The Energy Reforms Agenda

Proposed

For the New Government

v.2.32

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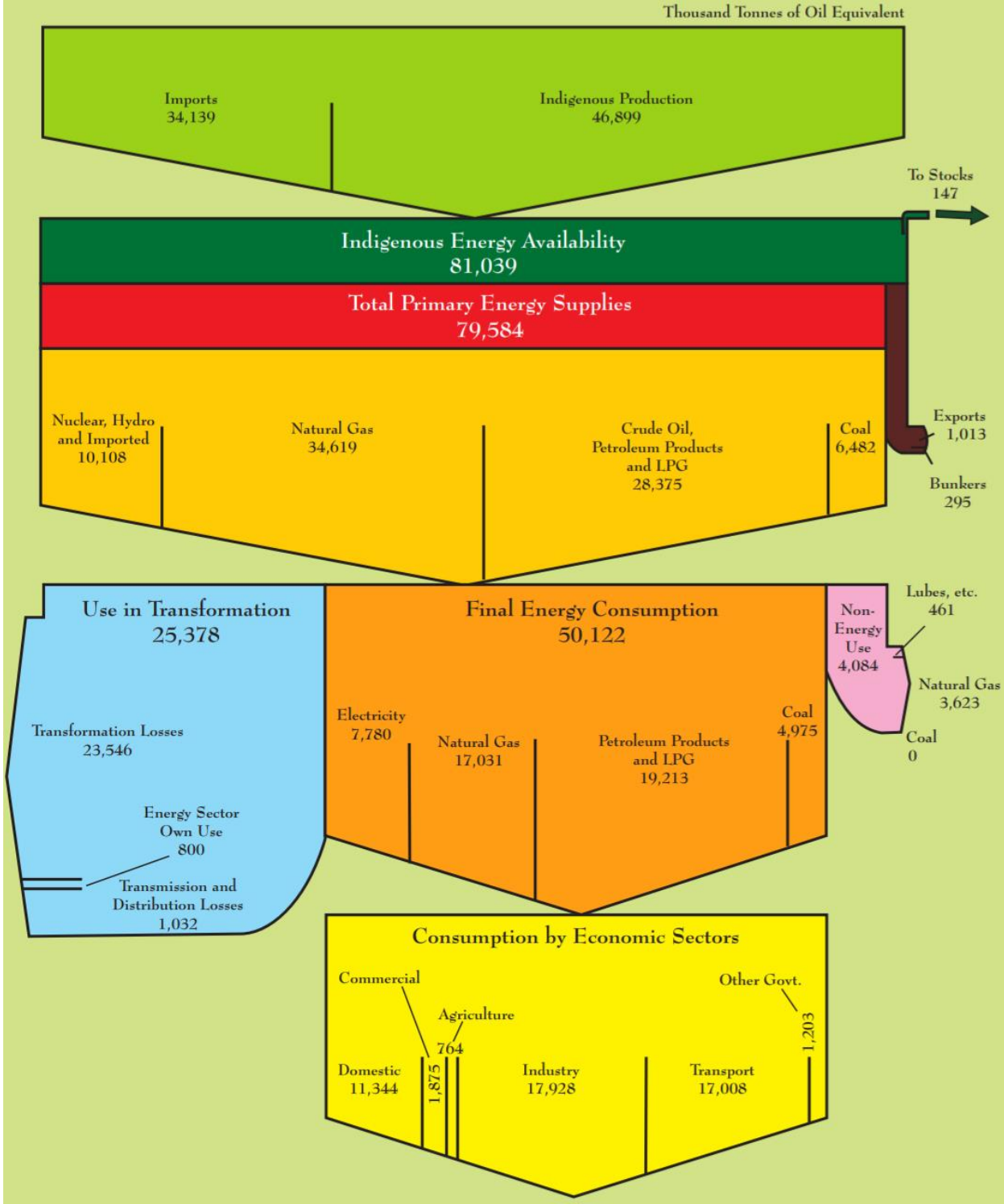
ENERGY FLOW CHART 2016-17



Preface

This is a short collection of my Essays and Articles written as a postscript to my book, ***Pakistan Energy Issues; Success and Challenges***, published recently. For the completion sake, a few chapters have been taken from the afore-mentioned book. Those who may not have time may read only **SUMMARY**, where a list of actions is given. An exposition of some of the more urgent and important items has been given in subsequent chapters. An associated presentation is also available which may be given, should it be required.

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About the Author

Syed Akhtar Ali is an eminent energy expert, an Engineer-Economist and consultant. His most recent assignment was as Member Energy, Planning Commission. He was Research Fellow Energy at Harvard University. He has held top management appointments in Pakistan's public and private sector. He was a visiting Professor of Energy at IoBM and has taught energy management to MBA students. He has been offering consulting services to public and private sector clients in the area of energy and environment, investments and tariff issues and has authored a number of books on these subjects. He is an author of eight books on various subjects such as energy, governance, political economy and resources. He has done consulting assignments in Energy and Environment Sector in the U.S., Europe, the Middle East, Africa and South Asia.

CONTENTS

22. Handling the Circular Debt

1. Summary

Energy deficit issues have been resolved for the time being by induction of 10,000 MW of power projects and induction of LNG. However, there are many issues that remain unresolved pertaining to the management of the system, and some are created by the new supplies as well such as that of import bill. Electricity sector has been a subject of reforms and restructuring since long and has come a long way from being dominated by a monolith of WAPDA to the dominance of IPPs and DISCOs. Oil and Gas sector, however, has escaped or has managed to prevent reforms and restructuring. As a result, there are more problems today in this sector of lack of performance, losses, transparency and others. In the following we are presenting a line item list of steps in Reforms and Restructuring that may have to be undertaken to improve the situation.

Privatization and independence of the companies and empowering of the companies' boards have been the buzzwords and continue to be so. None of the three has happened and obverse has happened; direct management of companies by the ministries from Islamabad. Earlier there used to be an intermediate layer of corporations and boards which essentially undertook the planning and coordination functions and used to serve as accumulator of human resource capital. Disintegration of the energy sector has occurred with many untoward consequences. It is vital that consideration be given to revive those institutions like PEPCO and PERAC with required changes in the earlier style. We have listed some other organizational changes as well like breaking large DISCOs into smaller companies. Current size of the companies is not amenable to direct management resulting in losses, leakages and theft. Imagine PESCO, spreading from Murree to Chitral and D.I.Khan; and SSGC and SNGPL covering the whole country.

Circular debt, leakages and theft are the hallmark of the energy sector. Electricity and gas theft have become standard practice. Some management approaches like fragmentation of large DISCOs, and the other technical approaches of installing smart meters on 11 kV substations and Distribution transformers.

Although Furnace Oil would be eliminated totally due to induction of LNG and Coal, but both are imported almost nullifying the putative advantage. In appropriate non-flexible fuel technology has been installed in coal power plant which has to be addressed. Progress on Thar coal has been slow and small scale approaches and other factors have made Thar coal expensive and even uneconomic. Major reforms in Thar coal and launching of a major Thar coal initiative are required and have been proposed in the list below.

Gas production has stagnated, reserves going down and demands on the increase. Unfortunately, the performance of public sector E&P companies has been lacking. A major shake-up in these companies is required in these slumbering giants. There is a lot of human resource and other resources tied in these companies. Inappropriate appointments have been responsible for the malaise in these companies.

Regulatory performance in assuring fair energy prices has been lacking, too. It is a difficult but essential task of the regulator to walk midway between attractive enough return to the developers and investors and the fair and affordable price for the consumer. Lack of know-how and facile working style of asking free data from the vendors themselves and lack of third party involvement are the factors among many others that have resulted in awkward regulatory decisions. Even CPEC energy prices as a result are 40% higher. Reforms and reorganization in regulatory sector is due along with a performance review. Ultimate solution is more competition than regulation as competition in Solar and Wind power sector has demonstrated in the region and around the world. Beginning towards a competitive regime are to be made, initially, through tariff based bidding and reverse auctions and finally through Energy Exchange pricing. A lot of institutional changes and existence of many competing buyers and sellers are required. Suggestions made in the following, directly and indirectly, would enable faster movement in the direction of a competitive and efficient regime.

Some of the recommendations made in the following have already been discussed in this very space. The idea is to paint a unified picture of the required changes and seek the attention of stake-holders and policy makers who may not need much elaboration themselves. Some of the line items would be our subject of discussion in coming days in this space.

1. Reorganize and Restructure

1.1 De-bureaucratize the sector (removing direct control by ministries) by Reviving PEPCO and PERAC; reorganize on the lines of Group Companies ala Shell, ENI, etc

1.2 Broaden the scope of Pakistan LNG as Pakistan Gas Supply, commingling LNG and normal gas procurement and supplies

1.3 Shake-up slumbering E&P companies create competition and establish another E&P company in Public sector

1.4. Reorganize Gas and Electrical DISCOs into smaller companies; Have 20 Electrical DISCOs and 15 Gas DISCOs

1.5 Reorganize and fragment PSO as well; *separating procurement from distribution or Geographically into Northern and southern*

1.6 Independent office of Reforms and Restructuring

1.7 Organize Users Committee at all levels in large public interest organisations including energy sector organisations. Consider Dual Board system ala European system

1.8. Merge NEPRA and OGRA

2. Electricity Tariff

2.1 Reform and Renegotiate CPEC, bring in competition now that Saudi Arabia is a part of.

2.1 Bring Tariff to cost recovery, for domestic sector charge 5% GST as it is non-adjustable

2.2 Reform regulators bringing in more expertise, transparency and public oversight;

2.3. Eliminate upfront tariff and adopt tariff-based bidding
2.4 Bring seriousness and transparency in EPC bidding
2.5 Reappraise Electricity Legislation 2017
2.6. In Electrical Tariff, introduce night tariff; increase base tariff and not peak tariff (high peak tariff gives an erroneous picture); introduce surcharge on 500+ Sq yds high class houses in posh urban areas.

3. LNG and Conventional Gas

3.1 As local gas prices increase, there is a case for commingling and a unified gas tariff.
3.2. Pakistan LNG and PLL may be merged into one company and eventually one Pakistan Gas may be formed ala PSO. All gas local and LNG may be bought by Pakistan LNG and a uniform commingled tariff be announced. Gas tariff to be announced monthly ala Electricity MFPA. Fixed Transmission and Distribution charges to be based on a priori-cum-performance basis ala KESC.
3.3. Bring Gas Tariff System to as close as that of NEPRA. Adopt KE model performance based tariff system for both DISCOs; Gas and Electricity. This can be done with or without merging NEPRA and OGRA, as proposed elsewhere in this document.
3.3. Tight gas tariff may be brought nearer LNG tariff

4. Handling Circular debt

4.1There is a circular debt of Rs.1160 billion. Attempts should be made not to let it escalate. If nothing is done, it will keep increasing specially with the increase in supply of electricity. The real solution lies in reducing the gap between cost of supplies and the electricity revenue. There are following means which may enable to achieve this; Tariff reforms in the form of reducing excessive RoR and other parameters, introducing competition, changing fuel mix to cheaper ones in the form of cheaper solar, wind and Thar coal; reduction of T&D losses and theft along with collection of bills regularly; improving the law and order situation in major default areas of PESCO, SEPCO and QESCO, in cooperation with provinces. This is a tall order. Details of how to implement the afore-mentioned desirables have been discussed in various sections. Increasing the load factor by increasing the supplies and network expansion may reduce the CPP cost and thus reduce the cost of electricity and vice versa.

Thus, the net cash injection requirements appear to be as follows;

1. PSO=Rs.300 Billion
2. IPPs=Rs.121 Billion
3. SNGPL =Rs.48.1 Billion
4. SSGC=Rs 54.8 Billion
5. Total= Rs.523.9 Billion

GOP has to pay RS 248 Billion in the form of various subsidies, thus a net of Rs 275.9 may be passed on to consumers in installments so as not to have an impact of more than Rs.0.5 per unit.

Recommendation: Years of accumulated problem cannot be wiped out from the balance sheets in one-go. A gradual approach would be required which in turn would require external financing. A concessional loan from Chinese banks or ADB to the tune of Rs.300 Billion may be obtained, if feasible. At 2% interest rate, the servicing cost would be Rs.6 Billion. The interest cost may be passed on to the consumer tariff, which would result in Rs.0.6 per unit addition to the latter.

5. Streamline and simplify Tariff system; current NEPRA practices are time consuming, inefficient and transaction based. Regulatory rate-setting interventions are to be minimized under Constant Price System.

5.1 Introduce Constant Price tariff for Electricity Distribution. CP+X, where X stands for escalation.

5.2 Let CPPAG announce uniform Electricity Prices for all DISCOs.

5.3 Monthly Fuel Adjustment MFPA continues as usual.

5.4GOP notifies consumer tariff based on its Tariff Revenue Model with volunteer advice from NEPRA

5.5. Subsidies for DISCOs are computed based on the difference between notified tariff and actual cost.

5.6 Eventually, DISCOs move towards Wire-only model and CPPAG assumes Power Supplier and Trader role.

5.7. Eventually, CPPAG may remain as one of many power suppliers when privatization and energy market operations are gradually implemented.

6. Create Energy Market and competition

6.1 Launch an Energy Exchange initially under a trial mode

6.2 A limited %, say 5% of electricity and Gas may be allowed to be traded.

6.3 Standardize Wheeling Contracts and procedures

6.4 Have all LPG under Energy Exchange pricing or bring it under regulation in the mean time.

7.5 Introduce LPG subsidies for northern areas

6.6 Adopt solicited projects tendering and reverse auction

7. Energy Sources:

7.1 Bring Reforms in Thar coal governance in consultation with Sindh government recognizing the federal relevance as buyer of Thar coal.

7.2 Launch a major Thar coal initiative of 5000 MW under a unified package and one or two mines totaling 30 MTPA. Under a maximal benchmark tariff of 25 USD per ton and 5 Usc electricity

7.3. Promote Thar coal usage in general industrial use and discourage imports, levy duty or ban imports altogether

7.4 Convert imported coal based plants to Thar; initiate a feasibility study

7.5 Launch a Biogas Policy, introduce Bio-CNG; substitute LPG by Biogas in existing LPG-Air-Mix schemes; launch 100,500 and 1000 Buffalo/cows schemes for Biogas.

7.6 Introduce a major programme of cheaper Solar Energy with every district having a share proportional to demand and population

7.7 Promote Hybrid Solar with Wind in Sindh and Balochistan and with Hydro in KPK.A target of 5-10000 MW of Solar-Wind capacity to be made with proportional allocation for every district.

7.8 Go slow on Hydro and nuclear being capital intensive and having high production cost.

7.9 Increase local gas production thru higher prices for tight and unconventional gases but more thru energizing the public sector companies.
7.10 Build gas storages in depleted fields being a cheaper option to take care of demand and supply issues and take or pay contract limitations.

8. Technical

8.1 Close down thermal power plants with efficiency lower than 38-40%.start with Furnace Oil PPs
8.2. Convert Refineries to produce Gasoline instead of Furnace Oil; in the meantime bring a policy of furnace oil exports
8.3 Focus on improving Transmission and Distribution in power sector, add transformers to eliminate overloading
8.4 Expand 11kV and small voltage networks to increase supplies to undersupplied regions.
8.5 Reduction of Losses in Power and Gas sector
8.6 Launch an initiative to improve maintenance practices in T&D electrical sector.
8.7 Complete GIS system
8.8. Increase and promote local content in Energy sector. Launch power equipment manufacturing projects under CPEC.

9.0 Reducing Transmission and distribution losses

9.1 Reorganization into smaller companies is a part of the solution, pending that introduce a cost-centre approach around 11 kV grids
9.2. Fire at least 100 known corrupt persons each in gas and electricity DISCO and make an example out of them
9.3 Introduce smart meters on 11kV substations, and distribution transformer as a cheaper and manageable solution. Similarly on all Gas –substation so as to narrow down defaulting areas and identify thieves.
9.4. Create high level positions of Chief Loss Reduction Officers both at Division levels and company level with targets, and implement or coordinate the afore-mentioned steps.

10. Petroleum Products

10.1 Cheapen Diesel prices vis-à-vis Gasoline; Gasoline prices in India are 60% higher than in Pakistan and Diesel prices in India are 21.5 % higher than in Pakistan. In Pakistan Diesel to Gasoline price ratio is 1.18 vs. in India of 0.90.Meaning that Diesel in Pakistan is 18% dearer and in India 10% cheaper than Gasoline. Keeping in view high growth rate of consumption of Gasoline of 20% per year, there is a case for increasing the Gasoline prices. Although, after significant increase in Gas and Electricity prices, there may not be much scope politically to move in this direction. Some kind of rationing may be needed at some stage as well. It would all depend, how international crude oil prices behave in the short to medium run.

10.2 Introduce Cheaper Gasoline Product for motor cycles and small cars under 800 CCs. Design a Gasoline product around RON87 and other attributes. Have two tariffs of Gasoline
10.3 Introduce Fuel Standards (chemical composition) and remove arbitrariness in this causing transparency and anti-competition issues. Also adopt or encourage Euro -VI for environmental improvement. Most new cars are Euro-VI capable anyway. Local Refineries capability enhancement must be studied. Imported fuel would be perforce EURO-VI. There would be a cost difference of less than a Rupee per Liter. EURO-VI reduces Sulfur based emission by 50 times .All new Refineries should be based on EURO-VI requirements.

10.4. Reduce or eliminate metal additives such as MMT in Gasoline
10.5 Mandate Ethanol-added Gasoline, initially E-5 and then E-10
10.6. Promote, encourage and install pipelines discouraging road transport of PPs as much as possible. Bring a policy and encourage private sector investments in this. Some initiatives are already in pipeline fortunately.
10.7 Promote and encourage Catalytic converters in automobiles, their maintenance and mandatory replacement after completion of service life.
10.8. Solve transparency and anti-competition issues in PSO
10.9 Go slow on Oil Refineries post LNG
Due to introduction of LNG, low efficiency F.O. power plants would be closed down and thus FO would go out of the energy-mix in w matter of few years. Imports of FO have been blocked almost. There is a Refinery conversion issue to replace FO production. However, Gasoline market is growing at a high rate of 20% per year and has not tapered off from a high growth of 20% p.a. yet. There is no immediate rationale for installing Oil Refineries. Low volume small refineries are to be discouraged as due to low technology, high quality low sulfur products may not be produced. New refineries may be required only if conversion of refineries does not take place. Oil Refineries create very little employment. At the kind of scale being considered, Oil Refineries may not be that profitable? It may eat into a limited quota or scope of FDI that could be utilized more efficiently in other sectors both in terms of value added and employment.

