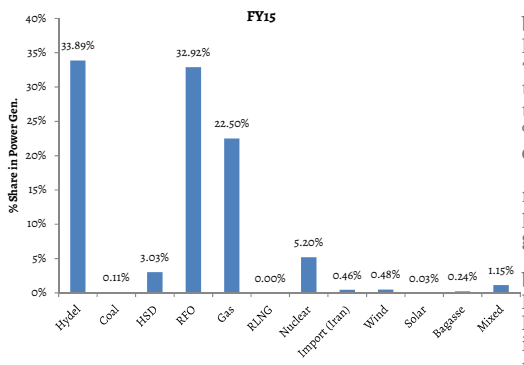


Fig-9



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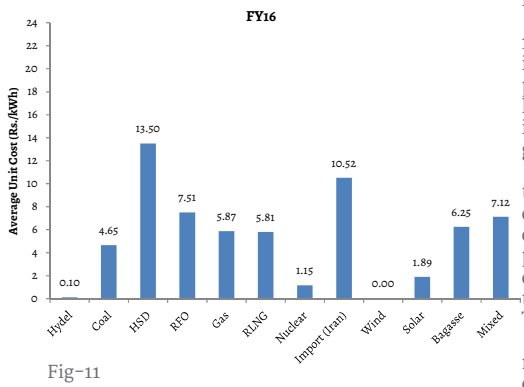

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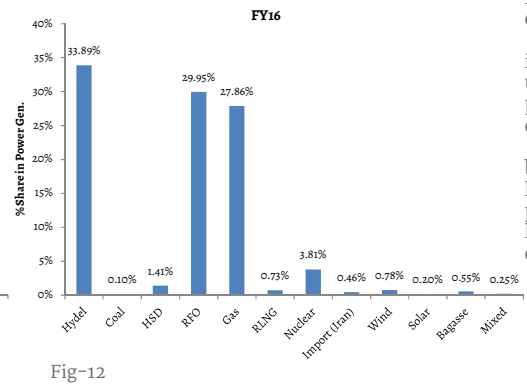


Fig-12

3. ANALYSIS BY FUEL TYPE

• The average unit cost of electric energy by hydel generation sources has decreased significantly from Rs. 0.31 per kWh in FY11 to Rs. 0.10 per kWh in FY16 whereas its percentage share in total power generation has also decreased from 35.32 % in FY11 to 33.89 % in FY16. Practically, as evident from these statistics, hydel is the cheapest source of electric energy in our national grid, vis-à-vis, per unit cost and percentage contribution. The 6-year trend of cost is graphically depicted in fig-13.

• The average unit cost of coal fired electric energy generation has increased from Rs. 2.97 per kWh in FY11 to Rs. 4.65 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall increasing trend from a meagre 0.07 % in FY11 to 0.10 % in FY16. The 6-year trend of cost is graphically depicted in fig-14.

• The average unit cost of electric energy generation by HSD plants has increased from Rs. 15.24 per kWh in FY11 to Rs. 22.29 per kWh in FY14 and decreased to Rs. 13.50 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall increasing trend from a meagre 0.47 % in FY11 to 1.41 % in FY16. The 6-year trend of cost is graphically depicted in fig-15.

• The average unit cost of electric energy generation by RFO based plants has increased from Rs. 12.32 per kWh in FY11 to Rs. 16.48 per kWh in FY13 and decreased to Rs. 7.51 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall increasing trend from a major share of 34.54 % in FY11 to 29.95 % in FY16. The 6-year trend of cost is graphically depicted in fig-16.

• The average unit cost of electric energy generation by gas plants has increased from Rs. 3.47 per kWh in FY11 to Rs. 5.87 per kWh in FY13 and decreased to Rs. 7.51 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall mixed trend from a major share of 25.42 % in FY11 to 27.86 % in FY16. The 6-year trend of cost is graphically depicted in fig-17.

• RLNG based plants are introduced in FY16 in the national grid with unit electric energy cost at Rs. 5.81 per kWh and percentage share in total electric energy generation at 0.73% in the same year.

