



9HA Turbine being installed at Bhikki Power Plant. Bhikki is automated by EPESOL's Engineering & Services Engineers.

Just a fold away...!



Technical Seminar
in Multan Region



Panels by EPESOL
rocking Systems



EPESOL performs new
automation in Pakistan



Technical Training
K-Electric gets trained



Field Services
traverses extra miles



From the Desk of **CEO** Akhlaq Ahmad

It is, indeed, among the favours of Allah SWT that we are witnessing yet another Ramadan. When I think of Ramadan, a necessary boot camp reflects in my mind; to renew and refresh our productivity and relation with Allah SWT. Quran says; 'O those who believe! Fasting has made compulsory for you' (Al-Baqarah). But there is much more into it than a ritual of abstaining from food. Lets ponder over this month for a while. Ramadan is a month of Barakah; as you purify your wealth and assets in this month and every reward on these acts gets manifold hence this is also a month of Rewards. But this is not limited to just these, Ramadan offers a unique opportunity to waive off sins and benefit from the increased favours and mercy of Allah SWT. Ramadan has so much of history with it, too. The descent of Quran from heavens to earth happened in this month, 27th Ramadan is the date of decisive battle of Badar, conquest of Mecca was concluded around 20th of Ramadan which was the final blow to the evil might in Arabia and Pakistan came into being in this month of Ramadan. The biggest question before us now is that are we ready for this month? The answer will be satisfactory if we decide to be decisive this month. One of the aspects that ensures the productivity of Ramadan is how and who manage our collective affairs; whether they develop a suitable atmosphere around us. Quran guides us that those who lead us should be pious so that they make our direction right. Ramadan is a reminder that we need to put our affairs in the hands of such people to ensure our prosperity.



A Scribe by the **Editor** Noor Al Huda

We are releasing a bit delayed 7th issue of EPETribune and our apologies be accepted for that. For our valued readers we've included a technical article, like previous issues, featuring analysis of electricity short-fall in PEPCO system in Pakistan from FY97 to FY16. We hope that our readers will find it insightful. In addition to that clippings encompassing new developments, customer trainings and seminars, salient projects completed by our field services team and engineering team, panel supply and relay supply orders are also part of current issue.

Amid the turmoil at all fronts faced by Pakistan; from ideological to geographical, it is imperative for all citizens of the state to shun all propaganda and stand united. Discrete small individual acts of goodness can help elevate our status in world community, nonetheless. The beacon in this journey shall be what Father of Nation, Quaid-e-Azam, said; "Everyone of you has an important role to play in strengthening the defence of the country and your watchwords should be faith, discipline and self-sacrifice. You will have to make up for the smallness of your size by your courage and selfless devotion to duty for it is not life that matters but the courage, fortitude and determination you bring to it."

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

ANALYSIS OF ELECTRICITY SHORTFALL

IN PEPSCO SYSTEM IN PAKISTAN FROM FY97 TO FY16

Engr. Noor Al Huda.

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



1. INTRODUCTION

Pakistan has been undergoing through a critical juncture of its history since last two decades where severe power cuts in almost every day are hampering lives of common masses and wheels at industry with little or no respite in sight in near or far future. Though Government of Pakistan is painstakingly trying to overcome this power crisis, however, things have not improved very much lately. Insufficient power generation, transmission and distribution system constraints, high system losses, electricity theft, accumulation of circular debt and non-payment of dues by certain 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.

This article is an attempt to present and analyse the electricity shortfall during the last twenty financial years (FY97 - FY16) in order to ascertain some insights where our national power system stands, vis-à-vis, demand and supply of electricity. The data for the analysis has been extracted from two-volume power data reference book published by NTDC in December 2016 and accessible via NTDC website [1], [2]. According to NTDC, the intended purpose of release of this book is preservation of system operation data for power system planning and it contains actual power system operation data such as recorded and computed peak load demand in MW on daily, monthly and annual basis; energy units sold to distribution companies; and plant-wise generation capability in MW on daily, monthly and annual basis.