Economic size of Oil Refineries these days is 500 BPD and above. India has installed an Oil Refinery of more than one million BPD in Jamnagar. In or around Gawadar, a similar refinery of 1 million BPD may be planned along with a petrochemical complex. This may cost 40 Billon USD.A Saudi-Chinese JV can be expected. The crude to come from Saudi Arabia and output is to be pipelined to China. Pakistan can get 200,000 BPD at international prices which can be shipped to various parts through pipelines. Pakistan can charge for land, property tax, security and other services fee.

11. Reform and Redesign CPEC

11.1. Build in Transmission and Distribution expansion and improvement project, if ADB component not sufficient
11.2. Build in Power Equipment Production Project
11.3. Reform CPEC Tariff

Proposed CPEC terms for Energy and Allied projects

	Existing	Proposed
RoE %	17	14-15
Debt Margin	LIBOR+4.5%	LIBOR+3%
Debt Repayment Period yrs	12-Oct	20-25
CAPEX Adjustment	100	60-80

Reference CAPEX prices as prevailing in China; seriousness in EPC bidding procedures

12. Shun CASA-1000 or Change it?

CASA-1000 was conceived a decade ago when Pakistan was facing energy deficit. Times have changed since and electricity surplus is being projected due to CPEC, LNG, Thar coal, Hydros and other projects.

Besides, CASA-1000 electricity is coming out to be too expensive at 11.00 Rs per kWh, perhaps the most expensive one as compared to other resources. Instability in Afghanistan also poses questions as to the feasibility of construction and operations of this project. It would remain an infirm source of power, if at all. CASA should be either closed down or modified. Afghanistan can be provided 30 MW each by Tajikistan in the north and Pakistan in the South at lower rates than the current form of CASA.A simple 220 KV transmissions would be required. It would promote electricity trade fulfilling World Bank ideals.

13. Build Bhasha Dam: Beg, Borrow or Steal

Ethiopia has built Alnahda dam, which is larger than Bhasha, itself without foreign finance, out of various personal contributions of the people. I.K. is very good at mobilizing. Some portion may come out of people's contribution. Neelum Jehlum has been able to finance Rs.50 billion out of NJ surcharge .NJ had no public support of the kind Bhasha has. Let us consider, Bhasha Dam surcharge as well, although high electricity prices due to exchange rate issue has not left much space in the electricity tariff. Surcharge on Gasoline can be considered also. There could be many other financing options like Bonds and Equity shares for the public. One need only finance the dam portion which is not more than 6 Billion USD. Power sector finance can be financed by IPPs themselves. There can be more than one IPP on Bhasha dam.EPC contractors can also bring suppliers credit. Let us show determination, rest will follow.

14. LNG on Take and Pay

After installing 4 RLNG CC plants, there is no appetite for these projects for the next 5-7 yrs. However, LNG may be required for sectors other than power.8 BCFD of gas demand is projected, while local production has stagnated at 4 BCFD for more than a decade. There is a scenario of exhausting reserves in 20 yrs time. Local production can be enhanced by going into Balochistan.KPK has more potential. However, LNG may be allowed in private sector on Take and Pay basis, without any government involvement, guarantee or undertake

15.New Electricity Tariff

1. Average Power Tariff is Rs.11.95 against cost of supplies of Rs.15.53 per kWh, creating a deficit of Rs.3.58 per kWh.

2. Total subsidy requirements/deficit amounts to Rs.364 Billion.

3.Residential sector creates most of the deficit amounting to Rs.275 Billion, out of which Rs.142 Billion is created by tariff slab of 1-100 units;Rs.84 Billion by the slab 101-200 units; and Rs.53 Billion by 201-300 units. Lifeline slab consumes Rs.30 Billion, with a maximum subsidy requirement of Rs.13.53 per unit. Residential share in electricity consumption is 46.1%. There is a case for gradually increasing the rates in these categories.

4. Agricultural sector creates subsidy requirement/deficit of Rs.113 Billion against a share in electricity consumption of 11.44%.

5. Surplus is created by Commercial, Bulk Supply, Public Lighting and General services. A surplus of Rs.25 Billion is provided by these categories against a share of 15.61% in Electricity consumption.

6. Perhaps there was no need of reducing Tariff for Life line consumers from Rs.4 to Rs.2.00 per unit which would have halved the deficit in this category saving Rs.15 Billion.

7. If very high reduction in Agri-tariff was avoided, 50% of the subsidy requirement could have been saved ,saving Rs.56 Billion. Lower agri-tariff has been done to boost agri sector. However, it would reduce incentive to switch to Solar Pumps. Receivables from this sector are the lowest, esp in Balochistan.

8. Tariff slab of 201-300 units has been decreased from Rs.12.09 to Rs.10.02 per unit, resulting in a decrease of 15.63%.Had a 10% increase been done, one could reduce the subsidy in this slab by Rs.30 billion.

9. An increase of 15% has been made in Tariff slab of large residential consumers.

10. There is a general 5% increase in Industrial tariff, except B1 Peak wherein there is a50% increase bringing the tariff to normal of Rs.18.84 per unit from Rs.12.00.This slab was reduced unreasonably, perhaps. However, there would be Tariff subsidy to export sectors which has not been reflected in this tariff proposal. It will require, reportedly, a subsidy of Rs.25 Billion.

10. There is 20-25 % increase in commercial and Bulk Supply categories.

11. If the above adjustments are made, there is a subsidy saving potential of RS.100 billion, reducing the subsidy from Rs.364 Billion to Rs. 264 Billion. There is some confusion in the reported reduction of Life Line consumer tariff. This estimate would be affected by it.

New Gas Tariff

In Gas Tariff for residential customers, numbers of tariff slabs have been increased from three to seven, the most important of which is addition of a Life line customer consuming 50 M3,with a tariff of Rs 121 per MMBtu. There is an increase of 15-25 % in Residential tariff of small to medium consumers. However biggest increase is in the large residential consumer category of 500 M3 and more, of 146 %, increasing from Rs 600 to Rs 1460 per MMBtu.

Commercial and CNG Tariff has been increase by 40% elevating to a level of Rs 980.Industrial Tariff has been increased by 30% which has become Rs.780.Export sector industries is an additional slab with a tariff of Rs.600, a 30% difference from general industrial tariff and thus no increase from the 2016 tariff.

Fertilizer sector has always enjoyed subsidy providing gas at life-line residential consumer's rate. For feed stock, it was earlier Rs 123, which has now been increased to Rs.185, an increase of 50.41%.For electricity production of self-use, normal tariff has been there, which has been increased from Rs.600 to Rs.780 an increase of 30%.In case of Power sector, increase is from Rs.400 to Rs 629, an increase of 57.25%.For captive power, there is an increase of 30%.

Export sector has been successful in getting the lowest possible tariff of Rs.600. as opposed to similar tariff in Gujarat of Pk.Rs 1025.It is hoped that they will be able to increase their export volume to the promised 40 billion USD level .In Gujarat though, cheaper alternative fuels like Lignite are used by the textile industry. Perhaps, the same can be done here now that Thar coal is available for industrial use. Sindh Engro has recently invited bids in this respect offering Thar lignite for sale. Perhaps Sindh and Southern Punjab-based industry may be able to benefit from it than distant Central Punjab.

Large Residential consumer now pays more than its counterpart in Gujarat India, with Pakistan Tariff of

Rs.1460, vs Pk.Rs.1024 in Gujarat. Top Residential consumer would be still paying 50% of what consumer pays in Europe. Highest consumer Tariff in Pakistan used to be 60% of corresponding tariff in Gujarat before the recent increase. It may be noted that there is no concessional gas tariff in India, although there is highly

differentiated concessional tariff in electricity sector there. Industrial Tariff in Europe is Pk.Rs.900 -1000 per MMBtu, being 25% higher than in Pakistan. It should be noted that European gas market is highly competitive getting all kind of gas from all kind of places like Russia, USA, Middle-East and its own production. However, all this comparison becomes topsy-turvy due to recent massive devaluation and prevailing dynamic situation. Another revision may be required soon to handle the situation. This scribes proposal of monthly gas pricing based on performance based tariff for GAS DISCOs may be considered seriously by the concerned authority.

2. Restructuring the Energy Sector

Formation of Ministry of Energy by combining the two ministries of Oil and Gas and the Ministry of Power has been done and the two are functioning as divisions. In many countries, except South Asia, this kind of unified organization or ministry is there. There is a commonality, one deal with primary energy and the other deals with its uses to convert into electrical energy and its distribution. The two divisions are operating independently with little apparent coordination as has been evident by a number of incidents such as the orders to close down some power plants based on furnace oil. Perhaps, bureaucracy is waiting and seeing as to the mood of the new government so that demerger does not create many problems involved in aggregating and disaggregating.
One wouldn't like to tinker with organizational structures unnecessarily, however, the energy sector is suffering from many problems; inefficiencies and stagnation in the E&P companies against the gigantic task ahead of them and increasing transmission and distribution losses and mounting circular debt are some of the few; Lack of inter-organizational collaboration which has greatly weakened local capabilities and participation of local content in the energy projects.

Reviving PEPCO

In the earlier round of reforms, WAPDA's role was considerably reduced to include only hydro power generation and water issues, and PEPCO was totally dismembered. WAPDA has been further pruned down to deal with hydro power only, as a new Ministry of Water has been created, which may be a step in the right direction, as the subject of water is too important to have a divided attention of one ministry. It deserved a unifying one ministry dealing with all issues of water exclusively, which has been achieved through the creation of water ministry.

The proposal of dividing the DISCOs, and for that matter gas companies also, into smaller companies in terms of organization and geographical domains, has been on the table for a long time now. Most of the vices, it is said in the two sectors of power and gas, came from the lower tiers of these organisations and it has been argued that smaller setups may give more direct and closer controls to the top management..

A common theme of reform proposals for power companies and even other public sector companies has been to make the board of directors independent, powerful and competent enough to undertake supervisory oversight functions or even manage the strategic affairs. This has remained largely a utopia. PEPCO was dissolved under this utopia. Neither independent nor competent board members could be inducted due to the political and social system prevailing in the country, nor has the bureaucracy been able to provide a conceptual and operational framework of the operations of the board. Senior bureaucrats often are not able to attend the board meetings and study various company proposals, and participate in special committees.

Boards' discussions and meetings are dominated by the chairmen and are mostly a perfunctory exercise attempting to meet the legal requirements. Practically, the companies are being managed by the bureaucracy from Islamabad. This is true more for power division entities like DISCOs and GENCOs. Whereby individuals may have a lesser inclinations for direct interventions, the CEOs alone function, without a meaningful oversight functions from the board of directors. In fact there is a vacuum and confusion as to who should be controlling DISCOs; ministry or NEPRA, as confided by Chairman NEPRA to me. NEPRA, as per its own understanding of its functions, it is responsible for broad oversight and perhaps rightly so. Actual controls rest with the board of directors and the ministry. However, Ministry thinks that NEPRA is responsible for the bad performance and lack of initiatives by DISCOs and the former is responsible for administrative and transfer functions.

PEPCO used to function as an intermediary between Islamabad ministry and the DISCOs. They used to have a CEO and technical department which could understand the technical and operational issues and could provide guidance to the entities, examine their reports and have an oversight over them. Rebellious and independence minded CEOs with the benefit of the utopia that we have mentioned earlier managed to sabotage PEPCO and got it dissolved in collusion with the interventionist bureaucracy of Islamabad. Under the current system, there is what the poet said; Na Khuda hi mila, Na visale sanam.

Over the years, power sector has been restructured and dismembered. It has gone from one extreme of a monolith WAPDA to another extreme of smaller splitted organisations which are not able to accumulate expertise and develop and absorb technologies and skills. Resultantly, there is hardly any major initiative or proposal which does not emanate from foreign consultants and experts tendered by IFIs (International Financial Institutions). We need an accumulator organization. This can be done by reviving PEPCO which should control DISCOS and GENCOs as well. Although some GENCOs (burning Furnace Oil) will be closed down, many new DISCOs would emerge. It would become well-nigh impossible to control and manage all these organisations from the ministry in Islamabad. Large companies controlling many organisations have similar central organisations even in the U.S., Europe and Japan. In India and Korea, there are integrating organisations of this nature. By reviving PEPCO in a slightly altered form as proposed earlier, the current extreme would be balanced.

Reviving PERAC with an improved agenda of National Petroleum Corporation

On the same logic as has been given in the case of reviving PEPCO, it is proposed to form a similar organization for Oil and Gas sector. Earlier there used to be only a few organisations. Several additional companies have come up, like Pakistan LNG, Pakistan LNG Terminal- which I have earlier proposed to be merged with Pakistan LNG-Inter State Gas System of Pakistan. Although, Oil and Gas Division has more technical content and organizational structure in the form of directorates which are manned by technical persons, an accumulator company might give better opportunities for coordination, synergy and exchange of technical information. A lot of effort is required to increase gas production for which even more public sector companies may be required may be in the form of JVs of PPL-OGDC-Private sector-Provinces or provincial companies. This is a proposal for accumulation and promotion of technical resources and not to create more bureaucracy. It is more than reviving PERAC, which was petroleum sector public sector cooperation. PERAC was dissolved as a part of privatization move, which did not happen. And technical

supervision and oversight was replaced with bureaucratic administration. If present government wants to dilute bureaucratic controls and strengthen technical content, this proposal can work.

All has not been well in petroleum sector. Most required infrastructural steps have not been taken worsening the logistics problems like undue reliance on truck transports, gas transmission issues in winters, lack of standards of fuel encouraging a laissez-fare on sensitive issues. Latest has been the Manganese issue in Gasoline. There are transparency issues, especially in oil sector. In fact direct involvement of the ministry and the minister without a safe distance in the form of an intervening institution like the proposed one has fostered transparency issues. Arbitrariness in petroleum specifications had earlier created a management crisis culminating in unceremonious exit of a former CEO of PSO.OCAC is too small to be effective in effecting a meaningful planning and coordination function. The issue of eating up incentives for refineries up-gradations by the refining companies is an additional issue. While India has gone a long way up into adopting appropriate standards up to Euro-V, in Pakistan, we are only talking about it without any meaningful steps. Resultantly NOx and SOX levels on our roads have contributed heavily to the smog and public health issues. The list is long. Some steps have been taken but too little and too late. It has been more of whimsical than structural. Corrective action is required which may be handled by the proposed organizational set-up.

There is no dearth of able and competent people in the sector. There would be no additional expenditure, as experts and professionals can be inducted from companies on a rotation basis. Only lower level of staff may have to be inducted and office facilities. However, there is a danger that the proposed organization may degenerate into another bureaucracy. There would be a need to define the functions and increase technical scoping of the organization.

3. Towards a Competitive Electricity Policy?

CCoE (Cabinet Committee on Energy) has announced some new decisions which have been followed by press briefings by the Minister Laghari .Most of it pertains to the Renewable Energy, while some is of general import. In this space, we would attempt to analyse the impact of what has been announced.

The main decision is doing away with up-front tariff for Renewable Energy in favour of competitive bidding. There was some confusion about competitive bidding in the wake of NEPRA decision in its favour but there was no word on it in black and white by MoE/GoP as to whether competitive bidding will actually take place and when. Now Minister Laghari has announced that competitive bidding will actually take place in two months' time. In parallel, GoS has also announced competitive bidding for a 50 MW solar power plant.

Competitive Bidding

Competitive bidding has been welcome by all within and outside the country as it has delivered highly competitive prices of 3-5 cents as opposed 10 cents plus in the prior period. Today, Solar PV energy is 100 % cheaper than the cheapest fossil based electricity. The announcement of Competitive bidding has been lamented by those vested interest which was expecting to earn extra profit thru exploiting the upfront tariff process by misleading and lobbying with the gullible NEPRA and getting a high tariff. The vested interest has in the past managed to extract 60 to 100 % higher tariff than international prices. Hopefully, competitive bidding will bring down prices resulting in lower cost of generation which would help both the people and the economy. It would be good for the solar power sector as it would expand under competition. It may not be liked by one-off fly-by-night category of investors who may have been in for quick-bux. However, real investors would welcome it which would be able to make longer term income under an expanded market, with a lower margin but higher absolute profits.

It is highly recommended that the government follows through the announcement of the Minister Laghari and organises the competitive bidding in an appropriate and credible manner. As local experience on competitive bidding (Reverse Auction) is not there, it may be a good idea to involve some external consultants who may have the requisite experience. Fortunately, there is a mature Power Policy and experience behind it, which would play a role in getting better result in the bidding. The test of the efficiency and outcome of the process would be the level of competition, volume of offers and the lower and competitive prices.

Extra Dose of Competition

At this stage, we would warn against taking an extra dose of competition. Competitive bidding in itself is a major step towards competition; it would be unwise to add or mix any other variability in it, like Take and Pay provision. It has to be Take or Pay contracts which have played a good role in assuring somewhat sceptic investors and managed to attract IPP investments. Take and Pay contracts may result in higher electricity tariff as the rate would be based on a capacity factor of 50% only as opposed to the usual 80% or even more undertake and pay.

The Energy Exchange

The proposed energy exchange will ultimately take care of this issue, as we will discuss in the foregoing. It is a good idea that the Minister Laghari has announced to entrust SECP to study and possibly organise the proposed electricity or energy exchange as they have the experience of a similar competitive process of share pricing. There is some similarity; however, electricity or energy exchanges have their own peculiarities. It is more obtuse and abstract than share prices. The possibilities of collusion and the other usual vices are many. A number of developing countries like Turkey, Philippines, Singapore and India have organised such exchanges but in a gradual, partial and considered manner, enabling them to learn through experience. A prerequisite for organising such exchanges is to have many suppliers and many buyers. We at this stage have only one buyer which is government/CPPAG. There are the following steps that need to be taken.

1 Strengthening of the Third Party wheeling processes
2. Diluting Regulation by ending generation licensing which will have a major market liberalising effect allowing SMES and Captive Power producers to enter into the scene.
3. Modifying and introducing either Take and Pay Contracts or limited-time (10-12 years PPAs) to enable large number of suppliers in the suppliers market.
4. Restructuring and dividing DISCOs into smaller companies and privatising.
5. Initially, existing PPA holders may be allowed to sell either 5-10% of their output in the electricity exchanges or extra electricity production beyond agreed PPA quantities as is being done in India currently.