• The average unit cost of electric energy generation by nuclear power plants has the highest unit cost of Rs. 1.38 per kWh in FY11 and the lowest unit cost of Rs. 1.15 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall mixed trend from a maximum of 5.20 % in FY15 to a minimum of 3.24 % in FY11. The 6-year trend of cost is graphically depicted in fig-19.

• The average unit cost of electric energy imported from Iran has increased from Rs. 4.84 per kWh in FY11 to Rs. 10.52 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall increasing trend from a meagre 0.3 % in FY11 to 0.46 % in FY16. The 6-year trend of cost is graphically depicted in fig-20.

• Wind based plants have been introduced in the national grid in FY11. The average unit cost of electric energy generation by wind based plants has decreased from Rs. 9.12 per kWh in FY11 to Rs. 0.001 per kWh in FY16 whereas its percentage share in total electric energy generation has an overall increasing trend from a meagre 0.02 % in FY11 to 0.78 % in FY16. The trend of cost is graphically depicted in fig-21.

• Solar based plants have been introduced in the national grid in FY15. The average unit cost of electric energy generation by solar based plants has been Rs. 1.89 per kWh in FY16 with 0.2% contribution in total electric energy generation.

• Bagasse based small power plants have been introduced in the national grid in FY15. The average unit cost of electric energy generation by these plants has been Rs. 6.25 per kWh in FY16 with 0.55% contribution in total electric energy generation.

• The average unit cost of electric energy generation by mixed sources has decreased from Rs. 11.21 per kWh in FY11 to Rs. 7.21 per kWh in FY16 whereas its percentage share in total electric energy generation has been recorded at 1.31 % in FY13. The 6-year trend of cost is graphically depicted in fig-24.

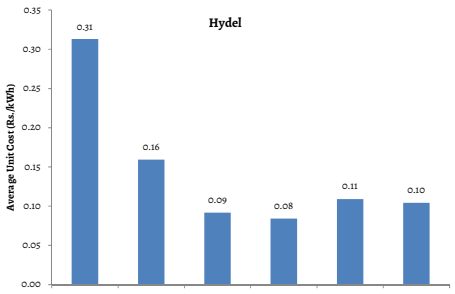
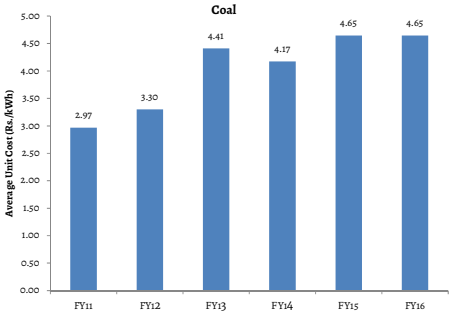


Fig-13



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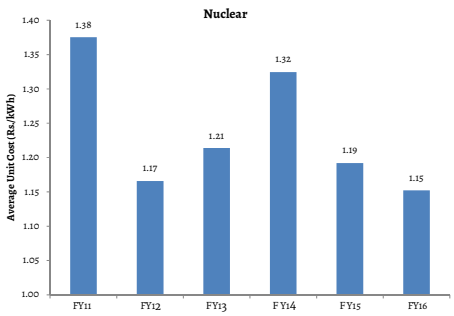

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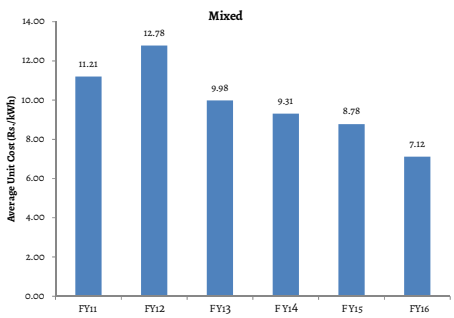