2. ANALYSIS OF GENERATION CAPABILITY AND COMPUTED PEAK DEMAND

During the last twenty years the computed peak demand (calculated maximum demand that occurred at any time of day during the entire year) has increased from 8,772 MW in FY97 to 23,199 MW in FY16 and it exhibits an average annual increase of 8.22% in computed peak demand during this period. In comparison to this, the electricity generation capability (actual available generation) at the time of corresponding computed peak demand has

increased from 7,838 MW in FY97 to 16,006 MW in FY16 which indicates that the generation capability has an average annual growth rate of 5.21% during the same period. In absolute numbers, we'd peak surplus (when generation is more than demand) electricity of 495 MW in FY00 whereas the peak deficit (when generation is less than demand) stood at 7,193 MW in FY16 in this analysis period. This peak shortfall of 7,193 MW translated to 45% of generation capability and 31% of computed peak demand in FY16. In other words, we were able to meet only 69% of our peak load requirements. Complete year-wise data has been tabulated in table-1 and table-2.

Year	Computed Peak Demand (MW)	Generation Capability (MW)	Surplus / Deficit (MW)
FY97	8,772	7,838	-934
FY98	9,165	9,033	-132
FY99	9,242	8,385	-857
FY00	9,609	10,104	495
FY01	9,988	9,957	-31
FY02	10,389	10,660	271
FY03	11,044	10,958	-86
FY04	11,598	11,834	236
FY05	12,595	12,792	197
FY06	13,847	12,600	-1,247
FY07	15,838	13,292	-2,546
FY08	17,398	12,442	-4,956
FY09	17,852	13,637	-4,215
FY10	18,467	13,445	-5,022
FY11	18,521	13,193	-5,328
FY12	18,940	12,320	-6,620
FY13	18,827	13,577	-5,250
FY14	20,576	14,584	-5,992
FY15	21,701	15,420	-6,281
FY16	23,199	16,006	-7,193

Table-1

Year	Surplus/ Deficit (MW)	% Peak Demand (%)	% Gen. Capability (%)
FY97	-934	-10.6%	-11.9%
FY98	-132	-1.4%	-1.5%
FY99	-857	-9.3%	-10.2%
FY00	495	5.2%	4.9%
FY01	-31	-0.3%	-0.3%
FY02	271	2.6%	2.5%
FY03	-86	-0.8%	-0.8%
FY04	236	2.0%	2.0%
FY05	197	1.6%	1.5%
FY06	-1,247	-9.0%	-9.9%
FY07	-2,546	-16.1%	-19.2%
FY08	-4,956	-28.5%	-39.8%
FY09	-4,215	-23.6%	-30.9%
FY10	-5,022	-27.2%	-37.4%
FY11	-5,328	-28.8%	-40.4%
FY12	-6,620	-35.0%	-53.7%
FY13	-5,250	-27.9%	-38.7%
FY14	-5,992	-29.1%	-41.1%
FY15	-6,281	-28.9%	-40.7%
FY16	-7,193	-31.0%	-44.9%

Table-2

For the sake of graphical representation, the twenty year period has been divided in two parts, first from FY97 to FY06 and second from FY07 to FY16, and data of table-1 and table-2 has been graphically depicted likewise. Fig-1 shows demand, supply and gap between the two from FY97 to FY06 and fig-2 shows demand, supply and gap between the two from FY07 to FY16. Fig-3 shows percentage deficit / surplus in relation to computed peak demand from FY97 to FY06 and fig-4 shows percentage deficit / surplus in relation to computed peak demand from FY07 to FY16. Fig-5 shows percentage deficit / surplus in relation to generation capability from FY97 to FY06 and fig-6 shows percentage deficit / surplus in relation to generation capability from

FY07 to FY16. It is evident from fig-1 and fig-2 that electricity shortfall was more intensive in FY07 to FY16 as compared to previous decade and in FY12 our national electricity deficit stood at 54% of our national generation capability or, in other words, 35% of our computed peak demand during that year.

3. CONCLUSION

Last ten years have been continually arduous for people of Pakistan owing to heavy electricity deficits translated into long load shedding hours especially during sweltering summers. According to some official estimates a deficit of 500 MW corresponded roughly to one hour of forced load shedding in the country and hence the inhabitants must have been suffering massive load shedding between 5 to 14 hours at maximum during the last decade. If factors such as transmission and distribution losses, repair and maintenance of electricity installations, varied urban and rural load shedding mix, zero or minimal load shedding for VIP, defence and industrial feeders, and weather extremities are also taken into account the real load shedding hours for common people on ground must have been much elongated than the theoretically calculated above.