The same exchange may also trade, LPG, Natural Gas and Oil on the lines mentioned above. Several national and international Oil and gas experts have told me that gas output can be increased by bringing extra production to the competitive market. Only last week, I wrote in these pages, how LPG market exchange can bring positive changes in this sector eliminating monopolistic or oligopolistic factors and near-quota market inhibiting actions. LPG association complains that LPG is supplied to only 25-30 companies while there are more than 130 bottling companies.

4. Towards a new Petroleum Policy

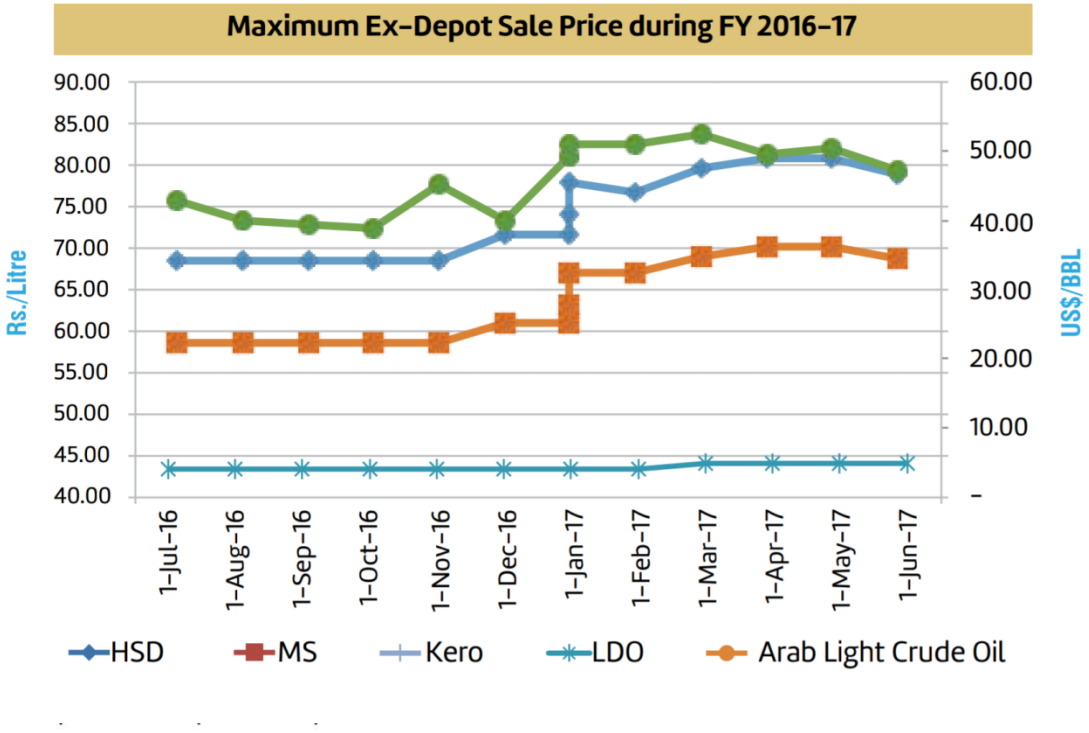
Diesel vs. Gasoline Prices?

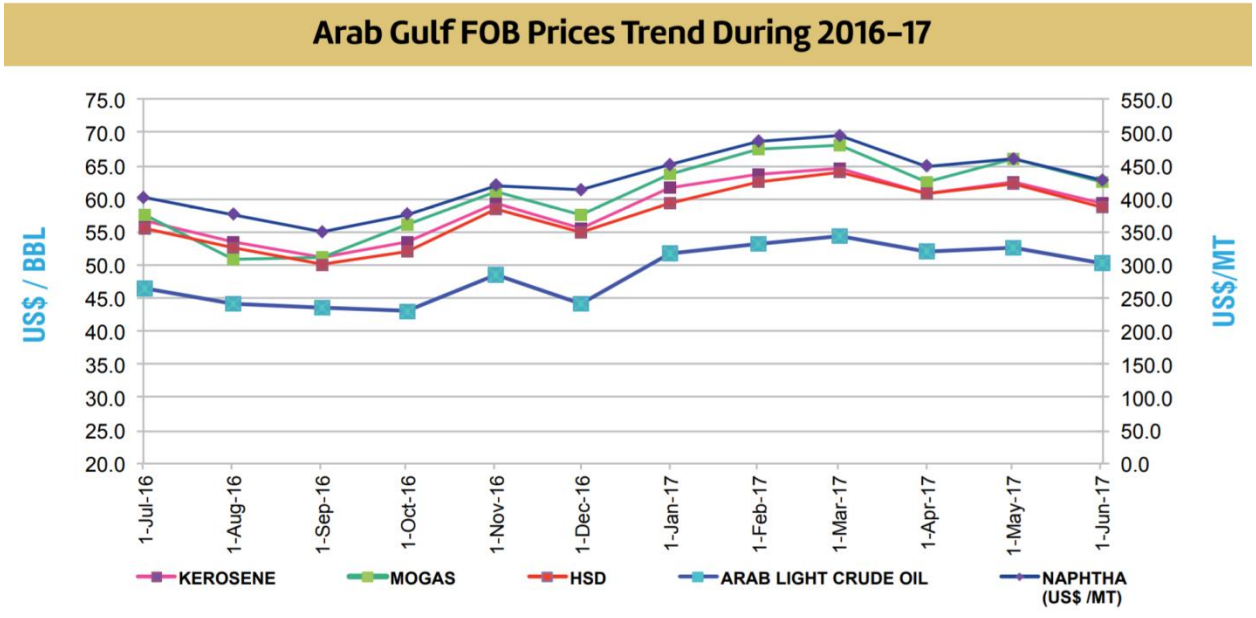
Petroleum Minister Ghulam Sarwar has in his first meeting with his ministry officials has said something very seminal about current Petroleum pricing policy. He said that Diesel should be cheaper than Gasoline. I have long held this opinion but did not speak vehemently about it due to the revenue constraints of various governments. HSD consumption used to be much higher than Gasoline in Pakistan and used to be a revenue earner; both higher taxes and high sales fetched higher revenue. Things have changed over the years. And it appears that time has come to change the pricing policy, making HSD cheaper or at-least equal to the Gasoline prices.

Table :Comparative HSD and Gasoline Prices in selected countries-28.8.18

Country	HSD	Gasoline	Difference%
Pakistan	0.92	0.77	16.30
India	1.02	1.14	-11.76
Bangladesh	0.78	1.06	-35.90
Thailand	0.9	1.15	-27.78
Indonesia	0.75	0.68	9.33
Mexico	1.05	1.08	-2.86
Brazil	0.83	1.09	-31.33
U.S.A.	0.83	0.83	0.00
France	1.7	1.81	-6.47
Spain	1.43	1.54	-7.69
Italy	1.75	1.89	-8.00
U.K.	1.71	1.68	1.75
Japan	1.14	1.33	-16.67
Turkey	0.96	1.05	-9.38
Germany	1.49	1.72	-15.44
China	0.99	1.11	-12.12
Australia	1.09	1.04	4.59
Netherlands	1.58	1.95	-23.42
South Korea	1.28	1.45	-13.28
Pakistan India Difference	-10.87	-48.05	
Pakistan-Bangladesh Difference	15.22	-37.66	
Pakistan Gasoline Consumption -2016	6. MT		
Pakistan HSD-Consumption-2016	8. MT		

Source:www.globalpetrolprices.com





Generally, HSD is priced lower than Gasoline in most countries of the world because of the simple reason that public transport of people in Buses and of goods in trucks use Diesel lowering transportation costs and lowering prices .Same is the case in the countries selected for comparison. Only 5 out of 20 countries have lower or equal Gasoline prices than Diesel; Pakistan, U.K., USA, Indonesia and Australia. Even there, USA has equal prices and U.K. HSD prices are only 1.75% higher.

In Pakistan, HSD prices are 16.30 % higher than Gasoline. In India, HSD prices are the opposite; 11.76 % cheaper than Gasoline prices in that country. In Bangladesh the difference is even higher of 35.90%.In

Thailand, the difference is 27.78%.Typically in Europe, HSD –Gasoline price difference varies between 6-23%.This is despite the fact that HSD is more polluting than Gasoline and Environmental considerations merit very high in European countries. However, it appears that social policy has traditionally been higher in European agenda; very high taxation on Petroleum and higher on Gasoline than on Diesel, the latter being predominantly used by personal cars. It may be noted that in Europe, on average, Petroleum is twice as expensive as in developing countries.

HSD used to be cheaper in the period 2005-2008 by almost 27 to even 50%.For example, HSD in 2005 was 26.21 Rs per Liter as against Rs.40.39 of Gasoline. Similarly in 2008, HSD price was Rs 55.15 vs. Gasoline of Rs.75.69.and reverse became the case in the period 2010 and onwards, when HSD became more expensive by 10-16%.

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However, examining the taxation trend (2013-2018) in Pakistan on HSD and Gasoline pricing and taxation, an opposite trend can be observed. Taxation on HSD has become higher, but excessive taxation on HSD started in 2015 and 2016, wherein taxation on HSD amounted to Rs.38.94-40.76 per Liter, more than 50% of the Sales price. In the same years, Taxation on Gasoline has been at almost half that on HSD at Rs.18.84-20.41 per Liter. Currently, the difference between HSD and Gasoline taxation is of the order of Rs.10.00 per Liter. *This ought to be reversed, i.e. taxation and consequently, the HSD should be 10-15% cheaper than Gasoline. Reason for higher HSD prices is higher taxation on HSD. For example, in the last price announcement, GST on Gasoline was Rs.4.00 per Liter while, the same on HSD was Rs.19.22.What is the solution for making HSD cheaper?*

Another point is worth noting in this respect. Laymen generally complain that, Petrol prices are higher than these are in India and Bangladesh, which is not true and probably has never been the case. At –least Petrol price has always been quite lower in Pakistan than in these two countries, as would be evident from the table. Gasoline price in Pakistan is 48 % lower than India and HSD price is lower.HSD prices are, however, higher in Pakistan than in Bangladesh by 15.22%.Gasoline prices are way lower than of Bangladesh by 37%.

Another trend is worth noting about Gasoline vs. HSD. Gasoline consumption has been growing very fast over the last decade and continues to do so, while HSD consumption has almost stagnated. Gasoline consumption in 2007-8 was only 1.5 Million Tons which is now more than 6.1 Million tons. Gasoline growth rate has crossed the limit of 20% per year. And HSD consumption used to be 8.2 Million tons and is almost the same now a decade later. Perhaps rise of motor cycles and Suzuki loader has something to do it or

industrial sector and intercity movement and commerce has stagnated. One thing is clear now, that revenue imperatives and impact are almost the same; one can tax either without losing revenue any significantly.

What is the moral of the story? Firstly, that there is a room for some increase in Gasoline prices and decrease in HSD prices. Secondly, some more revenue can be generated from this sector so long as the Crude Oil prices do not cross 100 USD per barrel. However, there may not be a lot of space in price maneuvering, as Gasoline is also used in Transportation in Pakistan and low income group uses Gasoline in Motor Cycles. However, there would be positive effect on the economy and inflation if HSD prices are lowered down than of Gasoline. It may be noted that the consumption of HSD and Gasoline has almost become equal and both can serve as a vehicle of revenue earning in equal terms.

The problem can be solved by introducing a cheaper Gasoline product that may be suitable for two and three wheelers, older vehicles and locally produced vehicles under 1000 CC. These vehicles can run on lower RON-87.This product may be sold at Rs.10 per Liter lower than the normal Gasoline. Normal Gasoline here is defined as of RON 92+ standard which is required for newer vehicles driven by well-to-do people who may be able to afford a little higher price. It can also be deducted from this formula that HSD retail would then be lower or equal to the cheaper Gasoline prices.

Concluding, the PTI government should examine the Petroleum pricing policy afresh keeping the afore-mentioned submissions in view. Higher HSD prices are hurting the economy and putting indirect load on the poorer sector of population who do not use personal transport and have to buy more expensive goods due to higher transportation costs.

Trend of Taxation Pakistan :HSD vs. Gasoline-Rs/Liter

HSD					
	Excise	PLD	GST	Total. Tax	Retail
2013	5.85	5.44	16.99	28.28	116.95
2014	5.67	5.77	15.84	27.28	109.34
2015	3.96	7.96	27.02	38.94	82.04
2016	3.18	8.01	29.57	40.76	75.79
2017	5.06	7.67	20.88	33.61	81.4
2018		7.89	19.22	27.11	109.01
Gasoline					
2013		8.29	16.45	24.74	113.24
2014		10.01	15.69	25.7	107.97
2015		7.54	11.3	18.84	77.79
2016	1.06	10.01	9.34	20.41	64.27
2017		9.75	11.88	21.63	72.8
2018		9.99	4.01	14	92.83

Source: Energy Yearbook HDIP-various years

Comparative Petroleum Products Prices in South Asia-1.11.2018

Country	Petrol	Diesel	Kerosene	LPG (14.2 Kg)
	(Pk.Rs. / Liter)			(Pk.Rs. / Cylinder)
India (Delhi)	140.26	130.38	48.88	893.04
Pakistan	96.88	111.16	85.13	1787.26
Bangladesh	134.66	101.78	101.78	1245.14
Sri Lanka	116.69	92.60	52.70	1482.12
Nepal (Kathmandu)	126.90	112.43	112.43	1558.43

Source: PPAC India, INR-Pakistan Exchange Ratio 1.762

Thursday, 04 October 2018 Kamran Ali Management, Energineers Blog

Product	Ex Refinery Import Parity Price	Petroleum Levy	Dealers Margin	Distributors' Margin	IFEM Primary Freight	Prescribed Price as Determined by OGRA	General Sales Tax	Max Ex-Depot Price	Consumer Price including Secondary Freight (Depot to Retail point)
	PKR/Ltr	PKR/Ltr	PKR/Ltr	PKR/Ltr	PKR/Ltr	PKR/Ltr	PKR/Ltr	PKR/Ltr	PKR/Ltr
Kerosene	69.72	5.85		1.58	2.56	82.27	1.23	83.5	86-87
E-10 Gasoline	69.71	0.85	3.47	2.64	0.54	77.21	13.13	90.34	93-94.5
MoGas	69.46	9.99	3.47	2.64	3.27	88.83	4.0	92.83	-
HSD	72.3	7.89	2.93	2.64	1.59	87.35	19.22	106.57	109-111
HSFO	72.76	-	-	-	2.56	-	12.8	88.12 Direct Sales	

TABLE – 1: Breakup of Petroleum Products Pricing

PoL Products consumption and growth rates (MT/yr)

	Imports	Production	Total	ROG%
Gasoline	4.455	1.699	6.154	20.7
HSD	3.534	4.61	8.144	2.9
F.O.	5.887	8.83	14.717	0.1
Others				
Total	13.876	15.139	29.015	
Crude Oil	8.97	4.246	13.215	

Source: HDIP yearbook-2016

Towards Environmental Fuel Standards

Ethanol Blending-E5 and E-10

Ethanol-blended Gasoline has, however, found much more acceptance throughout the world. Ethanol is mixed in ratio of 5 to 10% with Gasoline and turned into products called E-5 and E-10 (E for Ethanol and 5 or 10 representing the percentage of Ethanol in the fuel).E10 is almost a standard fuel in the U.S. having a market share of more than 95%.In Europe, E5 is almost a standard in Europe and in other countries. India has also introduced E5 targets. There are other advantages of blending Ethanol with Gasoline. One is reduced pollution on the roads but more important is the ease of burning. Ethanol is an anti-knocking agent in fuel burning in I.C. Engines.E10 offers a more acceptable way of enhancing Octane number. Higher the Octane number, better the burning and lesser knocking in cars. Knocking sound of carburettors used to be a common occurrence in periods prior to 1990s.

In Pakistan, it may be quite easy to introduce E5 or E10 due to local production capability and potential of Ethanol which is a by-product of Sugar industry. Pakistan is 8th largest producer of sugar in the world. There are 88 sugar plants producing 9 million Tons of sugar annually. Molasses are produced as a by-product of sugar. Molasses are refined (fermented) to produce Ethanol. Some of the Ethanol (Sugar) producers also installed additional refining and denaturing facilities to produce Fuel grade Ethanol which requires no-water (anhydrous) characteristics. Required Molecular Sieves have been installed. Ethanol has many applications in food and Pharma and other industries as well. Most of the Hydrous and Anhydrous Ethanol is exported by Pakistan. Average Ethanol production is 553200 tons per year out of which about 400,000 tons is exported on the average. U.S.A is a major importer of Ethanol which goes into its massive Gasoline requirements.

Assuming the market share of E10 to be 75%, Ethanol requirements of the local refineries would be 127430 tons per year. Imported Gasoline can be imported as E10. However, if importers would like to blend E10 locally, an additional requirement of 334110 tons of Ethanol would be required taking the total requirement level to 461530 tons which is still under 553200 tons of total Ethanol production. These figures would be halved if decision is made to introduce E5 first. In actual terms, both E5 and E10 may have to be introduced simultaneously. Perhaps additional processing components may have to be installed in some Ethanol plants which may be producing non-fuel grade Ethanol. However, the job of introducing E10 with a market share of 75% can be done.*E-5 can be made mandatory in a short time frame and ultimately E-10 may be adopted.*

Introducing EURO-VI by 2020 in urban areas

The whole world is shifting to low sulphur fuels. In Pakistan, only lately, we have been able to partly switch to low sulphur fuel satisfying the requirements of Euro2 standard, which is a rather old standard limiting sulphur level to 500 ppm. Most of the world has shifted to or in the process of shifting to even lower sulphur as required per Euro5 or 6 limiting sulphur to only 10 ppm. Industrialised countries have a problem of converting their refineries into low sulphur mode.

However, we import most of our fuel from abroad and should not face problem in such switching. Low sulphur fuel is available in international market. It is a bit expensive but compared to the health and environmental costs, such extras are much less. India has already adopted Euro4 (sulphur level 50 ppm) and is poised to switch to Euro 6 by the year 2020.In the meantime, India has already launched Euro-6 Gasoline and Diesel in 13 major cities. They have upgraded their refineries to produce Euro-6.

Thus our gasoline and diesel will be having 50 times more Sulphur and thus 50 times more sulphur emitting vehicles on our roads, even after the complete switch over to Euro2 standards. I would argue for adopting 10 ppm standard (Euro6), and not be victims or hostage of the existing old refineries which cannot produce low sulphur fuels. Either they should be asked to import low sulphur crude oil or their output should be relegated to smaller towns and rural areas. All major urban areas should be required to be switched to Euro-VI 10 ppm sulphur standard through distributing imported low sulphur fuels.