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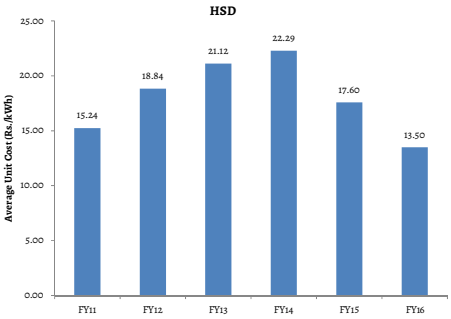

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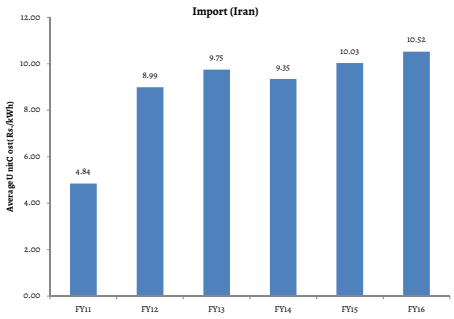

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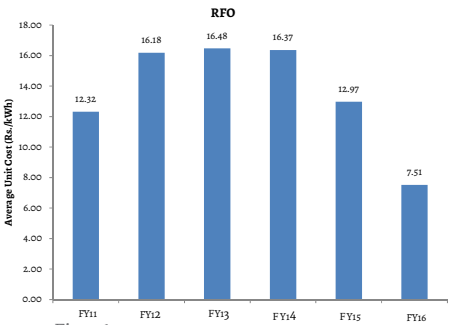

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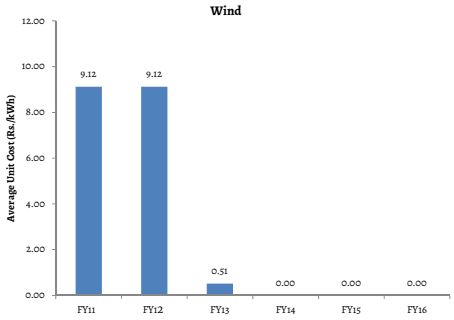

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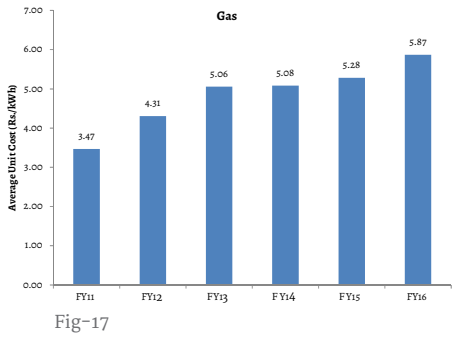

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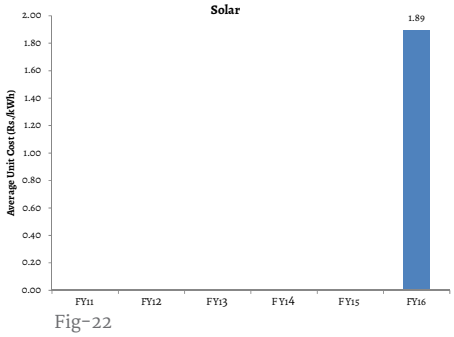

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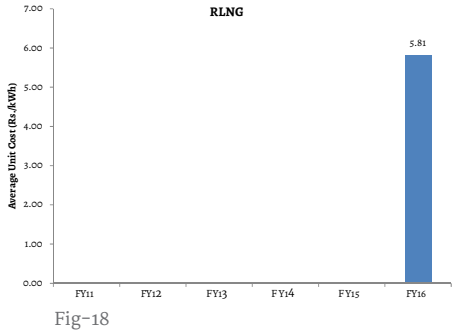

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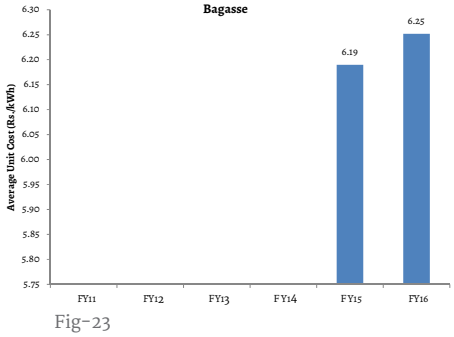