4. REFERENCES

1. Power Data Reference Book, Volume 1, Planning Power, NTDC.
URL: <http://www.ntdc.com.pk/planning.php>
2. Power Data Reference Book, Volume 2, Planning Power, NTDC.
URL: <http://www.ntdc.com.pk/planning.php>

Electricity Demand Vs Supply - FY97 to FY06

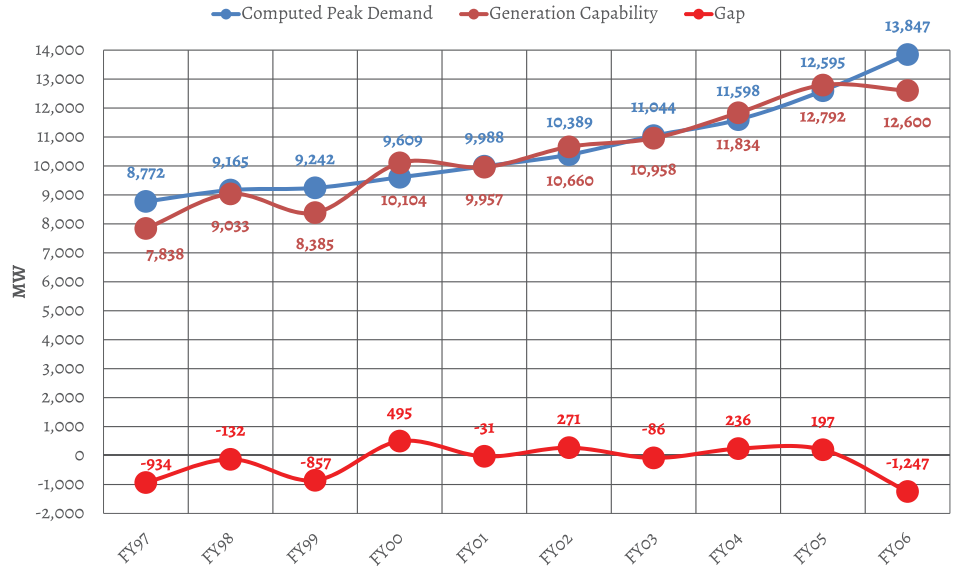


Fig-1

Electricity Demand Vs Supply - FY07 to FY16

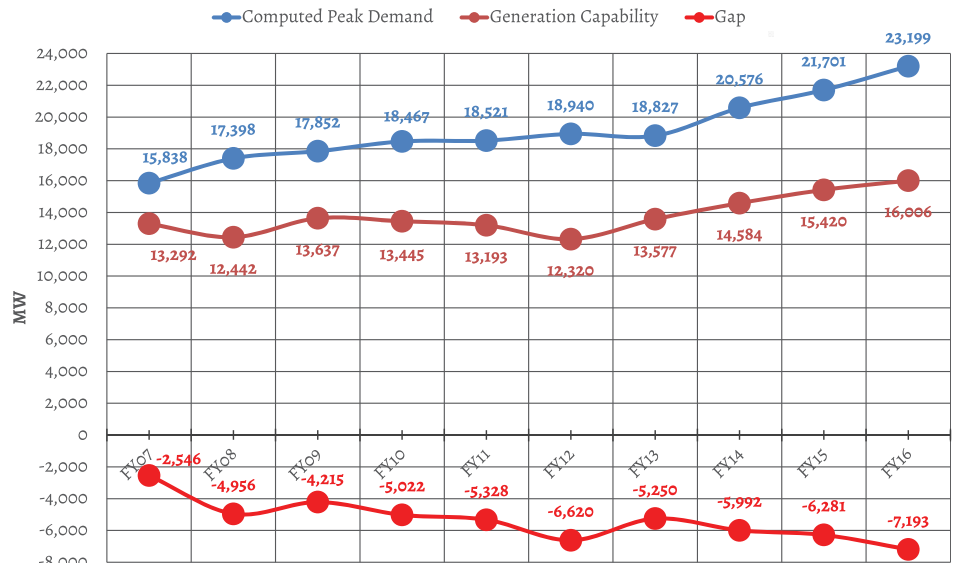


Fig-2

% Deficit / Surplus - FY97 to FY06

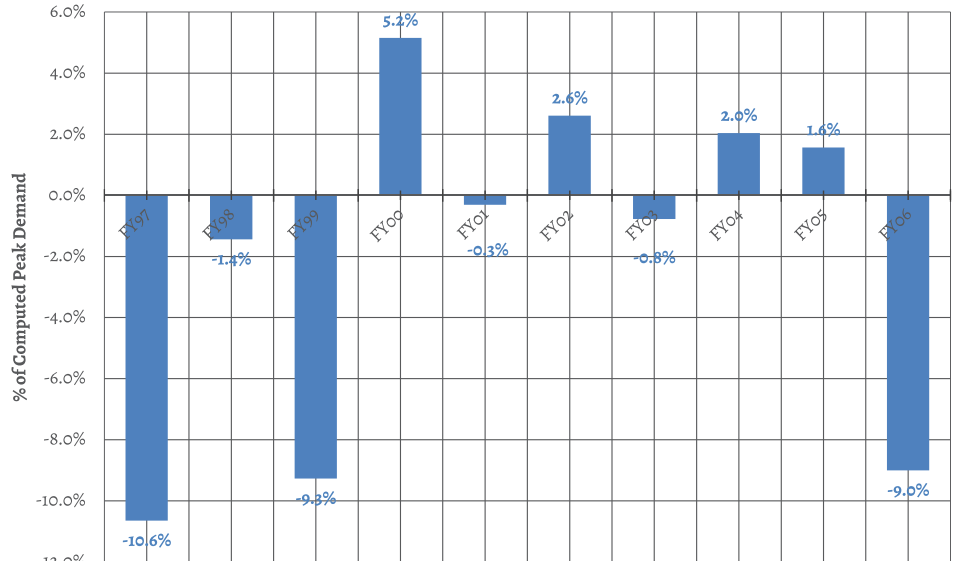


Fig-3


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- Contactors 20A-63A

- Entellguard ACB 400-6400A
- Record Plus MCCB/ 16-1600A
- Dilos NF-LBS/ 20-4000A

- Surion MPCB / 0.1- 63A
- PRC Plug-in Relays/ 6- 12A
- Mini Contactors/2.2-5.5KW AC-3
- RL Auxiliary Contactors/ 20A
- CL Contactors / 4-55KW AC-3
- CK Contactors/ 75-450KW AC-3
- MTO TOL/ 0.11-14A
- RT TOL/ 0.16-850A
- Electronic OL Relays / 0.1- 150A
- CSC Cap. Contactor / 12.5- KVAR
- ASTAT Plus Soft-Starter up to 715KW
- VAT 300 up to 370KW
- Control & Signalling/ 22mm
- Electronic Timers