All new imported vehicles are on EURO-VI which would be able to reduce emissions as per EURO-6 requirements. However, older vehicles would not be able to reduce pollutants to full level. The issue is that by 2020, Gasoline /Diesel other than of EURO-6 would not be available. Kuwait Petroleum has informed Pakistan that beyond 2020, it would be able to supply only EURO-6.In Pakistan, there is a fashion of bringing in and installing old and used oil refineries. The local refinery industry drags its feet on any move to improve. A sectoral study should be initiated estimating investment requirements and production costs. Presently, Indian Oil Corporation is not charging extra price. However, it has been announced that EURO-VI would cost 50 Indian Paisa more per Litre. In other jurisdictions, 2 cents per Gallon increase has been estimated.

A number of policy options can be examined keeping in view local refineries constraints, import levels, and older car populations and pollution variations between urban and rural areas. Initially, market-cum-legislative actions could be adopted. New vehicle owners may like to buy slightly more expensive Petrol in their own interest. Older vehicles may be allowed to have a choice. Similarly, more stringency may be adopted in urban areas than in rural areas. There would be no escape from EURO-VI beyond 2020 or slightly later, those left behind will have many unknown financial and non-financial consequences.

Post LNG-go slow on Oil Refineries

Pakistan is producing 100,000 barrels per day of crude oil, meeting 21% of total oil consumption demand in the country.53% of Petroleum product demand is locally refined through 8 number of Refineries producing 259,500 barrels per day. From today's scale point of view, all of this production could have been produced in just one Refinery. Imports of final petroleum products are 247,300 barrels per day. However, Furnace Oil would go out of menu, as it is being replaced by LNG. Already, imports of F.O. are almost nil. However, there would be a surplus of 162,000 bbls per day of Furnace Oil production capacity. Either conversion facilities would have to be installed in local refineries to produce Gasoline or HSD instead of F.O. or F.O. would have to be exported. Conversion may, however, not be feasible in all refineries, and thus some F.O. would have to be

exported. Oil consumption, therefore, should go down by 170,148 bbls per day. In effect, (net) imports of oil should come down to nil (exports of Furnace oil of 162,000 bbls per day would cancel out Crude Oil imports, or there would be no furnace oil production and thus no import of equivalent crude oil).However, Gasoline market is growing at a high rate of 20% per year and has not tapered off from a high growth of 20% p.a. yet.. Thus only in the mid to long term scenario, an Oil refinery would be required. That appears to be the rationale of a small 20,000 bbls per day proposed by KPK. However, this kind of small capacity is out-of date and uneconomic, unless consumers shoulders are to be burdened. Another problem with small refineries is that due to low technology, high quality low sulfur products may not be produced. But why are the others looking towards one or two large refineries of 100,000 barrels per day each? New refineries may be required only if conversion of refineries does not take place. What is the imperative of installing refineries in a dubious Oil demand scenario overlooking Electrical Vehicles? And Oil Refineries create very little employment. At the kind of scale being considered, Oil Refineries may not be that profitable? It may eat into a limited quota or scope of FDI that could be utilized more efficiently in other sectors both in terms of value added and employment. In this scenario, it appears rather odd to see oil refineries proposals worth 8 billion USD floating around by Saudis, Chinese and others. Thus there should be no itching for installing oil refineries in this difficult period.

Oil Refinery of 1 Million BPD

Economic size of Oil Refineries these days is 500 BPD and above. India has installed an Oil Refinery of more than one million BPD in Jamnagar. In or around Gawadar, a similar refinery of 1 million BPD may be planned along with a petrochemical complex. This may cost 40 Billon USD.A Saudi-Chinese JV can be expected. The crude to come from Saudi Arabia and output is to be pipelined to China. Pakistan can get 200,000 BPD at international prices which can be shipped to various parts through pipelines. The project could be installed in a total tax free environment. Pakistan can charge for land, property tax, security and other services fee.

Oil Consumption ,Production and imports in Pakistan(bbl/d)

	Crude Oil	Petr.Products
Production	100,000	259500
Exports	493	20720
Imports	166000	247300
Consumption	265,507	486,080
Production as % of Consumption	21	53

Source: OGRA, HDIP

Fig. 6.2: Consumption Trend of Main POL Products

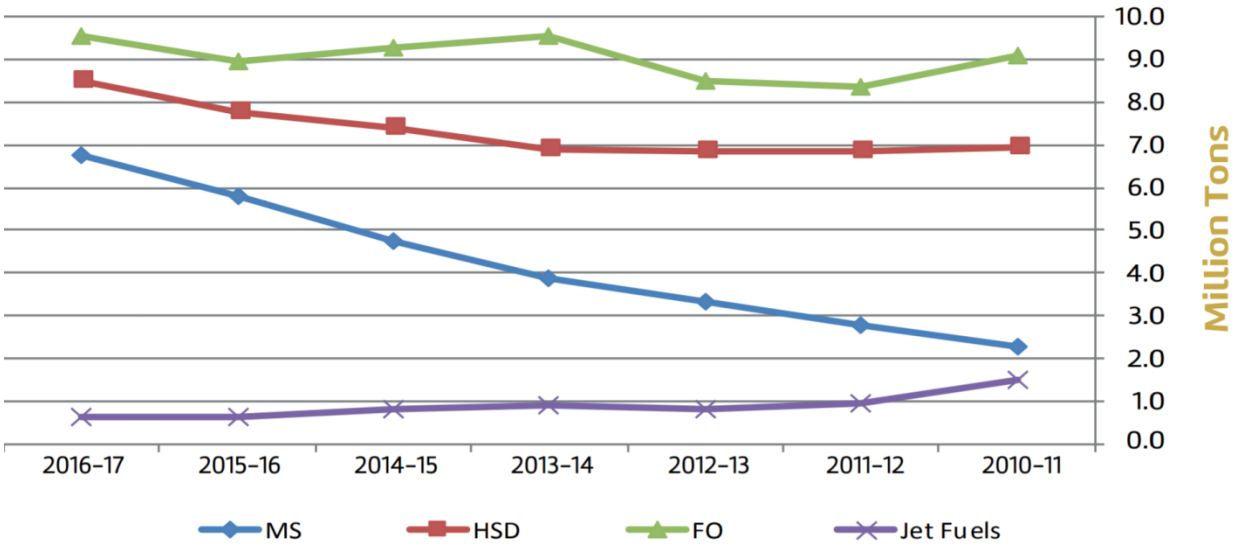


Table: 2.6

PETROLEUM ENERGY PRODUCTS CONSUMPTION BY FUEL

Unit: Tonnes
TOE

Energy Products	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	ACGR
Aviation Fuels	633,903 *656,900*	620,059 *642,660*	648,802 *672,453*	574,175 *595,425*	621,266 *643,916*	639,545 *662,728*	0.2%
Motor Spirit 87 RON	2,752,760 *2,941,049*	3,340,537 *3,569,030*	3,865,113 *4,129,487*	4,732,381 *5,056,076*	5,759,763 *6,153,731*	6,646,965 *7,101,617*	19.3%
HOBC	12,083 *12,847*	12,597 *13,393*	12,871 *13,684*	21,914 *23,299*	40,587 *43,152*	90,595 *96,321*	49.6%
E-10	14,717 *15,138*	9,141 *9,402*	2,644 *2,720*	0 *0*	0 *0*	0 *0*	
Kerosene	151,957 *156,759*	166,306 *171,561*	176,357 *181,930*	174,555 *180,071*	141,579 *146,053*	120,958 *124,780*	-4.5%
HSD	6,800,778 *7,149,658*	6,820,149 *7,170,023*	6,888,980 *7,242,385*	7,411,475 *7,791,684*	7,745,864 *8,143,227*	8,484,280 *8,919,524*	4.5%
LDO	27,793 *28,955*	35,742 *37,236*	49,767 *51,847*	43,096 *44,897*	24,106 *25,114*	19,490 *20,305*	-6.9%
Furnace Oil	8,284,272 *8,066,396*	8,388,598 *8,167,978*	9,464,150 *9,215,243*	9,202,472 *8,960,447*	8,953,515 *8,718,038*	9,560,113 *9,308,682*	2.9%
Energy Products-Total:	**18,678,263** ***19,027,701***	**19,393,129** ***19,781,283***	**21,108,684** ***21,509,748***	**22,160,068** ***22,651,899***	**23,286,680** ***23,873,230***	**25,561,946** ***26,233,957***	**6.5%**

Petroleum Products Demand Projections

	ROG %	Consumption	End 5 yr	End 10 yrs	End 15 yrs	End 20 yrs
Gasoline-MT	20	6646965	16539776	26637475	33996918	43389639
HSD-MT	4.5	8484280	10572956	13175827	16419478	20461657
Sub Total Gasoline,HSD-MT		15131245	27112732	39813302	50416396	63851296
Total Petroleum-MT	6.5	25561946	28121983	40983299	51772744	65423675
Miscellaneous Petroleum Products-MT	3	870588	1009250	1169997	1356348	1572379
Furnace Oil-MT		9560113	0	0	0	0
Gasoline-BBL		781996	1945856	3133821	3999637	5104663
HSD BBL		1131237	1409728	1756777	2189264	2728221
Gasoli+HSD-BBL		1913233	3355584	4890598	6188901	7832884
Gas to Diesel Ratio		0.7834	1.5643	2.0217	2.0705	2.1205
Misc Petroleum-BBL		108824	126156	146250	169543	196547
Total Petroleum-BBL		2022057	3481740	5036847	6358445	8029432
Petroleum Consumption incr.Timer		1	1.72	2.49	3.14	3.97

5. Should Oil Refineries be a Priority?

P.M. Imran Khan has made his economic ideology very clear in his last interview on Television network. He has spoken against anti-profit and anti-investment thinking which has discouraged business activities in Pakistan. In the wake of this interview or simultaneously, Petroleum Minister has also indicated that he is withdrawing his campaign against LNG projects. We will analyze the subject of investments in oil refineries under this new edict, and among other criteria.

Yes, business and investment activity brings economic growth and employment. However, it should be in competitive sectors, where profit is earned in the market and through government payout and subsidies or extraction from consumers and people, as generally the energy sector is currently composed of. This is, however, poised to change as there is now a consensus in policy circles that competition should be introduced. Last government would not have come under criticism, especially in LNG sector, had it resorted to competition and not have had a negotiated deal with Qatar. One can have G-to-G negotiation for an overall framework of cooperation, but finally procurement should be under competition, as much as it can be possible. The same is true for CPEC, wherein genuine competition among Chinese companies could have been organized.

News is coming out about investment prospects in Oil Refineries. It is not for the first time that such initiatives have emerged. Latest are news of Saudi investment for an oil refinery in Gawadar. There was similar news about Chinese interest in this respect as well. The most important proposal is Chinese one involving an oil refinery to be installed at Gawadar with a capacity of 21 million tons per year (500,000 barrels per day) and an investment of 12 billion US dollars. The output is to be shipped to Kashgar through a pipeline. There are proposals to install deep refineries in Punjab. And there is an old proposal of an oil refinery of 300,000 barrels per day at Khalifa point under a UAE investment of 5 billion USD. Nothing has happened on these proposals that have been floated for more than a decade.

Oil refining is a capital intensive business. Today, an oil refinery of 200,000 barrels per day would not cost any less than 4-5 billion US dollar. For comparison sake, a power plant of 1000 MW costs less than 1.1-1.4 billion USD. Pakistan consumes petroleum worth 12-16 billion USD, 85% of which is imported. Thus it is the largest item in our import bill. It would be nice, if we can do away with these imports or reduce it considerably. Would oil refineries make a significant impact in this respect? Not really. Refineries are a low margin business worldwide; 5 USD per barrel, while a barrel may be costing 70-80 USD per barrel on the average. This would amount to 5-6%.This is not profit. it is the value added out of which all expenses are to be paid out other than the crude oil. Thus the saving in foreign exchange by oil refineries may be hardly 1 USD per barrel or 1-2%.And in our case, where oil refineries require protection of 2.5% or even more, the aforementioned saving

also may evaporate away. So, it comes out that there is hardly any foreign exchange saving in this business.

Does it create employment? Hardly any? Billions of investment dollars refinery may not create more than a few hundred jobs. There are other sectors in the economy in normal industries where tens of thousands of job may be created with this kind of investment. The question is why not import high quality environmentally acceptable finished products like Gasoline and HSD and Kerosene etc. Oil refineries in this country have been churning out low quality dirty products having Sulfur content of 5000 ppm vs 10-50 ppm in most countries. On every directive to improve, this industry has been dragging its feet. The latest is the Manganese content, which is injurious to both car engines and to human beings both. Outdated and used oil refineries are relocated from abroad which cannot meet the quality and environmental standard requirements in the parent countries. Capital padding is practiced siphoning out the declared investment outlays. An oil refinery project approval is considered to be a gift to the participating elite from all sides.

On the other hand, there are two major issues which go in the favour of oil refinery investments. One is about Energy Security under which one would like to spread the options so as not to depend solely on a fixed route or solution. There may be situations where supply bottlenecks may occur in the importation of finished petroleum products. Thus one would like to spread the options in terms of local production in oil refineries and imports. Secondly, if DFI is there and not causing any liability, why not? Also, DFIs are investors' priority and may not be prepared to divert investments in other sectors.

However, we should know, as it has come out, that Oil Refineries are not great investments to be strived for. If alternatives are feasible, resources should be diverted to better opportunities which may have much larger impact on economic activity and employment. Governments should not award wholesale tax exemptions for long periods and provincial governments should charge adequate local taxation. Government should make it sure that the products and technology meet the required quality and environmental standards. If large projects are implemented, and taxation is not greatly reduced, it can generate some income.

For example, in India and elsewhere large oil refineries are the order of the day producing zero waste and many byproducts and petrochemicals. An example is Jamnagar Oil Refinery Complex, with a capacity of more than 1 million barrels per day which is compatible with the market situation pertaining in India. In or around Gawadar, a similar refinery of 1 million BPD may be planned along with a petrochemical complex. This may cost 40 Billon USD.A Saudi-Chinese JV can be expected. The crude to come from Saudi Arabia and output is to be pipelined to China. Pakistan can get 200,000 BPD at international prices which can be shipped to various parts through pipelines. Pakistan can charge for land, property tax, some corporate tax, security and other services fee. Thus a major policy question is whether to accept smaller proposals or go for larger ones involving World scale refineries of 1 million barrel per day supplying Pakistan market as a by-product?

Immediate priority in Petroleum sector today is elimination of Furnace Oil from the energy scene of the country. While LNG terminals are underutilized resulting in excessive capacity payments,(20-60%) expensive F.O. has to be utilized, because Oil Refineries while producing Gasoline and Diesel, also produces Furnace Oil. Stopping Furnace Oil production would mean stopping Gasoline and Diesel production as well. Immediate solution is exports and the other is refineries BMR to add F.O. conversion components such as Coker units. Apparently, no action is there which should receive priority of the competent authority and the stake-holders. An incentive or disincentive would be to reduce purchase price of Furnace Oil by 20%, which would do away with the inaction or go-slow of the oil refineries. Needless to say, policy announcements are required first, otherwise emergencies will be continually created and Furnace Oil will continue its ride.

Comparative Fuel Cost RLNG vs RFO-Sept 2018

Plant	Capacity	unit Fuel cost	Capacity Factor
	MW	Rs/kWh	%
Baloki-RLNG	1320	8.8815	29.54
Haveli Bahadur Shah-RLNG	1230	8.7686	89.50
QATPL	1180	9.7437	85.94
HUBCO-RFO	1200	15.1868	26.43

Source: CPPAG NEPRA submission September 2017

6.The days of Furnace Oil are over, not quite yet?

GoP has finally banned the import of Furnace Oil, a long awaited and expected decision. In the intervening period, there has been quite some confusion. Export of F.O. has also been allowed, which would allow local refineries to sell abroad in the wake of reduced F.O. demand due to the influx of LNG.LNG is 20% cheaper and is used in highly efficient combined cycle power plants having thermal efficiencies of 60% as opposed to 35-40% for the F.O. steam plants. Internationally, F.O. has been used as Heating Oil and as bunker fuel in Ships in addition to its use in Power Plants. F.O. has traditionally been a high sulfur product containing 3.6 % Sulfur. In the U.S. and elsewhere, there is now a low Sulfur Furnace Oil that is being widely used. F.O. is under pressure in its traditional market segment of being bunker oil, as IMO (International Maritime Organization) has announced restrictions on the usage of High Sulfur F.O., requiring all ships to install scrubbers or discontinue HSFO. The compliance is due by the year 2020.Reportedly, its market effects are expected to be showing even earlier. In a few years time, interestingly, F.O. may become cheaper than coal and may again become attractive for some regions still having HSFO power plants in operating conditions. Alternatively, it will make installations of deep conversion units more profitable due to a cheaper feedstock of F.O.

Keeping the afore-mentioned in view, it is almost clear that the days of HSFO are gone. Oil Refineries which are producing HSFO have two options; one to install hydro-treatment facilities to greatly reduce Sulfur content or to add deep conversion units such as Coker or Catalytic Cracking Units or others to convert HSFO to middle distillate products like gasoline, Diesel and others.

Pakistan cannot afford double jeopardy of import of both LNG and F.O. in addition to paying fixed terminal charges which may remain underutilized due to continued HSFO imports. GoP has taken a wise decision to ban F.O. imports so as to block any excuse to import F.O. We have ample power production capacity to do without F.O. power plants. The problem, however, is of local oil refineries which will continue to produce F.O. as a fixed by product of producing the two main products of Gasoline and Diesel. There are backward linkages in the supply chain as well; if local refinery goes down, it stops lifting condensate, which in turn affects gas supplies, as condensates come from gas fields(which may partly explain the recent gas supply issue). So either local Oil refineries have to shut down or keep producing F.O. until a time consuming technical solution is implemented or exports markets are found. Is locally produced F.O. a big problem, as it can only generate some 2000 MW of electricity? Or can it or some part of it be kept as an option?

Oil Refining was supposed to initiate installations of technical solution as the writing was clear on the wall in face of more competitive LNG influx. Probably, political controversies on LNG have prevented them to do so or have caused confusion. There is, however, a danger that in the absence of a firm policy and a deadline, nothing may be done and F.O. may remain a liability to be used as a constraint.