Fig-23

4. CONCLUSION

From fig-25, it is evident that the average cost of energy procured by CPPA (G) in FY16 has decreased significantly from preceding years. The highest cost recorded in this 6-year window is Rs. 7.83 per kWh in FY14 and is mainly attributed to high cost of Rs. 16.37 per kWh associated with RFO based power plants with 37.86 % energy contribution in the average annual energy generation in the same year. So far, in the analysis period considered, hydel has remained the cheapest and biggest source of electric energy for Pakistan and it is due to this source that the overall cost of electric energy has remained on the lower side. Had this not been the case, the cost of energy in a developing country such as ours would have been not affordable for its citizenry.

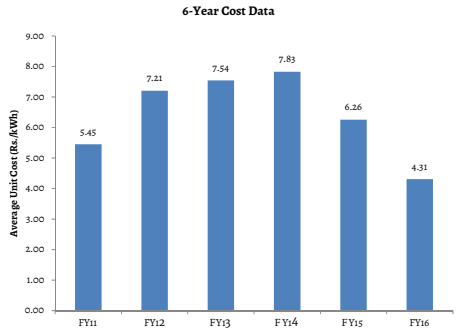

Fig-25

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EPESOL Panels, rocking the Power Systems!

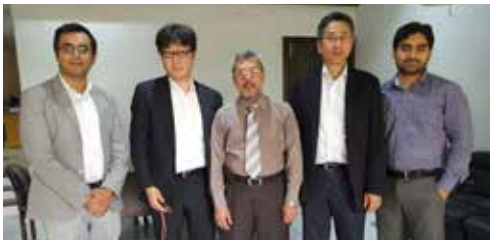
Purely ingenious, customized and beautifully designed

EPESOL Panel Manufacturing team with close tabs on Design and Consultancy completed a state-of-the-art metering panels along with hi-tech communication box. Metering panels incorporated 4 energy meters and a paper-less recorder for swift and hassal free recording. Communication box consisted of a compact modem/ Ethernet system along with a P2CC communicator equipped with GSM/GPRS. Harvey Energy ordered 2 such panels along with the communication box and QASP ordered another such box. Team Manufacturing also manufactured an LV PFI Panel for a local manufacturing plant. The panel was a best solution to the cost and technology for local customers.

Toshiba Corp. Japan delegation visits EPESOL to explore possibilities

Trust of international MNC is an honour

Earlier this quarter, a delegation of Japanese multinational conglomerate Toshiba Corporation visited EPESOL at its headquarters in Garden Town, Lahore. Mr. Hiroaki Sugiyama and Mr. Toshiya Imai were accompanied by their local liaison. The purpose of visit was to explore the areas of mutual interest in the rapidly growing power industry of Pakistan. Toshiba delegation were really impressed by the state of quality consciences at EPESOL which indeed is an honour.



Power Elektronik, a Turkish energy solutions provider visits EPESOL

This connects us with 17 years of experience

Power Elektronic is Turkish products manufacturer with expertise in solar and wind energy, dynamic and rotary UPS, chargers, regulators and Forklift battery chargers. Recently Power Elektronic Project Sales Director Ayhan GÜVEN called on EPESOL Team Lead. Sales & Marketing Mr. Engr. Khawaja Asif Naeem and CEO Mr. Engr. Akhlaq Ahmad. Areas of mutual interest were explored and a possible collaboration of technology transfer between EPESOL's own energy solutions including battery chargers, solar and wind application UPS and a dozen other products were also brought under discussion.

A large number of LV material delivered across Pakistan

EPESOL is the pioneer in Pakistan to introduce world class LV engineering. Normally there are some standards and quality control procedure at work in HV and MV levels but LV is the area greatly untouched still. Recently EPESOL provided a large number of LV material including ACBs, MCCBs, MCBs, RCBOs and control products to Aisha Steel Mills, Siddique Sons and HUBCO.