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Partner GE Energy

% Deficit / Surplus - FY07 to FY16

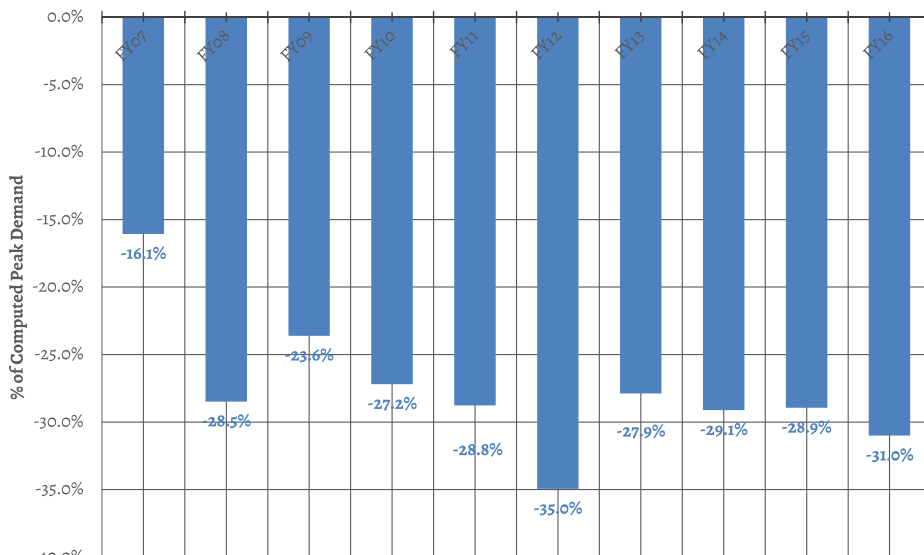


Fig-4

% Deficit / Surplus - FY97 to FY06

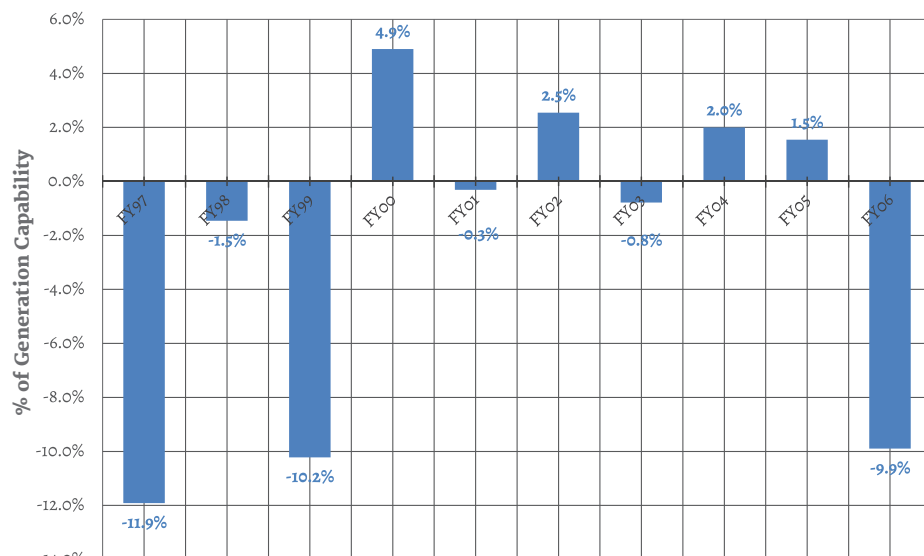


Fig-5

% Deficit / Surplus - FY07 to FY16

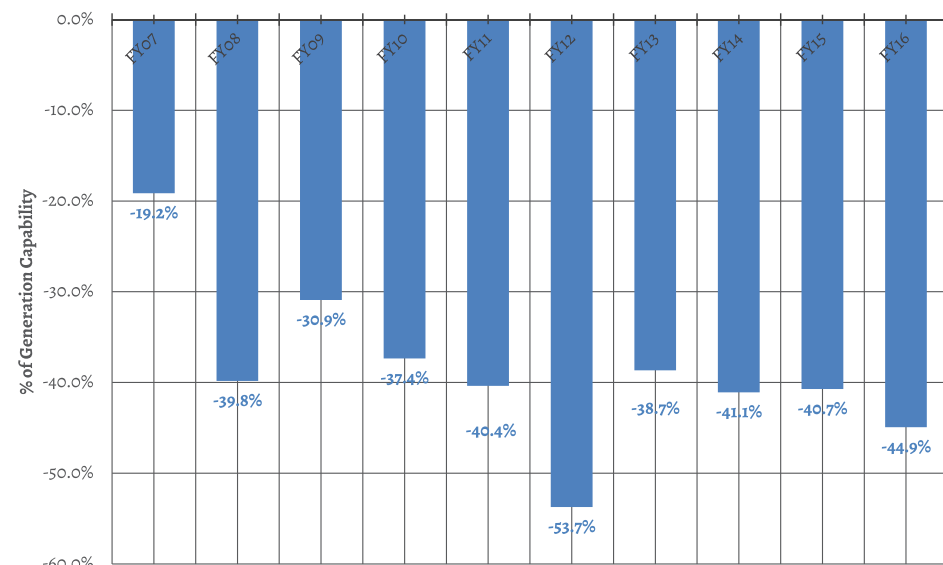


Fig-6

New additions to EPESOL family

As the footprint of EPESOL expands, so does the EPESOL family. This quarter has seen a steady increase in our human resource as experienced resource has joined us ranging from 5 to 15 years.



Engr. **Qasim Habib**

Designation: Team Lead.
Experience: 14 years
Department: Project Management Unit

Engr. Qasim is a stalwart engineer of his field with a gigantic experience of 16 years to his mark. All of his experiences were in MV, HV and EHV power systems protection and control. He has recently joined us as Team Lead, Project Management Unit reporting to CEO.

A graduate of University of Engineering and Technology, Lahore his first role was in 2003, just after his graduation, as a protection [design] engineer in Syed Bhais (Pvt.) Ltd. where he served for more than six years. Later he was promoted as Team Lead. of all engineering activities in T&D unit of Syed Bhais for 132, 220 and 500 kV systems.