In India recently, a Coker unit has been installed at a refinery at Pradip. It has cost them a CAPEX of 590 Million USD with a production capacity of 1.7 Million Tons per year. In India, they have started designing and building their own facilities with minimal foreign input and in fact in competition with international

companies. In Pakistan, there is a F.O. production capacity of 3 million tons per year. In the North, PARCO produces around 1 MTPA and ATTOCK 0.45 MTPA, together an output of 1.5 MTPA. In the South, BYCO, NRL and PRL together produce an equal amount (1.5 MTPA).Thus two facilities may have to be installed; one in the North at PARCO and one in The South ,probably, at BYCO. Ideally, all oil refineries should have their own conversion to avoid transport which may not be possible because most of the refineries are too small. This is why, one would like to propose location in North and South, one each. Transportation issue may still be there, between inter-refinery movement although still lesser than in one plant only.

The question is what is the incentive with Oil Refineries to make such an investment? The incentive is clear. F.O. is priced at around 350 USD per ton and may go down to as low as 200 USD per tonne in a few years due to low demand. The middle distillate would sell at 500-550 USD per ton. Thus there is a margin of 200 tons now and even more eventually as a result of price collapse of F.O.A 200 USD gross margin would yield revenue of 300 million USD. Assuming OPEX of 20%, there would be a net surplus of 240 Million USD, giving a payback of 2.5 years. This is obviously, a guesstimate, which however indicates a good probability of a profitable enterprise. There are many other technical options which have to be examined keeping in view our own particular circumstances such as refinery configurations, crude mix, product requirements, scale economics etc.

Furnace Oil used to be a lynchpin in Pakistan's Energy system providing 30-40% of electricity. Today, it is a liability. There are many Furnace Oil based power plants with a capacity of 5000 MW, most of which will complete their contract period in the next ten years or earlier. Contracts of some F.O. power plants were extended. This period gives a good opportunity to plan and phase-out F.O, both its production and consumption. There is, however, a problem; emanating out of merit order power dispatching which requires cheaper fuel plants to be utilized first and expensive ones later. In a power demand deficit scenario, all power plants would have been utilized to the full as has been the case. But in a power surplus scenario, the turn of F.O. pants may never come. And thus the F.O. would remain unutilized and the emergence of the same issue of what to do with it? But then, how many plants are to be in must-run mode. More economic and Renewables power plants fall in earlier due to their own merit requiring no fuel. RLNG power plants are to be must-run due to Take or Pay contracts of LNG and its terminals. It appears that it would be difficult for a political government to buy expensive oil and produce expensive electricity leaving aside cheaper options. Exports at a discount or loss might be more preferable than disturbing the merit order. One should not be that pessimistic about export possibilities and finding local customers in a unique market situation such as KE, although, it would be equally inadvisable to continue to use F.O. in KE. Options of increasing exports from DISCO system to KE should be explored, now that there appears to be a power surplus. Cheaper renewables may also be allocated to KE.

Finally, shift from F.O. predominance to LNG is a major one. Time is required to implement whatever strategy is to be adopted to effect the transformation. In the interim, a decision has been taken to provide for consumption of 10,000 tons per day of local F.O.in power production, which cannot continue for long. GoP may have to take two decisions; one, how many months to give refineries to be able to organize exports in terms of finding markets and the associated logistics; two, how many years to give them to add the required F.O. conversion units. However, it should be for Refineries to decide whether they would like to invest in modernization or prefer exports of F.O.

8.Shunning inefficient Power Plants?

By Syed Akhtar Ali

There are many questions and issues faced by the policy makers of energy sector in Pakistan; What to do with rising energy price, especially, under devaluation? Should expensive furnace oil be totally removed, if not totally, how much? What to do with Oil Refineries which are producing Furnace Oil? F.O. export possibilities? Should more of RLNG be inducted, despite classical stand? What to do with thermal power plants producing expensive electricity? Can these be shut down? What to do with the retiring power plants which have adequate efficiency and are still good to run? How to satisfy the renewable energy sector by adding a reasonable Renewable Energy quantity despite a purported surplus in the near term and also the financial crisis? These are the kind of questions, we would be discussing in the following space.

Recent Trend in Electricity Generation

1. Hydro production has increase in capacity of 9000 MW with the inclusion of Neelum Jehlum and Tarbela-IV: Hydro share in generation is perhaps all time high at 34%.

2. Classical Thermal IPPs have had a very little share of only 650 Million kWh (8.61%), even lower than GENCOs at 855.3 Million kWh. Major exclusions are HubPower, KAPCO etc. a share of 8.61% only.

3. Major producers in thermal are all new players; Coal and RLNGCC with a combined share of 31%.

4. Nuclear is at 10.88 % is all time high; and Wind and Solar 2.33 %.

5.There was almost nil generation on Furnace Oil, which if continued in December(data awaited) probably created the gas crisis by closing or drastic reduction in Refineries production, which stopped condensate induction and the latter stopped some gas production.

5. Conclusion: Practically government and its new CPEC partners are producing electricity to the extent of 92%.Only high efficiency combined cycle power plants or cheaper or no fuel cost like coal and nuclear and renewables are coming in merit order.

Unstable Oil Prices

Brent Oil prices are unstable at best. The year 2018 started with Brent prices of 69 USD Increased to as high as 80 Usd and is now trading at around 60 USD per barrel. It would be a good news, if oil prices remain at this level, although in 2014, oil prices went as low as 40 USD. Adjoining Table provides comparative energy prices of Coal, Furnace Oil (RFO),Local Gas and RLNG. These prices are based on higher Brent prices, as prices in Pakistan develop with a time lag. If Brent remains at 60 USD, the prices would go down by 20-25%.As one can see, Coal is the cheapest source at 4.54 USD per MMBtu. However, coals advantage is slightly reduced being burned in low efficiency (42%) plants as compared to RLNGPP having 60% efficiency. RLNG prices are 11.3 USD per MMBtu as opposed to 14 USD for RFO. There is a price advantage of 20% in RLNG vis-à-vis RFO. This advantage is increased being burned in High efficiency (60%) combined cycle power

plants; fuel cost per kWh of 6.43 Usc of RLNG vs 11.37 Usc of RFO.RFO is slightly less than double. Local Gas prices are almost half that of RLNG. The price effect gets even more pronounced with local gas wherein fuel cost per kWh in high efficiency plants becomes as low as 3.41 Usc vs 11.37 of RFO, a three times difference. However, cheap local gas prices are double edged weapon; it helps keeping energy mix prices low but simultaneously leads to less optimum allocation of resources. GENCO lowest thermal efficiency plants are quite early in the merit order and are running due to the cheap local gas price. If priced, at RLNG prices, these plants would never be able to operate and will be at the end of the merit order. I have actually checked this by actual calculations. There is a strong case for shutting down these plants with a few exceptions as has been mentioned elsewhere in this space.

Comparative Energy Prices

	Coal	RFO	Nat. Gas		RLNG	
Efficiency-%	42	42	42	60	42	60
Energy-Price-USD/mmBtu	4.54	14	6	6	11.3	11.3
Electricity Fuel Cost-USD/kWh	0.0369	0.1137	0.0487	0.0341	0.0918	0.0643

Source: Compiled by the Author, data OGRA,NEPRA,PSO

Shutting down inefficient power Plants

1) There is 6000 MW of thermal power plants under public sector GENCO, which have a fuel cost of 16 to 20 cents per unit. Only two power plants, namely Guddu-Combined Cycle (747 MW) and Nandipur (567 MW) have somewhat acceptable thermal efficiency of 40% or above. Except these two, all other power plants in this category should be shut down without further procrastination. One may think about their future or efficiency improvement possibilities later.

2)Another 5-6000 MW of IPP thermal power plants are to retire in this decade ending 2030;important among them is KAPCO-1600 MW(retiring 2021) and Hubco-1262 MW(retiring 2027) .Out of 10 plants in this category,4 have thermal efficiency, including HubPower, lower than 40% and should be retired as their PPA expires. There are other plants such as KAPCO, Rousch etc which have higher efficiencies respectively, of 43.7% and 47%.Higher efficiency plants such as these may be considered for extension, on a take-and-pay basis. These may also be ideal candidates for putting them under the proposed Energy Exchange. A policy should be devised in this respect. The power plants may need BMR for which they would require time to plan, arrange financing and implement. There is CPP cost of 4.5 cents for new power plants but would have higher thermal efficiency of 50-60%.One has to calculate the cut-off point where it may be of interest for both operators and the buyer. Power planners should provide for a retiring capacity of 8-10,000 MW from GENCOs and IPPs.

The Local Refineries Issue

GoP has banned import of RFO but had to allow local production of RFO till exports are not lined up or Refineries install conversion facilities to produce lighter products than RFO. There is a capacity of 6785 MW on RFO/Oil, which required on average 9 million tons per year; 3 million tons local and 6 million tons imported. It appears that local production of RFO should be able to fire 2200 MW. Would that be enough? Energy ministry has not yet done its mathematic, it appears. In winters, there is higher demand of gas in domestic sector, while there is no hydro generation. In summer, it is the opposite but Electricity demand goes high, almost double that of winter. There is a shortage of RLNG in winters as we are seeing. Even if all RLNG terminal capacity is fully utilized, there may still be gas shortage. Thus it appears that RFO may not be totally wiped out from the scene in near future. And possibly, we can afford to wait for the Refineries to

install their conversion facilities. RFO prices are slated to go down in near future due to MARPOL convention requirements.IMO has asked the international shipping sector to do away with High Sulfur RFO used by them in their engines or install scrubbers. Compliance may take some time. And RFO prices would go down significantly.RFO may emerge again, is an open and interesting question. However, it would be in our Refineries interest not to drag feet and go ahead on fast track towards installing conversion facilities.

Future of RFO

Seeing these kinds of prices, one is really uncomfortable. The table provides comparative fuel cost data. Fixed costs in Pakistan are also very high due to the so-called investor friendly policies. Another 4 to 5 USC are to be added to generation cost and 20% for the losses on top of all. Top it with cross subsidies to domestic and Fertilizer sector and now the concession to zero-rated export industry. Who is left unsubsidized? And there is devaluation. And GoP has no money. People don't pay taxes. Amnesty schemes have not worked. GoP should keep monitoring gas and power prices in the region from where our textile exports get competition. It is clear that our electricity prices are high. But it is not as true for gas. RLNG is now being imported in significant quantities in Bangladesh and India. Gas prices in Gujarat, a textile state of India are already crossing 11 USD per MMBtu. In Bangladesh, Gas prices are being doubled and even tripled in some cases. Undue enthusiasm for zero-rated sectors should be tempered with continuous gas prices monitoring in the region.

Renewable Energy

It is now patently obvious that the time of Renewable Energy has arrived. Internationally, Solar projects are being installed at 2-3 Usc. In Pakistan, due to credit rating and interest rate issues, Solar and Wind could be installed at 5-6 Usc. Hydro power, however, has become expensive from traditional one rupee to or even 10 Usc. Many Hydro projects are in pipeline. In the current, there is a case for installing at-least 5000 MW (may be more) of Solar and Wind, may be hybrid. This is a must for balancing the energy prices and reducing fuel import bill.

Total Power Generation-Nov.2018

Plant Name	Plant Type	Capacity	Dependable	Generation Million
		MW	MW	kWh
Hydel	Hydel	9000	8239	2563.968
Wind	Wind	1500		126.874
Solar	Solar	336		48.03
Bagasse		138		69.72
Others		153		64.8
TPS Jamshoro	ST	880	782	50.017
GTPS Kotri	GT+CCPP	144	100	1.35
TPS Guddu-units 1-4	ST	640	390	29.662
TPS Guddu-unite 5-13	GT+CCPP	1015	530	323.743
TPS Guddu-units-14-16	GT+CCPP	747	721	451.691
GENCO-Total				
Habibullah Coastal	GTs+CCPPs	140	130	65.947
TNB Liberty Power	GT+CCPPs	235	212	121.287
Uch Power –II	GE+ST.CCPP	381	381	243.08

Attockgen	DE+STs	164	156	5.326
Engro Powergen	GT+ST.CCPP	217	213	114.163
Liberty Powertech	DE+STs	202	196	0.841
Foundation Power	GE+ST.CCPP	185	171	111.631
Sahiwal Coal Power Plant	ST	1320	1320	538.941
Port Qasim Coal PP	ST	1320	1320	504.776
RLNG BahadurShah,Jhang	CCPP	1230	1230	541.627
RLNG,Bhikki,Sheikhupura	CCPP	1180	1180	297.817
RLNG Balloki,Kasur	CCPP	1223	1223	460.305
Chashma NUCLEAR-I	Nuclear	300	300	200.414
Chashma Nuclear-II	Nuclear	315	315	204.73
Chashma NUCLEAR-III	Nuclear	340	340	209.192
Chashma NUCLEAR-IV	Nuclear	340	340	206.717
Total Power Plant capacity Utilised-MW		23645		7556.649
Total installed Capacity-MW		31723		

7.LPG Market and its regulation?

LPG demand has soared and as usual in the winter season, LPG prices have gone haywire causing discomfort among users and especially among the poor ones. LPG has evaded an acceptable solution that satisfies both consumer and producers. In fact, producers and sellers have always been benefiting whatever be the market regime, it is the consumer who has suffered.

Successive governments and the regulatory leaderships have tried to have handle on the LPG market issues, but have literally failed while pushing policies from one extreme to the other. Following are the two or three major issues; firstly, what should be the criterion or formula to allocate LPG production among many LPG marketing companies and at what price and what should be the mechanism of keeping retail LPG prices under control in the high demand winter seasons and particularly in Northern areas and the poor section of the populace thereof.

LPG has made many millionaires in the past when LPG quotas were allotted to the politically powerful and cronies of the successive governments. This attracted much controversy and criticism. Later on the LPG quota policy was changed and a confused free market regime was introduced. Under this regime, producer sold to the highest bidder eliminating quotas and there was a name-sake regulatory control on indicative retail prices. Last Minister Petroleum, Khaqan Abbasi brought regulatory and government control again, fixed producer prices and imposed controls on retail prices. I am not sure, what is the criterion of LPG allocation/sales to the marketing companies. It is probably akin to quota but based upon company producer history and not the free for all quota policy of the yester years.

I propose here a three pronged solution, which I have been talking about earlier as well. Producer price is set by the market in a commodity exchange, like of which are already operating in the country in case of Cotton and other materials. Eligible and prequalified buyers and sellers may be allowed to be the members of the exchange. Secondly, retail prices are controlled by the regulator under a formula. This way, there would be an indirect control on producer prices. Naturally marketing companies would be bidding based on the constraints of the retail prices.

However, the problem is that governments cannot fight the market forces of supply and demand. Prices would go high when demand is higher than supply and vice versa, call it free market or black market. An obvious answer would be that imports are opened and facilitated through taxing policy. However, imported LPG is expensive than the locally produced one, and thus sufficient imports are not made by the LPG companies in order to meet the high winter demand. Taxation reduction has not worked either in the past. In fact a LPG import project went bankrupt in search of a reasonable formula.

The solution lies in governments or government -companies' involvement in the retail distribution in the LPG sector. A LPG subsidy has to be provided for Northern areas, effectively controlling the market in those regions through imported LNG. The subsidy can be general or restricted to the needy and registered customers. There is LPG subsidy in India, providing one subsidized LPG cylinder per family. It is still operating successfully. There used to be a Ration Card system during my childhood days, which provided controlled prices Atta and Sugar to consumers. It worked quite well. In computer days, it can be even easier. There are

proposals in India of transferring equivalent amounts in consumer account. There is a LPG subsidy, even in Pakistan, in the form of LPG-Air-Mix plants; the scheme may not survive or succeed under political controversies.

There would be a surplus influence on the markets in central and Southern areas and the prices would remain under control, if correct market, supply and imports estimates are made and implemented. This way, you do not fight with the market but play with it in the direction of public good and welfare. What has been proposed here is not very unique; like of this is being done in case of fertilizers wherein due to volatility of the international market prices, GoP implements a price subsidy and fertilizer import scheme.

It is not necessary that all of my proposals may be implemented in order to be effective. These are not intertwined. The subsidy aspect can be given priority. Revenue or funds may be created through some adjustments in Oil pricing. Oil prices in Pakistan are quite low compared to the regional prices. Also, LPG-Air-Mix sources and means could be utilized as well.

May be it is too late in the day as we are in the mid of the season. I have spoken about it for the last one year at-least and should not be held responsible for being late. In our system, policy makers and others start thinking when the problem is on their head. So it might be an opportune time to talk about it to invite attention and consideration of the issue. In the instant case, this administration is new and cannot be possibly blamed for the prevailing ills. However, in the next season, they would be held responsible. So please think about it.

8. LNG Controversy

LNG controversy has been always there and has emerged again. PMLn government of the past strongly defended their LNG acquisitions and projects and have challenged the present government to prove any corruption. Enquiries have been made but so far no clue to the allegations has been there. There are other objections as well advanced by the opponents of LNG: one is that, there was no need of LNG and that it has increased the imports bill; second that it is more expensive and has increased the cost of generation; third, LNG from Qatar is expensive than other countries which has been possibly due to some intermediary interests; and fourthly, which has emerged more recently that LNG terminals tariff is too high and that it should be brought down. Fifthly, many argue that buying on SPOT may have been a better option than a long term contract. And finally, why negotiated contract instead of competitive bidding? This scribe has no axe to grind and would like to examine these issues dispassionately and in a non-partisan manner.

Before we get down to the subject matter, we would like to submit that in large measure, Khaqan Abbasi, the former Minister of Petroleum and Prime Minister is himself responsible for the controversy. He first did not disclose the price and later did not disclose the contract, citing commercial secrecy reasons which are not understandable in these days of public disclosure requirements internationally. And neither were the prices so good and the lowest that other Qatari customers would be jealous or demanding price revision; similarly, the resistance to contract disclosure. Finally, with the change of government, the contract was disclosed. And, it has been revealed that there is nothing extra-ordinary about it. Reportedly, there is a clause in the agreement that allows the buyer to resell a LNG cargo to a third party and a third destination. This is a good clause favoring the buyer and was unusual at the time of signing the contract. Traditionally.LNG suppliers used to insist on one destination only prohibiting reselling. This is changing now due to the competitive pressures.

One would not be able to trace the motivation of a negotiated contract, except that for past many years doing the PPP government such negotiations were continuing. Later they did invite competitive bids, which were lower than Qatar price, and which enabled them to renegotiate the Qatar price down. Current price of 13.35% of Brent is that later negotiated price. Earlier agreed price was higher than this. The relevant officials argue that sometimes competition is not well participated and that it may not be necessary that best prices may be obtained. However, I would have my reservations on this. In the adjoining, we provide a comparative table, which shows that Qatar LNG prices to India and Bangladesh are almost the same, or only very slightly higher. These are,however, not the lowest in the world as claimed by the Ex-Minister Abbasi.