Utilities rely more and more on EPESOL, quality proven

Serving national institutes is the first priority

This quarter proved a next gear in terms of serving the Pakistani utilities. This only strengthens EPESOL confidence on its track but also proves and benchmarks the quality claim of EPESOL. This quarter we served a number of local utilities throughout Pakistan in multiple domains. From providing relays namely MIV II, BJ8R, MIFII, TS101, 350, 345, VDF10, D60 and others. We also offered an extensive training to K-Electric of three days covering power system fundamentals, over current, transformer and distance protections with hands on trainings. NTDC, GWPD, MEPCO, LESCO & K-Electric were served during this quarter.

EPESOL enabling OEMs of hi-tech engineering

This boots overall national expertise - CEO

EPESOL has a long history of introducing world class engineering standards and quality equipment in Pakistan. This is on one hand enables EPESOL of scaling the expertise of its own engineers to global level but also enhance the complex understandings of global ongoing. Recently EPESOL provided advanced engineering equipment to different OEMs of Pakistan. South Asian Eng. Siddique Sons, MK Engineering, JDW, Green T&D, ZMC, EPCS Switch gear, Ghafoor Eng, Bilal Eng, Tariq Electric and PEMPAK. Equipment included D60, MIFII, MIVII, BJ-8R, 345 Relays, test blocks and annunciators.

Industries across the Pakistan get secured with EPESOL intervention in power engineering processes.

Industries in Pakistan, in most of the cases, operate on decade old sluggish technologies mainly due to very less focus of the electrical engineering & planning. EPESOL with its highly trained and foreign certified engineering team of Design & Consultancy and Field Services and with its partnerships with GE, ALSTOM (after GE acquiring ALSTOM) and ABB provides a thorough solution for industrial customers who want a turnkey problem free solution for their industrial units. EPESOL recently served a number of industrial customers throughout Pakistan.

Starting in these quarters from LV material procurement for Dost Steel Mills, EPESOL provided services to Engro Polymers & Chemicals, Aisha Steel Mills, SIEMENS, Olympia, FFBQL, Saphhire Textile Mills, ALSTOM Grid and others. EPESOL served across a multitude of domains including material facilitation, testing & commissioning, designing and studies and manufacturing. Some of the material provided were BA300 - battery monitoring and alarm system, MIF II relays and various LV components including MCBs, MCCBs & control equipment.

POWER SYSTEM STUDIES FOR 49.5 MW *TGL* WIND FARM

EPESOL is the leader in Pakistan for carrying out power system and protection system studies for wind energy. Recently, it has completed power system and protection system studies of 49.5 MW Tenega Generasi Limited (TGL) Wind Farm Project, located in Mirpur Sakro Taluka, District Thatta. The scope included load flow study, short circuit study, harmonic study and relay configuration, parameter settings and coordination of relays at 33 kV and 132 kV systems and the protection systems included line protection system, transformer protection system, low impedance bus bar protection system, and over current & earth fault protection system.

POWER SYSTEM STUDIES FOR KPD – TAY INTEGRATED DEVELOPMENT PROJECT PHASE-II, OGDCL.

EPESOL has successfully conducted Power system studies for KPD – TAY Integrated Development Project Phase-II, Oil & Gas Development Company Limited (OGDCL). The proposed electrical power system of KPD-TAY phase-II consisted of 6.6 kV gas and diesel engine driven generators, 6.6 kV primary and secondary switch gears and various motor control centres at 0.4 kV for power distribution to various loads. The scope of the project was to perform electrical network analysis for whole electrical system and included following studies:

- Load flow study
- Short circuit study
- Motor starting study
- Protection coordination study