Later he joined ABB Contracting, KSA as Design engineer (and later as Sr. Design engineer) in September 2009. In this capacity he proved himself as an authority on Transmission and Distribution. He later switched to FACTS department within ABB Engineering covering SVC & SC Plants. He worked there until December 2016 and has joined EPESOL since then.

Others who have joined us in quarter are listed below:



M. Abdullah

Designation: Sr. Sales Engr. [LV]
Experience: 5 years
Department: Project Management Unit



Waqas Tausif

Designation: Projects Engr.
Experience: 3 years
Department: Project Management Unit



Zeeshan Haider Lughari

Designation: Products Engr.
Experience: Fresh
Department: Products Development Unit



Farhan Farrukh

Designation: Design Engr.
Experience: Fresh
Department: Engineering Unit

New Web presence as the portfolio expands to new levels

EPESOL.com goes live again

EPESOL is proud to present its refreshed online comprehensive and user-friendly portal, where the client's time is of essence. The new all-in-one web page structure transforms the reader into a discoverer and facilitates adequately through our RFQ interface. This structure allows the visitor to get the information in one click right away from any of our more than 10 business portfolios. The news section of the site allows a visitor to become a fellow in our journey towards Pakistani multinational.



EPESOL Panels, rocking the Power Systems!

Purely ingenious, customized and beautifully designed

EPESOL has now become the most thriving and most trusted panel supplier in Pakistan. With a large foot print in 132 kV EPESOL is truly the master in its field. This quarter was not so different, as usual, starting with MEPCO; by supplying large numbers of RP3 and RP4 that cater the protection of Line and Transformer and have state of the art protection system like D60 and T60 microprocessor based numerical relays. FESCO was also supplied with a huge order of RP3, RP4, CP20, CP30 and CP50. The control panels been offered were for Line and Transformer control. HESCO was another utility been served, as large number of RP4, CP30, CP50 and AC/DC panels were supplied to them.

EPESOL Nests-In

All the engineering teams now under one-roof

EPESOL; now have an all-in-one headquarter in Lahore where we define the problem, brainstorm and operate solutions best to the client's mind-set. This has led to a better association and partnership between the EPESOL teams. Also, a training centre that can cater a small team of engineers for their training needs and protection lab for products' after sales and support. Hence providing a One-Stop solution for the Power industry. EPESOL is highly motivated to serve their clients in the most convenient way possible by settling in vast market and hub Lahore. The office in the easily accessible New Garden Town, adjacent to Kalma Chowk, has been extended and renovated according to the world-state standard and quality that we abide by.

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 trust. EPESOL provided DGA Analysis, Kelman Transport-X, Hydran, Transfix, Motor management relays and several LV components. IPPs & GENCOs served were AES, Jinnah Hydro, Engro PowerGen, TNB Liberty and Fauji Kabirwala.

Industries across 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.

Educating the customers on what we provide

NTDC - GSO and Protection being trained on Protection Relays

EPESOL has trained a vast number of utilities, IPPs, industries and others through its Training School. Recently NTDC executives amid their large order for the procurement of 220 kV Relay and Control panels were trained at EPESOL inhouse training facility. D60 Distance Protection, T60 Transformer Management and C60 Breaker Management relays were introduced to the team and a detailed summary was presented in a comprehensive time. D60 is a microprocessor-based Line Distance Relay relay in three-pole and single-pole stumbling applications. The T60 Transformer Management Relay is also a microprocessor based relay for protection of MV, HV and EHV three phase power transformers. The trained personnel were thrilled by the unique training methodology of EPESOL training staff as evident from the below feedback:



PROTECTION SYSTEM STUDIES FOR 500 kV YARD AT 1180 MW CAPP BHIKKI

EPESOL has been a leader in Pakistan to carry out protection system studies. With numbers of projects successfully done and a happy clientele, EPESOL is a leader in market. This being the prime reason that it was entrusted recently for new power initiatives of national interest. Recently, we completed protection system study of 500 kV switchyard at 1180 MW CAPP Bhikki; included protection relay setting calculations for 500kV switchyard at 1180 MW RLNG based CAPP Bhikki. The scope included setting calculations for line protection set-1 & set-2, transformer protection, busbar protection, breaker failure protection, and synchro-check relays



POWER SYSTEM STUDIES FOR AL-WAJEED WELLS IN KINGDOM OF SAUDI ARABIA

EPESOL has successfully conducted power system studies for a water treatment plant (WTP) at Al Wajeed Wells in Kingdom of Saudi Arabia consisting of various pumps / motors / loads and an in-house generation to cater these loads. The electrical system of WTP consisted of 4 x 2281 kVA synchronous generators generating power at 13.8 kV and stepped down to 4.16 kV, 0.4 kV and 0.38 kV for various loads by 6 x distribution transformers to feed various loads at these voltage levels by various MCCs. The scope of the project was to perform electrical network analysis for whole electrical system and studies including; Short circuit study, CI/PT calculations and Protection coordination study.