Table ..:Comparative LNG Import Prices in Countries

	Brent Coefficient	Constant	LNG price * USD/MMBtu	Effective Coeff.
Pakistan -Qatar Gov to Gov	13.37	0	6.685	13.37
Pakistan ENI	11.9	0	5.95	11.9
India-Petronet-RasGas-Qatar	12.66	0.6	6.93	13.86
India-Petronet-Exxon-Australia	13.9	0	6.95	13.9
Bangladesh-Qatar	12.65	0.5	6.825	13.65
Japan METI-2017 SPOT Avg yr			6.4	

*based on 50 USD Brent crude oil price

Source:1)DNA India;2)Daily Star Bangladesh;3)METI-Japan;4)MPNR-Pakistan

In the favour of LNG, there are following points; it is clean burning fuel; it is 20% cheaper than Furnace Oil, and the RLNGCC plants running on it offer highest thermal efficiency of 60% as has been noticed in the recent installation of 3 RLNGCC power plants in Punjab. Combining LNG price difference of 20% and 50% higher efficiency, the price difference comes out to be 80%.For example, fuel charges of RLNG power plants these days are Rs.10.37 per kWh as opposed to Rs.14.46 per kWh for Furnace Oil. Also, CAPEX of RLNGCC power plant, it is argued by the protagonists, is low at 1000 USD per kW. Other technical reasons are cited like fast ramp rate(it can be brought to line from stand by conditions in minutes, as opposed to hours for other thermal plants).They also argue that it is an important intermediary between base load plants and the peaking power plants like Diesel engines etc. The cost argument may be controversial as Solar and Wind power plants are now available at under 5-6 cents per kWh and do not require any fuel saving foreign exchange. However, Solar suffers from day-time availability and Wind and Hydro from availability only in summer. Lack of constancy is cited to be an issue. However, the consensus is that almost all power sources are required in some mix and combination and that no single source can alone be enough to meet the varied demand and cost issues.

And perhaps most importantly, whether, it is necessary to add and import LNG.As will be seen from the forthcoming discussions and projections, even if one excludes LNG from Power production, there is unmet demand from the other vital sectors of the economy; domestic, commercial, industries, Fertilizer and CNG etc. Due to Gas crisis, Fertilizer plants were closed, and many industrial units were shut down. In winters, domestic consumers suffered, especially, in Punjab. It has been estimated that largest consumer sector of Gas would be Domestic sector. In Power sector, there may be many alternatives such as Alternative energy and Thar coal, but for other sectors there is no substitute at least in the short to medium term. Eventually EV and electrical stoves may offer some substitution.

There are a number of Demand-Supply scenarios, all of which predict exhaustion of local gas and a major supply demand gap. Can this gap be supplied by local producers; it is quite uncertain on two grounds. Conventional gas is not projected to be much so as to sustain another 4000 mmcfd in addition to current 4000 mmcfd. After the turn of the century, no major gas discovery exceeding 1

TCF has been made. Major discoveries occurred in 1950s which gave Sui, Mari,and Uch and later in 1990s which gave Qadirpur, Pirkoh and Zamzama gas fields. Present government has invited exploration tenders. There are prospects in Balochistan and FATA which could not be explored due to poor law and order situation. It is said that not more than 20 TCF could be expected to come out in the next 20 years. There are Shale gas deposits which remain questionable, at-least in the short to medium term, for a variety of reasons of cost, water consumption and degradation issues.

There are three Demand-Supply scenarios, one developed by OGRA and the other two by this scribe called SAA-1 and SAA-2.Major unknown in all these scenarios is the local production. OGRA assumes a slower reduction rate in local production, so that by 2030, there would be still some local reserves left, while SAA-2, assumes that all reserves are consumed by 2030.All scenarios assume same demand, and data on IPI and TAPI.OGRA predicts a demand supply gap of 2836 mmcfd with a LNG component of 1800 mmcfd (three LNG Terminals).Where will the Gap supplied by; the options could be to increase IPI or LNG. SAA-2 Scenario, assuming no local gas reserve, projects 5724 mmcfd being supplied by LNG, which could be reduced by increasing the capacity of IPI. If OGRA gap is supplied by LNG, LNG supplies become 750+2836=3586 mmcfd (6 LNG terminals

Comparative Gas Supply Projections-2030(mmcfd)

	OGRA	SAA-1	SAA-2
Local production	1408	4000	0
Lng	1800	1724	5724
IPI	750	750	750
TAPI	1325	1325	1325
Total supply	5283	7799	7799
Total demand	8119	7799	7799
Gap without IPP,TAPI,LNG	6711	4000	7799
Gap with IPI,TAPI,LNG	2836	0	0

Compiled by the Author

As for TAPI, there is unknown of Afghanistan factor and for IP pipeline from Iran, the unknown is the U.S. foreign policy. One would like to assume that these problems may be resolved in 5-10 yrs .Like it or not, LNG appears to be more reliable and predictable option than anything else. One terminal imports LNG of around 1.5-2.0 billion USD per year. Six terminals would import 9-12 billion USD per year. The only good news would be reduction of 10 million tons per year of fuel oil costing 4 billion USD. The figure could be higher in absence of LNG.

The problem would not be solved if Power production is shifted to local Thar Coal or renewable energy, although it should be maximized. Unfortunately, 4 coal power plants are being built on imported coal; two have been completed and two are under construction.60 % of gas is consumed by non-power sector including domestic, commercial, industrial and Fertilizer. All these sectors require gas, most of which cannot be substituted except some. Fertilizer can go on Thar coal, but is futuristic. Some may be half, of the industry can shift to Thar coal briquettes.LNG is no panacea, it

requires foreign exchange, but local production is also priced and paid in foreign exchange to quite some extent.

Finally, there is an issue of the tolling tariff of LNG terminals which the Minister Petroleum Ghulam Sarwar argues to be too high and that it should be renegotiated. ENGRO has responded that the rates cannot be legally negotiated under contract. Average LNG terminal tariff in Europe is around 25 cents per MMBtu. In some seasons at peak demand, it may be higher. ENGRO had initially required a tariff of 66 cents but later brought it down to 44 cents. Pakistan Gas Port tariff is lower at 41 cents. ENGRO has leased the FSRU and was the first one to take the risk, argues ENGRO.PGPL and its JV partners own the FSRU vessel. One may not that the competitive participation was limited, PGPL was the sole bidder, and the other bidder was technically disqualified. In such low competitive situations, Cost-plus tariff is usually a better approach under which lower tariff could be obtained. Excessive profiteering is a common issue with Pakistan investors, especially, in energy sector. Capital padding, avoiding inputting any equity at all is a commonly known syndrome. Regulatory institutions are weak. Public sector has its own issues of performance and corruption. What is the loss of public sector is usually the profit of the private sector. Policy makers are in a quandary.

Biogas may provide about 10% of Pakistan's gas needs. Thar coal to Gas is an option worth pursuing. China is producing most of its fertilizer on coal gas and there are other coals to chemical plants there. Thar coal field is situated very close to a number of fertilizer plants. These are mostly medium to long term options. However, there may not be any urgent need of installing any more power plants on LNG, as four plants have already been installed, out of which one is under construction. Frankly, LNG appears to be akin to one in the hand vs. two in the bush. However, would we have the continuing foreign exchange availability to keep buying it from abroad? Our recurring problem is of current account deficit. Imports have to be avoided as much as we possibly can, if we have the alternatives and options?

But how about the market and the private sector? If there is a demand and some party is willing to supply it without any government involvement, guarantee or undertaking. For example, CNG sector may want to import its own gas requirement along with some other end-users, uses the existing terminals or builds its own terminal on take and pay basis. Already, there are proposals from the private sector for installing LNG terminals on Take and Pay basis. It is a difficult question as it has implications for the regulated sectors. One would tend to side with the market and private sector development; however, safeguards may have to be built. One thing is certain though that there should be no more LNG power plants as there is a surfeit of LNG based power plants in the short to medium run and already surplus is predicted. Concluding, it may be advisable to depoliticize the issue and decisions be made in national interest only.

Table: 3.10

NATURAL GAS CONSUMPTION BY SECTOR

Unit: Million CFt
TOE

Sector	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	ACGR
Domestic	261,915	291,917	269,135	278,069	271,302	290,868	2.1%
	6,128,822	*6,830,868*	*6,297,770*	*6,506,824*	*6,348,456*	*6,806,322*	
Commercial	39,627	40,689	38,117	35,187	33,633	32,858	-3.7%
	927,272	*952,115*	*891,927*	*823,381*	*787,005*	*768,884*	
Gen. Industries	286,055	274,450	250,490	239,591	230,436	261,267	-1.8%
	6,693,679	*6,422,139*	*5,861,460*	*5,606,436*	*5,392,202*	*6,113,656*	
Pakistan Steel Mills	10,125	9,827	8,542	7,623	1,081	739	-40.8%
	236,925	*229,952*	*199,883*	*178,378*	*25,295*	*17,293*	
Cement	1,266	586	522	831	497	583	-14.4%
	29,629	*13,720*	*12,215*	*19,449*	*11,633*	*13,651*	
Fertilizer (as Feedstock)	168,694	148,782	164,378	166,903	182,076	182,241	1.6%
	3,157,367	*2,754,794*	*3,024,845*	*3,088,834*	*3,559,855*	*3,622,881*	
Fertilizer (as Fuel use)	43,134	39,237	52,139	58,609	80,847	94,564	17.0%
	817,280	*727,491*	*963,123*	*1,064,643*	*1,471,520*	*1,737,760*	
Power	358,381	362,262	349,535	371,562	440,593	446,941	4.5%
	6,732,876	*7,084,177*	*6,602,422*	*6,847,894*	*8,577,146*	*8,643,403*	
Transport (CNG)	119,000	100,228	87,634	66,517	64,455	67,245	-10.8%
	2,784,591	*2,345,331*	*2,050,646*	*1,556,505*	*1,508,246*	*1,573,536*	
Total:	**1,288,198**	**1,267,980**	**1,220,493**	**1,224,893**	**1,304,919**	**1,377,307**	**1.3%**
	27,508,442	***27,360,587***	***25,904,290***	***25,692,343***	***27,681,360***	***29,297,384***	
Annual growth rate	3.83%	-1.57%	-3.75%	0.36%	6.53%	5.55%	

Gas Demand Projections: local Gas and LNG(Million Cft)
Under Scenarios:1) Constant NG Production;2)zero Reserves in 20 yrs

	2016-17	RoG %	End 5 yr	End 10 yrs	End 15 yrs	End 20 yrs
Dometic	290868	2.1	322719	358058	397267	440769
Commercial	32858	3	38091	44158	51192	59345
Industrial	261267	3	302880	351121	407045	471877
Fertilise as feed stock	182241	3	211267	244917	283926	329148
as fuel	94564	3	109626	127086	147328	170793
Transport	67245	3	77955	90372	104766	121452
Power	446941	4	543772	661582	804915	979303
Power-MW			4183	5089	6192	7533
Total Gas Consumption-Million Cft	1737307	4	2113700	2571639	3128792	3806654
Total demand per day-BCFtD			5.79	7.05	8.57	10.43
Production-BCFD-Scenario-2	4		3	2	1	0
LNG Demand I-BCFD			2.79	5.05	7.57	10.43
LNG-No of Terminals of 4.5 MTPA			4.65	8.41	12.62	17.38
Constant Local BCFD-Senario-I	4		4	4	4	4
LNG Demand II-BCFD			1.79	3.05	4.57	6.43
No of LNG Terminals of 4.5 MTPA			2.98	5.08	7.62	10.72

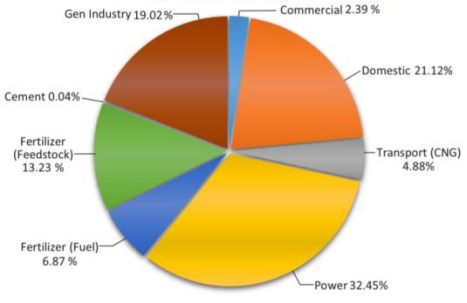
Comparative data on two LNG Terminals

	Engro	PGPL
Capacity-MTPA	4.5	5.6
Capacity-MMCFD	690	750
FSRU-Volume M3	151000	170582
Contract Capacity-mmcfd	600	600

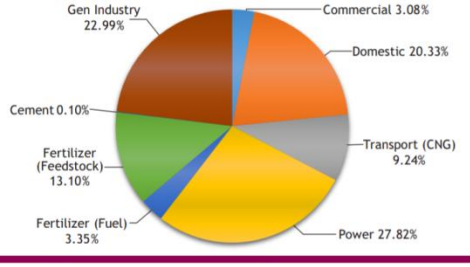
Contract Capacity-MTPA	4.5	4.5
FSRU-CAPEX Mn USD		300
Other Terminal CAPEX		150
Daily Charge-USD		
Tariff-USD per MMBtu	0.44	0.4177
Lease period yrs	15	15
Gas Supplies Contracts		
Qatar-MTPA-3.75		
ENI		
Guvnor		

[redacted]

Figure 3.2
NATURAL GAS CONSUMPTION BY SECTOR
2016-17
Total: 1,377 Billion Cu. Ft.

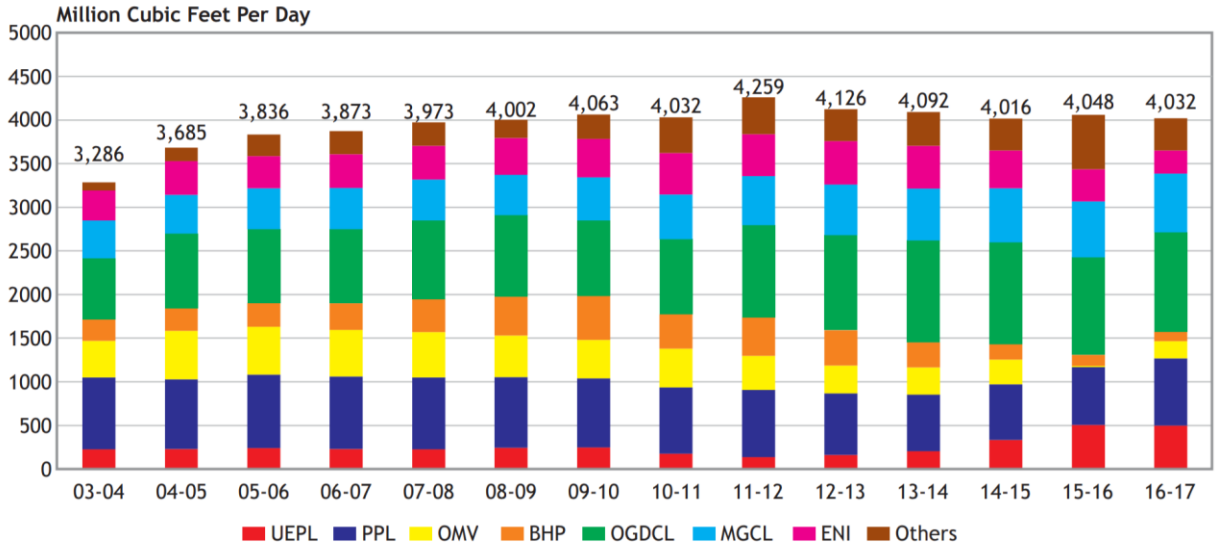


2011-12
Total: 1,288 Billion Cu. Ft.

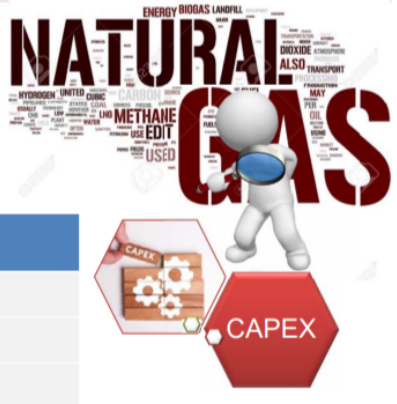


[redacted]

Figure 3.1
NATURAL GAS PRODUCTION



3.1 CAPEX COMPARISON



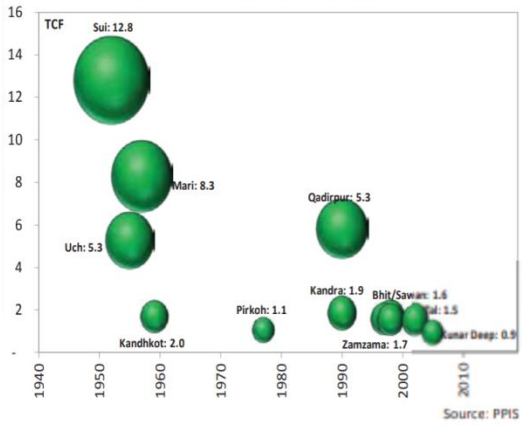
CAPEX Comparison Of Terminal with FSRU (3MTPA)

Component	LNG Terminal	FSRU
Jetty including piping	US$60m	US$60m
Unloading Lines	US$100m	N/A
Tanks 1X180000m3	US$85m	In FRSU
FSRU Vessel	N/A	US$250m
Process equipment	US$130m	In FRSU
Utilities	US$60m	N/A
On-shore Infrastructures	N/A	US$30m
Land Fee and others	US$125m	US$20m
Total	**US$560m**	**US$360m**

The cost of a new FSRU is approximately only 60% of the cost of a new onshore terminal

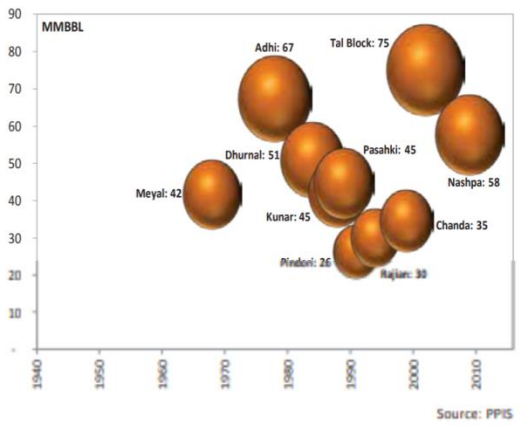
26/10/2017

Chart 4.3: Major Gas Discoveries



Source: PPIS

Chart 4.4: Major Oil/ Gas Condensate Discoveries



Source: PPIS

Large natural gas discoveries have been hard to come by despite increased exploratory drillings in Pakistan since the turn of the century. Tal block was the last 1.0 TCF plus find which was discovered in 2002.