PROTECTION SYSTEM STUDY FOR 50 MW SWPCL WIND FARM

EPESOL has completed protection system studies of 50 MW Sapphire Wind Power Company Limited (SWPCL) wind farm, located in Jhimpir. The scope included relay configuration, parameter settings and coordination of relays at 33 kV and 132 kV systems and the protection systems included line protection system, transformer protection system, low impedance bus bar protection system, and over current & earth fault protection system

EPESOL tweaks IPPs & GENCOs for more efficiency

IPPs constantly need monitoring to enhance their efficiency & swift operations. EPESOL being the primary provider of advance tech with local expertise is the first priority of every IPP. This quarter proved to be a continuation of this tremendous feat. EPESOL provided L90 cards, MCBs, several differential IEDs, different panels, several LV components. Apart from that design, testing & commissioning services were also provided. IPPs & GENCOs served were Engro, Saif Power, Alpine, KAPCO, HUBCO, GEPCO and AES.

International Field Services

EPESOL around the globe, pinning brand Pakistan with its quality commitment

Ras Al Khair Pumping Station 2 & 3, KSA
» Installation, Commissioning and Service of 8 Transfix DGA equipment.

132 KV IBRA Substation , Oman
» Commissioning of 3 Transfix units and configuration of IEC61850 protocol for remote monitoring of units.

QASSIM Power Plant, KSA
» Testing and Commissioning of 03 No. of Generator Protection Panels

Field Services, Serving at home!

Happiness is to traverse the whole country with top quality

Attock cement, Hub Baluchistan
» Functional Testing of Feeder and Generator protection relays make ABB

500kV Roucsh Power plant
» Testing of all SIEMENS make Protection relays installed in the Power plant including bus bar, line, Generator, Breaker failure and Transformer Protection relays.

132kV Saif Power Plant
» Testing of all Plant Protection Relays including Generator, Motor, Transformer, Bus bar, Breaker failure and Line Protection relays and related transducers for 132kV system.

Fauji Fertilizer Company Goth Machi, Sadiqabad
» Commissioning of 2 G60 Generator Protection Relays by GE.

Internationalisation for the better industries

EPESOL along with K-Electric executives visit Spanish mega factories for FAT & to enhance international collaborations.

EPESOL is committed to bring the international experience to enhance local expertise, said Akhlaq Ahmed.

Amid the rapid growth and demand of EPESOL businesses in Pakistan and adjacent markets, EPESOL's executive team comprised of Engr. *Khawaja Asif Naeem*, Team Lead. Sales & Marketing and Engr. *Noor Al Huda*, Team Lead. Design & Consultancy paid a detailed and extensive visit to the GE Digital Energy (now GE Grid Solutions) mega factory at Bilbao, Spain at the tail days of August. The visit further followed to the visit of Arteche's - a major shareholder of international transmission and protection equipment manufacturing and services - mega factory at Mungia, Spain.

GE factory visit was done along with the K-Electric engineering team from Karachi, Pakistan. K-Electric is the biggest public-private utility looking after the biggest metropolitan of Pakistan, Karachi. The visit to GE factory was liaison by Commercial Manager - GE, Iñigo Escalante. The visit was followed by detailed FATs and training sessions on GE's flagship Distance Protection relay D60, covering all the possible scenarios raised by K-Electric team. Another major relay MIFII for feeder protection was also discussed in detail and was trained on exclusively. The training sessions were resource by Application Engineer - GE, Carlos Aguilar.

EPESOL team further hold detailed technical sessions on protection and control matters with Iñigo Escalante - Commercial Manager, Carlos Aguilar - Application Engineer, David Pozo - Lead Project Management Specialist and Andrea Lopez Gonzalez - Project Engineer - EMEA from GE.

At Arteche mega factory EPESOL team was liaison by Javier Serrano - Area Sales Manager and Nuria Calvo - Product Leader Secondary Equipment. The agenda included hands on training of different potentially useful equipment for the regional power sectors and technical matters concerning.

Luis Maria Pérez, GM Global and Commercial regions for GE Grid Solutions and Grid Automation also hold a brief meeting with EPESOL team at GE's Bilbao factory and praised the technical orientation of EPESOL. He asserted his more than a decade long strengthening experience with EPESOL.