RETROFIT DESIGN FOR GENERATOR STEP UP & STARTUP TRANSFORMERS AT LALPIR POWER

Scope included preparation of complete schematics drawings, relay setting calculations, installation, testing and commissioning for replacement of Alstom make KBCH130 relay for backup differential protection of 24/220kV generator step up transformer (GSU) with Alstom make P643 relay and Alstom make KBCH120 relay for primary differential protection of 220/11kV start up transformer (SUT) with Alstom make P642 relay.

EPESOL; biggest facilitator of OEMs in Pakistan

This boots overall national expertise - CEO

This quarter proved another success as EPESOL provided tripping and lockout relays, substation parts, 345 relays, MIFII, MIFN, MIVII and test plugs. NSI ABB, GA Sons, Tariq Electric Pvt. Ltd., M-Tech, Ghafoor Engineering, FICO, Comet Enterprises, Green T&D, Siddique Sons, ELMETEC and Tech Links were being served this quarter.

Utilities trust EPESOL as quality proven

Serving national institutes is the first priority

Utilities, over the years, have shown great confidence in EPESOL and its engineering. This quarter we provided them MIV II, BJ8R, MIFII, TS101, 350, VDF10, D60, T60, C60 relays and CP-20, CP-30, CP-50, RP-3, RP-4 and AC/DC protection and control panels, 500, 220 and 132 kV protection relays and LV breakers. Over the past quarters, every utility have displayed content and satisfaction with EPESOL's expertise. Utilities this quarter are FESCO, MEPCO, HESCO, NTDC, K-Electric and NTDC.

International Field Services

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

380kV Al-Samir BSP, Jeddah KSA

» Commissioning of GE Transfix transformer online gas analyser

Sulmania Power Plant, Iraq

» Testing and Modification of Protection Relays

Indorama Petrochemical, Nigeria

» Commissioning of Generator Protection Relays

Thermal Power Plant, Turkey

» Commissioning of GE Transfix transformer online gas analyser

132kV Al-Mahadiyah BSP, KSA

» Commissioning of GE Transfix transformer online gas analyser

Field Services, Serving at home!

Happiness is to traverse the whole country with top quality

FCCL Attock

» Dissolved Gas Analysis of Transformer oil

Bhikki Power Plant

» Dissolved Gas Analysis of transformer oil

Siemens GSM & USM sites

» Testing and commissioning of Transducers

Kot Addu Power Company

» Replacement and commissioning of Marshalling Kiosk Panel

EPESOL harnesses the future for Pakistan by Training the Engineering Resource on latest developments in the world

2- Days seminars in Multan and Lahore conclude with expository experience for Pakistani utilities and industries

Over the years, EPESOL has shared its knowledge base with a number of utilities, IPPs, industries and other customers. EPESOL Training School facilitates both in house and on demand trainings. Recently, K-Electric chose EPESOL, to train their engineers. EPESOL is determined to educate Pakistan's engineering resource. The seminar took place in Lahore and Multan, where Deniz Kose (GE Turkey), Ali Hamze (Commercial Manager GE) and Hamza Farooqi (GE DE Multilin UAE) were invited from GE to be our trainers. Ms. Deniz presented monitoring & diagnostics of transformers' dissolved gas analysis (DGA). Ms. Deniz further explained that, according to IEEE & IEC, all transformers excrete gases

to some extent, when in operation. The pivotal role of DGA is to distinguish between normal and abnormal conditions based on the standards percentage of dissolved key gases in the transformer oil. Moreover, she explained that Dissolved Gas Analysis is the new state-of-the-art test set for analysis of 7 fault gases and moisture. It has vast range for detection of gases from 1-50,000 ppm. DGA also minimizes the time-taking documenting, packaging and shipping samples to a laboratory. Hence, the accurate results are produced in less than 30 minutes. On-site analysis takes less time, hence increases speed and decreases cost. Ali Hamze educated the audience on the newly added Agile

protection and control portfolio in GE Grid Solutions by former Alstom. He explored the common avenues in the characteristics and the commercial aspects of Agile series. Hamza Ahmed Farooqi discussed the Automation of Digital Substation. Mr. Hamza had an intuitive session on the future of Grids with Digital Substations in line. He explored the concept by explaining the existing line protection, distance protection, generator protection systems using G60/G30 and low impedance bus bar protection using B90. He asserted that smart choices do not effect the human resource but in fact elevate the overall performance in addressing a problem and a more smart human resource is what Digital Solutions ensure.