9. Towards a Biogas Policy

Biogas is made by fermentation of bio-materials like food waste, agricultural residue, waste water, solid waste and excreta of human and animals among others. Several biogas initiatives have been launched in the past but did not achieve the desirable impact and targets for a variety of reasons. Several initiatives continue to-date with various levels of achievements. Perhaps there is a need to have a Biogas policy to integrate all the relevant sides of the project, identifying gaps and promoting solutions and possibly announce some incentives. We will in this space explore biogas sector and its potential and make some recommendations for the growth and development of Biogas in Pakistan.

Biogas has emerged from ***small is beautiful*** syndrome and is playing a significant role in Renewable Energy sector in Europe, where it is being utilized in electricity generation mostly in cogeneration mode producing heat and power, and bio-methane production. There are more than 12000 large biogas plants operating in Europe, most of which are in Germany, Italy, Sweden, Austria and Netherlands and UK. In Italy and Sweden, bulk of the bio-methane goes to CNG while in Germany, Netherlands and Austria, bulk of the bio-methane goes to normal gas grid. Raw biogas is converted to Bio-methane after cleaning and enrichment.

In Pakistan 62% of the population uses some kind of biomass for its energy needs; this includes 50% of urban population and 90% of rural population. It is mostly agricultural residues and trees and dung cake (UPLA).Pakistan is an agricultural country generating 43 M.tons of agricultural waste, of which some 11 million remains unutilized .There are 32 million Cows and Buffalos generating cow-dung of 480 M.tons. It is estimated that 50% of it can be collected and utilized better in the form of biogas than Uplas. It has been estimated that 60% of the rural energy needs can be met through biogas.

There are three major modes of producing biogas; a) micro-plants for 2 or 3 families utilizing the dung output of 3 animals; b) small plants utilizing dung from 3 to 50 animals and; c) from 50 to 1000 animals and more. In large plants other agricultural material can also be utilized.

It has been estimated that some 5000 family sized biogas plants have been installed most of which are under operation. Most of these plants have been installed under some subsidy programme due to the low purchasing power of the rural families. Small biogas plants have been installed by farmers to produce electricity and run their tube wells. It appears that there is a greater possibility of success through larger plants installed in commercial modes. Several dairies have installed and are operating large biogas plants and produce electricity for internal use. Some niche entrepreneurs have started even selling biogas through their biogas plants where gas distribution possibilities are there.

There are three major areas where biogas can play a major role; rural gas generation and distribution in off-grid areas; b) Bio-CNG plants in off-gas grid areas; c) electricity generation projects up to 1 MW in rural areas, possibly in tandem with Solar PV. Biogas has a great potential in substituting or replacing LPG which is many times more expensive than Biogas.

Ministry of Energy (fuel division) has launched a scheme of providing natural gas in far-off areas through installing isolated distribution networks and filling it with LPG. Heavy subsidies would be required to distribute expensive LPG costing Rs.2500 per MMBtu which would be sold at Rs.600 per MMBtu. Biogas can easily replace LPG in these projects, as the LPG-Air-Mix Plants (LPGAMP) plants are installed in far-off locations where biomass materials may be available in abundance. Initially, one may try mixing expensive LPG with cheaper biogas to the extent of availability.

Similarly, Bio-CNG plants can be installed in rural areas to cater for transportation needs and for agricultural tractors. In Bio-CNG, Biogas production plant is sited at a suitable interior site where bio-material or dung is available. Biogas so produced is cleaned and enriched (Raw biogas contains only 50-70 % Methane and contains H2S) and is transported to the road-side filling station through a specially laid pipeline of may be one or two kms. Raw biogas produced in small systems is consumed it its raw form and is thus cheap and least capital intensive. Clean Biogas of right specs can cost almost twice as much as the raw biogas. Clean biogas based CNG can compete with RLNG and LPG. Mahindra group in India has installed a similar project I India. There is a plan to install 1000 Bio-CNG plants in India for which cooperation from 1000 farm-stead have been enlisted. It has been estimated that one Bio-CNG plant would cost 5-7 Crore Indian Rs. In Sweden also, Bio-CNG plants have been installed. Large companies like PSO, SSGC and SSNGPL may be asked by GOP to install a few demonstration plants. Private sector is likely to adopt Bio-CNG business in a whole-sale manner. There should be an immediate market of several hundred Bio-CNG stations in Pakistan. Thirdly, in isolated areas where electricity is not there and abundant supplies of agricultural and plant material is there, small electricity plants up to 1000 MW can be installed.

Biogas has always suffered from distribution problem. However, creativity has no limits. Biogas is being distributed by biogas entrepreneurs in Kenya and India in used truck tubes. However, in organized sector as well, beginnings have been made in India to distribute biogas in FRP cylinder. For 15 M3 of biogas, consumers pay IRs 300 which contains as much energy as a LPG Cylinder of 14.2 kg. In India, a LPG cylinder of that capacity is sold at a price of IRs 650. Output of the plant is 3000 cylinders per day. There are plans to deploy 20 such plants in various districts of Bengal.

In Karachi, however, a Biogas project at Landhi cattle colony (LCC), with a planned electricity production of 30 MW could not be implemented, even though IFC financing was available. Biogas cannot compete with cheap local gas, it may, however, compete with RLNG.KMCs self-generation or Biogas-Electricity swap arrangement with KE could also be examined. An alternative CNG project could be examined. LCCs 200,000 cattle can give 200,000 kg of CNG per day. Many CNG pumps can be installed near the cattle colony. A less ambitious project can probably fuel KMCs truck fuel demand. Alternatively, cleaned and enriched Biogas can be pumped into the SSGC gas grid. It is KMC resource.KMC will have to assume charge of this project; otherwise, it would remain a football among various KE and IPP vested interest.

Until recently, dung had been almost exclusively used in biogas production. Recently, processes have been developed to digest crop residue as wee. In many jurisdictions, crop residues are co-digested with Cow-dung or/and municipal waste water. Crop residues thus have acquired a market for their waste which hitherto had no market price. Thus Biogas would increase the earnings of farmers and as well as animal owners. Additional benefit of biogas is the production of fertilizer as a byproduct. And last but not the least, biomass are CO2 neutral. Research is going on to convert CO2 to Methane by reacting it with Hydrogen, which means more Methane, would be produced in every user cycle.

Pakistan is suffering from gas shortages which have been reduced by imported LNG. Local gas resources are depleting. In addition to developing local gas resources, Biogas resources should also be utilized,

particularly, in far-flung areas where both conventional gas and electricity, or one of these cannot be provided economically. Biogas can have multi-dimensional impact in rural and agricultural development, hygiene and foreign exchange saving.

Table ..:Production cost of Bio-methane in Europe-2000 M3/hr Plant	
CAPEX-Digester(USD/M3)	5400
CAPEX-cleaning and upgrading	2500
Plant Capacity(M3/hr)	2000
Annual production-M3	14000000
Density of Methane-kg per M3	0.76
Annual Production in tons	10640
Total Capex-2000 M3/hr Plant	15800000
RoA at 17%	2686000
Depreciation at 5%	790000
Amortization cost per ton-USD	252.44
Manure cost-USD/ton	50.00
other Opex-USD/ton	50.00
Production Cost-USD per ton	352.44
Exchange Rate-Rs per USD	115.00
Production cost-Rs per kg	40.53
Production Cost-Rs per MMBtu	779.41
1 MMBtu=kg of Methane	19.23

Midi Biogas Plants Data Pakistan

	USAID Okara	WinRock Sukheki
Digester Volume-M3	375	200
No of Cows	375	175
Daily Biogas Production-M3	150	79
Plant efficiency-%	40	60
Daily Dung Requirement-tons	3.5	3.5
Dung Required for initial Fill-tons	120	64
Dung output of one cattle per day-kg	10	20
Biogas Production from 1 kg-M3	0.04	
Household beneficiaries-cooking	165	87
or Electricity generation-kWh/day	242	
Plant CAPEX-USD	49700	
Plant CAPEX-Rs	5170000	2,560,000
ROA@17%	878900	435200
Depreciation at 5%	517000	256000
Opex	1200000	600,000
Total Production Cost	2595900	1291200
Production Cost per 1000 Cft	1412.73469	1334.22888

Bahadar Nagar Farm Okara
Commissioning Dec.5,2016

10. Towards a gas Pricing Policy

ECC has again delayed decision on the proposed increase in gas prices which has both political and economic consequences. OGRA had made its Tariff award which was not notified by the previous government. Gas prices did not increase earlier partly due to an intervening period in which Oil prices dived and accordingly well-head prices also went down. But Oil prices have increased again and gas price revision was long overdue, also because of recent Rupee devaluation. SNGPL complains that it buys gas at a price of Rs 629 per MMBtu and sells at an average price of Rs 399, resulting in an annual loss of Rs.220 billion for the two companies. Consequently, being short of cash, the two companies do not pay to the gas producers and postpone payment of other government and non-government dues. Another cycle of circular debt has started to grow. We will in the following discuss the whole gamut of gas pricing issues and attempt to make some recommendations to improve the development of gas sector.

Let us first examine our gas prices in the context of regional and international prices. We live in an interconnected world. Even domestic production and its prices have an international context and relationship. Gas prices have been low in Pakistan including Gasoline and Diesel, much lower than I most of Europe, but even in the regional context. We have dealt with Petroleum products prices elsewhere and restrict here with reporting that Gasoline prices in Pakistan are 48 % lower than India and 38% lower than Bangladesh prices. Also, in case of Diesel, prices in Pakistan are 11 % lower than India and only 15% higher than in Bangladesh. There may be variations in percentages depending on the location. This difference apparently pertains to New Delhi, where prices are the lowest in India.

In Pakistan, highest household gas tariff is 60% that of Gujarat .In Europe, household gas tariff is 4 times that of the highest slab in Pakistan. In India, there is no price support for the poor in gas sector as opposed to the electricity sector there where there is a considerably low electrical tariff for small consumer, as is the situation in Pakistan. In Pakistan, even after the increase, the lowest gas tariff has been around Rs 100 or so per MMBtu, which is several times lower than that of India. It may be noted that we have taken Gujarat prices as reference for prices in India for two reasons; firstly, Gujarat is adjacent to Pakistan and secondly Gujarat is one of the most progressive states in India having market economy characteristics. In Europe, although it is not admitted, there is cross subsidy by household sector to the industrial sector, although a difference of more than 100% in household and industrial gas tariff reflects higher service costs in household sector.

Well-head prices are higher in India than these are in Pakistan. There well head price even after the recent gas price increase in India are Pk.Rs.469 per MMBtu which is 23% lower than Rs 629 per MMBtu for SNGPL, and Rs.589 for SSGC. In India, there is a unified gas pricing of normal well-heads. Most recently, they have devised a well-head pricing based on the average of prices in 5 major international markets like Henry Hub, NBP, and Gazprom etc. From difficult gases, the Indian tariff is higher, almost twice than that of normal fields, greatly encouraging tight and difficult gas finds and production. In Pakistan, there isn't good enough a margin for tight gases which may warrant reconsideration, keeping in view the falling reserves and falling

exports and increasing imports. After all, we are importing LNG at prices around 10 USD per MMBtu. It is, however, quite a difficult issue. For unconventional gas sources, like Shale and Coal gas, however, we will have to consider near-parity prices with LNG.

A very important factor in comparative gas tariff is a very low service cost rate in Pakistan as compared to that prevailing both in India and in Europe. In India, service cost is higher than in Europe of the order of 4 USD per MMBtu, as compared to 2 USD in Europe and only around 0.5-0.6 USD per MMBtu in Pakistan. While, there might be some peculiarities in Gujarat system, which this scribe might not have been aware of, it is quite evident that the distribution tariff is pathetically low. It may, therefore be appropriate to adjust and allow higher UFG (gas losses) at cost or at actual. Disallowing full UFG has not helped in reducing the losses. It may have even contributed to it due to the poor liquidity conditions of the two gas companies, namely, SNGPL and SSGC. We have argued this point in detail elsewhere, and would like to close it over here.

There are a few areas that must be looked into rather deeply. Fertilizer sector gets a lot of subsidy in terms of cheaper gas prices .Finance Minister Asad Umar himself has spoken of Rs 10 billion having been gulped by the fertilizer sector. Apparently, Fertilizer prices are unregulated. There is a lot of support to the proposition that Fertilizer sector subsidies should be given in cash form (rather than in cheaper gas form as presently is the case) to the fertilizer industry and fertilizer prices have to be regulated at the producer level. The issue merits serious and immediate considerations.

A sector of gas sector experts are opposed to CNG as to be the wastage of precious resource and blamed to be one of the major sources of theft.CNG continues to be supported in a number of countries including India for environmental reasons. Overall, I also think that it has positive impact on the economy, environment and the society. Besides billions of rupees of investment and thousands of people are employed in the sector, which would be affected, if the CNG sector becomes unviable for one reason or the other. CNG and its gas feed pricing is, however, an issue. Should CNG be priced on higher LNG prices or should it be provided cheaper under local gas regulated prices. We have argued elsewhere that Gasoline prices should be enhanced vis-à-vis Diesel, as the latter is used in public transportation. Minister Ghulam Sarwar has also made a similar statement recently. Higher Gasoline prices would be more compatible with LNG based pricing of CNG, as some margin has to be there in order that CNG remains monetarily attractive to the users.

Local gas production is going down and LNG use is increasing. With increasing use of LNG, average gas prices will go up and there are foreign exchange limitations that have emerged due to stagnation in exports. On the contrary, Textile industry argues that it can export up to 45 Billion USD, if it is provided competitive energy. However, we have seen that at-least gas prices are lower in Pakistan than in India.LNG has positively contributed in saving money and foreign exchange replacing furnace oil.LNG is 20% cheaper than furnace oil. There is additionally a saving in the form of 50% lower gas consumption in LNG or gas based combined cycle power plants. What are the limits of LNG market share, as it drains foreign exchange? As reported recently, the third LNG terminal will have gas imports or sales of 4 Billion USD. There is a pricing issue to this as well. Whether LNG should remain ring fenced and sold at cost plus or the local and imported LNG should be mixed financially and gas be sold at an average commingled price. Where are the economic optima? Unless there are foreign exchange limitations, and exports increase considerably to be able to absorb imports, there should be no limitation. Under a free market system, if buyers can buy and sellers can sell, there shouldn't be any policy constraints. However, how to solve the foreign exchange issue in the short term would remain a major unknown. Local production incentives and reorganization of the gas sector to promote local gas production appears to be a solution, which carries uncertainties of its own and merits deeper considerations.

Generally, the rationale of gas price increase seems to have been understood by the consumers. However, there is audible and visible resentment and criticisms against the 186% rise in case of small and poor class of consumers in one go. One has to examine, as to how much of a drain it was and how much effect it was on the average prices. I guess not much, however, lacking data one may not be able to insist on it. Secondly, one would like to question the rationale of continuing with gas price subsidy in Fertilizer sector, and maintaining lower prices for it than the lifeline customers. It is certainly an-anti poor bias; And finally, such unaffordable and large scale increase in one go may lead into theft, beating the very purpose of escalation. It is worth examining by the political screeners of the government. It may have violent repercussions, when the news filters down or the poor starts getting high bills. Regulator is a big calculator usually having no heart. However, politicians should have some heart and sensitivity. The increase may be reduced to the average level of 46%.

From the foregoing, it can be concluded that the gas price adjustment and consequent increase was unavoidable and is the right decision. There is in fact some playing space both in Petroleum and Gas sector of extracting some revenue from these sectors. One can estimate a revenue potential of an additional of Rs. 300 billion from it, if oil prices do not increase anymore. Both the people and the government should be ready to make this sacrifice in national interest, should the need arise due to the dire circumstances and prospects that appear to be on the horizon; governments sacrifice would be in taking a hard and unpopular decision and peoples in agreeing to pat more without causing disturbances.

The real issues are in electricity cost and tariff which are incomparably higher than the regional or international prices in the industrial sector. It can be improved with some effort and risk taking with external forces in reforming and adjusting CPEC. Induction of cheaper renewable energy and reduction in Thar coal costs can make a difference. The issue will be discussed separately in forthcoming opportunities.

NEW GAS TARIFF

In Gas Tariff for residential customers, numbers of tariff slabs have been increased from three to seven, the most important of which is addition of a Life line customer consuming 50 M3,with a tariff of Rs 121 per MMBtu. There is an increase of 15-25 % in Residential tariff of small to medium consumers. However biggest increase is in the large residential consumer category of 500 M3 and more, of 146 %, increasing from Rs 600 to Rs 1460 per MMBtu.

Commercial and CNG Tariff has been increase by 40% elevating to a level of Rs 980.Industrial Tariff has been increased by 30% which has become Rs.780.Export sector industries is an additional slab with a tariff of Rs.600, a 30% difference from general industrial tariff and thus no increase from the 2016 tariff.

Fertilizer sector has always enjoyed subsidy providing gas at life-line residential consumer's rate. For feed stock, it was earlier Rs 123, which has now been increased to Rs.185, an increase of 50.41%.For electricity production of self-use, normal tariff has been there, which has been increased from Rs.600 to Rs.780 an increase of 30%.In case of Power sector, increase is from Rs.400 to Rs 629, an increase of 57.25%.For captive power, there is an increase of 30%.

Export sector has been successful in getting the lowest possible tariff of Rs.600. as opposed to similar tariff in Gujarat of Pk.Rs 1025.It is hoped that they will be able to increase their export volume to the promised 40 billion USD level .In Gujarat though, cheaper alternative fuels like Lignite are used by the textile industry. Perhaps, the same can be done here now that Thar coal is available for industrial use. Sindh Engro has

recently invited bids in this respect offering Thar lignite for sale. Perhaps Sindh and Southern Punjab-based industry may be able to benefit from it than distant Central Punjab.

Large Residential consumer now pays more than its counterpart in Gujarat India, with Pakistan Tariff of

Rs.1460, vs Pk.Rs.1024 in Gujarat. Top Residential consumer would be still paying 50% of what consumer pays in Europe. Highest consumer Tariff in Pakistan used to be 60% of corresponding tariff in Gujarat before the recent increase. It may be noted that there is no concessional gas tariff in India, although there is highly differentiated concessional tariff in electricity sector there. Industrial Tariff in Europe is Pk.Rs.900 -1000 per MMBtu, being 25% higher than in Pakistan. It should be noted that European gas market is highly competitive getting all kind of gas from all kind of places like Russia, USA, Middle-East and its own production. However, all this comparison becomes topsy-turvy due to recent massive devaluation and prevailing dynamic situation. Another revision may be required soon to handle the situation. This scribes proposal of monthly gas pricing based on performance based tariff for GAS DISCOs may be considered seriously by the concerned authority.