EPESOL joins the most prestigious automation club with projects covering ARAMCO substations for GE-MENA

COPA-DATA Zenon Energy Edition will take Pakistani power sector to next levels of productivity and management, CEO

EPESOL offers a complete automation solution to power sector with engineering team having advance certification in COPA-DATA Zenon Energy Edition cross platform universal automation software. Recently an EPESOL engineer was assigned to support GEII KSA for power system automation projects of Saudi-ARAMCO using COPA DATA Zenon HMI software. The very first sites covered were MARJAAN GOSP2 & GOSP3. Scope of the project included the preparation of Complete graphics of GOSP2 and GOSP3 projects including all plant SLD's, all plant Relay Screens, annunciator screens, legends, alarms, system tools, event screen, network screens and metering screens. In addition we prepared and submitted 03 revisions of HMI standardization document, 02 revisions of graphic design document, modification and up-gradation in complete IO list, 02 revisions of handover document and addition of PSA reference and logical node in complete IO list for GOSP2 & GOSP3. In addition we included typical IEDs of 115Kv Relay Panels and prepared and submitted 02 revisions of IP address list, FDS document, 2 revisions of annunciator layout document for typical Incomer/Feeder/Transformer for GOSP2 & GOSP3 and enabling of status & alarm points of database building for 115kV Typical Relays for GOSP2.

The second site covered by EPESOL was MASTER GAS BGCS3 & BGCS5 of ARAMCO. The project scope covered preparation of graphics of BGCS3 and BGCS5 substation including all plant SLD's, relay screens, annunciator screens, legends, alarms, system tools, event screen, network and metering screens. We also prepared and submitted 2 revisions of IP address list, modified and submitted graphic design document for BGCS3 and BGCS5 and database building of BGCS3 for status & alarm points of 13.8Kv incomer & feeder F650 IED.

Third site of our work was AL MU'AJJIZ CRUDE OIL TERMINAL that required rehabilitation. The scope of the work included modification and addition of graphics of all seven substations of RAMT including seven plant SLD's, all plant relay screens, annunciator screens, legends, alarms, system tools, event screen, network screens and metering screens. We also prepared and submitted 2 revisions of graphic design document for all substations.

EPESOL also offers cheaper automation solutions through GE-Power and EnerVista ViewPoint software by GE. However COPA-DATA Zenon is the most sought after solution currently that powers more than 10,000 sites globally. EPESOL offers customised solutions for Pakistan also with local expertise most demanded by the Pakistani market.

K-Electric engineers get certified by EPESOL Training School

EPESOL has trained a huge number of utilities, IPPs, industries and other customers. Recently K-Electric choose EPESOL for its engineers to get trained. EPESOL Team Lead for Design and Consultancy, Engr. Noor Al Huda lead the program in its theory and presentation. Training program included a three days extensive schedule. The day one of the training encompassed power system different faults and Sequence Component Theory followed by over current protection, its basic concepts and protection system requirement and the applications on MIF-II feeder protection system in totality. The day ended with a proper hands on experience offered through live session lead by EPESOL Team Lead. for Field Services Engr. Mubasher Ahmed Ch. The session included physical inspection, input connections, output connections, pickup measurement accuracy and time measurement accuracy. The day two was entirely focused on Transformer; its winding connections and complete protection. The relay most commonly used for the purpose GE Multilin SR 345 was trained on exclusively including all its features, Differential Protection, Phase Shift Compensation, hardware, access, software and settings. The day ended with a live training session on 345 physical inspection, input connections, output connections, pickup measurement accuracy and time measurement accuracy. The final day was given to Distance Protection in entirety to cover its Basic Theory, Zone Setting Criteria, Switch on to Fault (SOTF), Power Swing, Teleprotection Schemes and GE Multilin D60 was used for the training purpose including its Feature List, Distance Characteristics, EnerVista URSetup Software and its front keypad along with hardware.