Paradigm shift from conventional control to fully automated Balance of Plant and Generation in Pakistan

EPESOL completes three large automation projects for GE Grid Solutions for the new projects in Pakistan.

EPESOL presents a protection and control integration in electrical substations and industrial plants through the most convenient, economical and technically sound solution. The system architecture is appropriated and extensible and contains IEDs, a communication network, various Human Machine Interfaces (HMIs) and remote links to Plant Master SCADA (PLC or DCS), maintenance operators and engineering offices.

After EPESOL entering into Automation last year; this year has proven its professional competency by automating all biggest new power system in Pakistan including; 1180MW Bhikki combined cycle power plant, 1230MW Haveli Bahadur Shah combined cycle power plant and 1223 MW Balloki combined cycle power plant. The solutions implemented on these plants were robust, versatile and configured to cater the needs of future. The solution can monitor, manipulate and analyse generator protection, Excitation gadget, LCI gadget, pumps associated with turbine operation, DC auxiliary of plant, AC auxiliary of plant, ATS gadget of emergency DC supply and HV switchyard. The prime benefits of this redundant automation gadget start out through live tracking of all analog values, statuses, events, alarms and trips of related system. Secondly, controlling of all pumps and AC/DC supply system to the plant through Bay Controllers have been made viable. Moreover, evaluation of fault with Automation extraction of fault statistics related to generator protection, pumps and AC/DC auxiliary machine, gives us the liberty to troubleshoot even inside the complicated of situations. All Interlocking of HV gadget for operation and troubleshooting can now be monitored. Lastly, stage 3 communiqué, to provide all analog, alarms and experience alerts to Turbine manage system (Mark VI) was also implemented. The IEDs used for the purpose were C650 and MM300 (motor management system) in the GE Power automation environment. EPESOL being a partner of GE Grid Solutions had its human resource exclusively trained by GE in their Bilbao, Spain facility on their state-of-the-art GE Power that allows network tincture for testing and commissioning. Amid the importance of these projects to the national persona, EPESOL deployed its finest engineers on the task. Both Engineering Unit and Services Unit were engaged day and night to coup with the fast pace and need of task completion. They on the same time our teams catered Monitoring and Diagnostics needs of these plants' transformers, meanwhile, by installing Transfix online mutli-gas DGA system on all three sites.

KE entrusts EPESOL Training School for its technical capacity development

KE once again looked towards EPESOL for enhancing their human resources' capacity. EPESOL Training School provided an extensive Distance Protection training comprising of 3 days at Days-Inn, Karachi starting from 11th January, 2017. A practical hands-on experience was presented after a detailed theory of UR series D60 Line Distance Relay by GE. The D60 Line Distance Relay is a microprocessor-based relay on transmission lines of any voltage level in three-pole and single-pole stumbling applications. The essential capacity of the relay comprises of five phase and ground distance zones of protection, either mho or quadrilateral according to client determination, with implicit rationale for the five common pilot-supported plans.

First day of the training began with D60 features including; Protection, Control, Monitoring, Metering, Others), D60 - Hardware, Front HMI, Ordering Information, D60 - EnerVista UR Setup Software, and Flex Logic. Afterwards the trainees set up the relay interface, setting configurations and flex logic building under EPESOL trainer supervision.

On the second day, Phase Distance (Mho, Quad), Ground Distance (Mho, Quad), Line Pickup (SOTF) and Telepotation Schemes of D60 were discussed in detail. It was followed by hands-on-experience where they performed D60 - Phase & Ground Distance Pickup & Time Testing, Line Pickup (SOTF) Testing and Telepotation Schemes Testing on D60 itself.

Lastly on day 3 Synchronism Check, Fault Locator, Autorecloser, Power Swing were introduced and practiced by the trainees.

EPESOL training school is a pioneer in Pakistan in protection and control trainings.