OGRA GAS Tariff increase 2016 vs 2018(Rs/MMBtu)

	Residential	Dec-16	Sep-18	% increase
R1	**upto 50 M3 per month**	121	110	10
R2	**100 M3**	127	110	15.45
R3	**200 M3**	264	220	20.00
R4	**300 M3**	275	220	25.00
Rs	**400 M3**	780	600	30.00
Rs	**500 M3**	1460	600	143.33
R7	**Over 500 M3**	1460	600	143.33
R8	**Institutional,schools ,gov etc**	780	600	30.00
C	**Commercial**			
C1	**Commercial**	980	700	40.00
I	**Industrial**			
I-1	**General**	780	600	30.00
I-2	**Ice**	980	700	40.00
I-3	**Textile,Sports etc**	600		
CN	**CNG**	980	700	40.00
F-1	**Fertilizer-feed stock**	185	123	50.41
F-2	**Fertilizer –energy**	780	600	30.00
	Power			
P-1	**IPP-WAPDA**	629	400	57.25
P-2	**Captive Power**	780	600	30.00
	Average			

Comparative Gas Prices in Europe and in South Asia for various sectors(Pk.Rs/MMBtu)

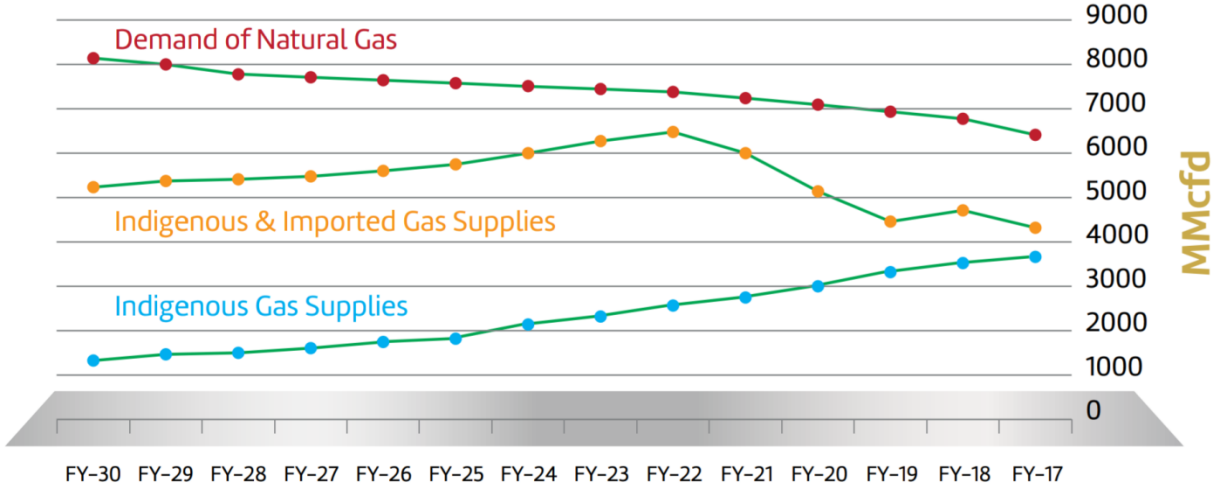
	Household	**Industry**	**Well-head**
France	2810	1095	
Spain	2636	1161	

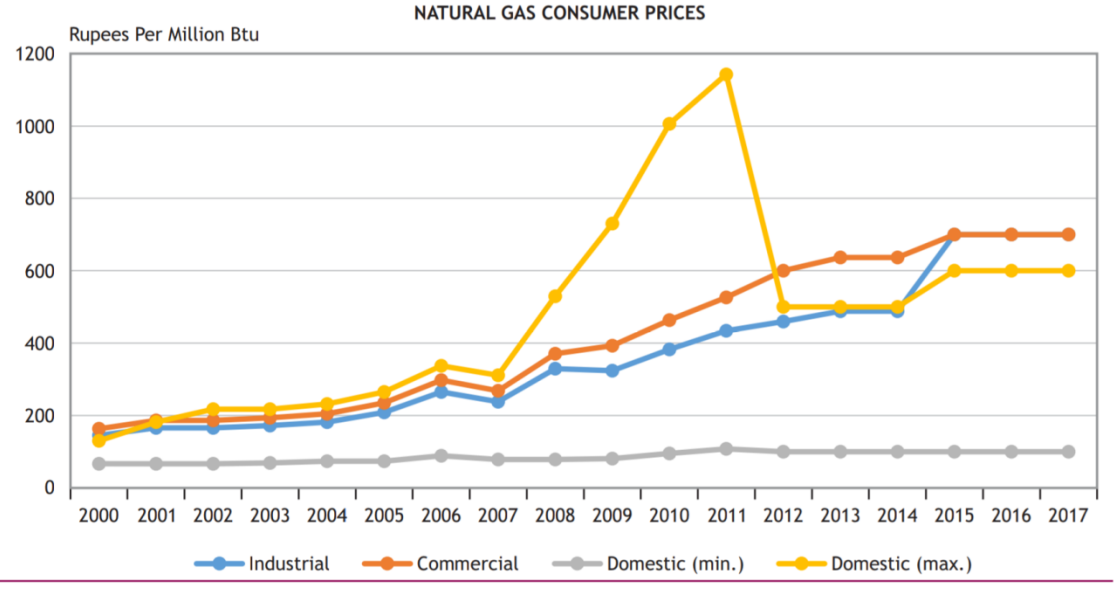
Italy	2784	979	
Germany	2417	1095	
U.K.	1855	904	
Gujarat India	1028	1028	467
Pakistan after Increase-SNGPL	1460	780	629
Pakistan before increase-SNGPL	526	484	609

Exchange Rate 1 USD=120 Pk.Rs=70.59IRs:1 Euro=142.43 Pk.Rs

Source: OGRA, Gujarat Gas, Europe Energy Portal, Economic Times of India

Fig. 2.16: Demand Supply Scenario (Indigenous & Imported supplies)





Demand Supply Scenario with Indigenous and Imported Natural Gas

MMcfd

	FY-16	FY-17	FY-18	FY-19	FY-20	FY-21	FY-22	FY-23	FY-24	FY-25	FY-26	FY-27	FY-28	FY-29	FY-30
Committed & Anticipated Supply (Indigenous)	3,731	3,686	3,473	3,236	2,956	2,715	2,499	2,305	2,100	1,864	1,745	1,649	1,604	1,548	1,408
LNG Supply	600	600	1,200	1,200	1,200	1,200	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Iran - Pakistan Pipeline	0	0	0	0	450	750	750	750	750	750	750	750	750	750	750
TAPI	0	0	0	0	500	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325
Total Supply (Indigenous & Imported)	**4,331**	**4,286**	**4,673**	**4,436**	**5,106**	**5,990**	**6,374**	**6,180**	**5,975**	**5,739**	**5,620**	**5,524**	**5,479**	**5,423**	**5,283**
Total Demand	**5,859**	**6,436**	**6,880**	**6,967**	**7,055**	**7,142**	**7,234**	**7,328**	**7,428**	**7,536**	**7,645**	**7,759**	**7,877**	**7,997**	**8,119**
Gap without IP, TAPI, LNG	**2,128**	**2,750**	**3,407**	**3,731**	**4,099**	**4,427**	**4,735**	**5,023**	**5,328**	**5,672**	**5,900**	**6,110**	**6,273**	**6,449**	**6,711**
Gap with IP, TAPI, LNG	**1,528**	**2,150**	**2,207**	**2,531**	**1,949**	**1,152**	**860**	**1,148**	**1,453**	**1,797**	**2,025**	**2,235**	**2,398**	**2,574**	**2,836**

SOURCE: Data taken from Gas Companies (SSGCL/SNGPL) and Independent System Companies (Central Power Generation Company Limited, FFCL Plants, Uch Power,

11. Problems and Solutions of CPEC

There is no doubt that CPEC is an important contribution towards the development of Pakistan's energy sector and the economy, although calling it a game changer may be an unnecessary expectation and distraction conveying a wrong message that nothing else may have to be done. There are problems in the terms and the design of the CPEC programme. Design issues are still evolving specially after the new government that has come on the saddles. Interim reviews and adjustments are a norm in such capital intensive and decade's long programmes. The author points out the problems of excessive costs and affordability in energy sector and suggests modification in the terms. Author also recommends steps in other areas to improve Pakistan's exports, local capabilities and economic performance.

There is a hue and cry in Pakistan that it is going to go under default which can cause great chaos in the country and its economy. Current account deficit caused by increasing imports and stagnant and even falling exports is held largely responsible for this evidently. Budgetary and trade deficits have been the two major weaknesses of Pakistan's economy making it unsustainable. Most of the times crises have occurred and have been managed through IMF and other friendly countries support. This time CPEC was invented to be a game changer and solution of all woes. The unholy truth is that CPEC has been part of the problem due to rise in imports of machinery and equipment. Improved trade relations have also caused imports from China to have increased to 12 billion as against Pakistan's exports to China of hardly 3 billion USD.

It was a political sloganeering and an attempt to avoid real working and policy changes. Infrastructure like energy and roads can be helpful in lighting the industry and moving the goods. But you have to have goods and production. The third component of CPEC launched lately is still in limbo and seems to be in search of strategy and a real blue print. We will in this space try to propose a few measures which may be of help in improving the CPEC, correcting some of its defects and may decrease the trade gap.

Textile industry claims that it can achieve exports of 40 billion USD in a short time if the impediments are removed. Exporters argue that Pakistan exports are falling due to high energy prices, among others factors. Are electricity prices high in Pakistan and whether CPEC projects will result in lowering the electricity prices over the next ten years .And if not, what can be done with CPEC to get more competitive prices. We will explore options as to how CPEC projects can be made more helpful than these appear to be currently.

Pakistan's industrial electricity tariff is among one of the highest in the world , comparable to only European countries, except perhaps Italy and Germany, where there is heavy taxation on electricity .Pakistan's tariff is more than double that of the U.S., and 50% higher than that in India, Bangladesh and Turkey. In the U.S., cheap gas and coal and least taxation are largely responsible for such a low industrial tariff. In India, Cheaper coal based electricity is responsible for lower tariff. In Bangladesh, cheap local gas is responsible for lower tariff. They are also into imported LNG now and things may change there soon.

One would have expected, CPEC and China, to be helpful in this regard, especially with the induction of coal in our generation mix .It has not happening though. It is true that CPEC undertaking of 35 billion USD in power sector investment is really very good, but it is also not bad for the supplier side: a captive market of 35 billion USD without competition (and if one adds another 10 billion USD of 2 nuclear power plants investment already under implementation outside CPEC, could prove to be a disaster for balance of payment, if not corrected appropriately). So if it is good for both sides and coupling with the strategic access and cooperation, some quid-pro quo was expected in terms of fair if not softer pricing. Part of the problem could be placed on the shoulders of our own institutions, ministries, bureaucracy and the politicians.

A special package should have been designed for CPEC projects keeping in view the award of a big market and risk covers. The general tariff is largely aimed at our local investors which have a poor balance sheet and risk rating as compared to the foreign companies. As such, NEPRA framework has many problems; its high return on equity of 17-20% is unprecedented to be found almost nowhere in the world. These rates have been calculated on a set of very dubious assumptions as shown in their concept paper. In India, ROE is 15% and that in local currency. If one adds, currency depreciation of 5% per year, Pakistan RoE becomes 22-25% and which is not taxable, except for 7% dividend tax rate. Similarly, a spread of 4.5% has been provided, keeping in view lower LIBOR rates prevailing earlier. It has jumped to 1.5% from 0.5 % earlier. China has provided similar projects to Sri-Lanka and Bangladesh at a spread of 3 and 3.5%.Are we a very rich country or simply careless and unthoughtful of the future and of the associated liabilities. What has gone wrong is that no opportunity of negotiations even in the framework of NEPRA has been afforded. Terms have been agreed in background, which then were requested by GOP/PPIB to NEPRA to accept it. Obviously, at least initially, NEPRA would have felt under government pressure to accept what was being demanded. Only in case of HVDC project, NEPRA could have collected courage to challenge the asking prices and did have some success there. Why should have GoP/PPIB become the champion of the supplier obstructing or loosening the negotiation in NEPRA.

To be fair, one may consider, as it is argued that there was hurry and beggars are not choosers and hard negotiations could not have taken place due to time and urgency. But now, is the chance to renegotiate the terms. Keeping in view a dangerous scenario that is emerging, Chinese government may be persuaded to look into the terms of new and incoming projects. One or more of the following can be the basis for adjustments:

1. Adjustments of CAPEX or of generation tariff, in line with prevailing costs and rates in China itself or elsewhere, say, in India. CAPEX of coal plants is said to be 40% or more high than the norm. Only recently, an EPC contract has been signed for Jamshoro Coal Power Plant being financed under ADB assistance. Jamshoro Plant CAPEX is coming out to be half that of similar CPEC projects.
2. Softening of financing terms, reduced interest rates, and longer repayment schedule of 20 yrs, so as to significantly reduce the capacity charge by around 40%.Extension of lending terms itself may reduce the foreign exchange flow in debt servicing, even if rates are not reduced.
3. Genuine competition among Chinese companies at EPC contract level. Current practices have not resulted in right prices.
4. The above would result in Generation cost adjustments keeping in view tariff in India or even in China of around 4-5 cents.

Proposed CPEC terms for Energy and Allied projects

	Existing	Proposed
RoE %	17	14-15
Debt Margin	LIBOR+4.5%	LIBOR+3%
Debt Repayment Period yrs	12-Oct	20-25
CAPEX Adjustment	100	60-80

Comparative Capex and COGE of various coal power Plants

	Capacity MW	**CAPEX MnUSD**	**unit CAPEX MNUSD/MW**	**COGE.Level Usc/kWh**	**Completion Year**
CPEC-NEPRA upfront Tariff	1320	1463	1.45	8.36	2018
Jamshoro Coal Power Plant-ADB	1320	1181	0.895	6.2361	2020
Hassayan-UAE-USC	2400			4.501	2021
Egypt-Shangai-Dongfeng	6000		0.733(EPC)	5.4	2022
Malaysia-Manjung-USC	1000	1200	1.2	5.695	2015
Malaysia-Tanjung-4	1000	100	1.1	5.695	2016
Kudgi SSTP-USC-India	2400	2300	0.9		2017
Khargon-USC-India	1300	1500	1.1		2019

Source: IEEFA,TNB Malaysia, Source Watch, NEPRA

Ultra Mega Coal Power Plants India-Tariff

	Capacity	L.Tariff		Coal
	MW	Irs/kWh	Usc/kWh	
SASAN-Madhya Pradesh-6x660 MW	3960	1.196	2.1198	local
Mundra,Kutch,Gujarat-5x800 MW	4000	2.263	4.0110	imported
Exchange Rate-2007 Irs/USD		56.42		

Source: CERC India

Comparative Financing Terms under Sovereign Guarantees

	interest %	Grace yrs	Repayment	Lender
NJHPP	2.80%	8	20	ChinaExim
NJHPP	1.5-2%	8	20	KFD,IDB
Jamshoro coal Power Plant	under 2%	5	25	ADB
CPEC-Roads	2%		20	China AIIB
World Bank General	under 2%		20	World Bank
ADB General	under 2%		20	ADB
SECMC-sovereign Guarantee	3.30%		12	
CPEC- Power commercial	6.00%		12	China various

Source: NEPRA, Planning Commission, ADB, World Bank

Note: Higher risk in NJHPP, War Zone, disputed area, high seismicity, Climate Risk

Is CPEC under debt or investment?

A controversy has emerged whether CPEC investment can be classified under debt or investment? Such determination has positive and negative implications, and has become important, as IMF has enquired about it as well. We will explore this interesting and important issue in the following space.

The real confusion or controversy is about the nature of Energy investments. There is a standard answer that it is a DFI and not debt. But when, one digs deeper, the answer does not appear to be that straight forward. It is not a normal DFI but it has both character of debt and equity finance. Let us see what a standard DFI investment is. For example, let us take the example of a Textile factory project. A Chinese JV builds a factory to make textile yarns in collaboration with a private Pakistani investor or alone. There is no involvement with government. Chinese company brings its own equity and debt. It sells in the open market, local or international, at prices decided by it and in volume that it chooses to. It makes a profit out of which he pays taxes and appropriates and sends profit to its home country. There is no government involvement or guarantee of price or sales. It is a clear DFI.

However CPEC energy projects are different. Although, Chinese company in this case brings its equity and debt capital under its own, GoP is involved in a major way. First of all, GoP guarantees that it will buy energy at a certain price and at a fixed volume, whether it needs it or not or whether it is able to sell it onwards to the companies or consumers. Although, Chinese company is responsible for its debt repayments, it has a back-to-back arrangement under GoP guarantee to pay and service its debt and as well as profit. If interest rates increase, GoP pays and if any other cost increases, GoP pays. All risk s are covered and transferred to GoP. These are called Take or Pay contracts. One can compare this case with the afore-mentioned case of textile factory.

It is not a matter of semantics only. It has implications on the calculation of interest rates. It is an almost sovereign guaranteed equity and debt repayment and deserves a risk pricing of debt under a totally different risk and business environment. The interest rates under this take or pay model may be, somewhere between 2% and 6%, let us say 4%. This issue becomes more important under monopoly pricing of CAPEX which appears to be 40% higher than normal. If NEPRA under a coalition's pressure has agreed to a higher interest rate, it is the time to renegotiate. And IMF can be of some technical help in intermediating to an understanding in this respect. Or if nothing else, the repayment period may be extended to 20 or 25 years, in order to lighten the cash-outflow and foreign exchange out-flow. There is a strong case to renegotiate the terms in this respect. There should be some consideration for strategic cooperation and the monopoly market for 60 billion USD sales.

The problem is that GoP for all practical purposes is to make payments as it would make in case of debt, irrespective of what one may call it. It is as good or as bad as debt-a fixed liability to pay in foreign currency. It is important to recognize this liability and include it in our projections and plan accordingly. As they say, Storm doesn't go away if the ostrich or camel puts its neck in the sand .The Energy projects debt is GoP debt and even its equity is also a debt. A 40 billion USD investment would require a servicing of 6.4 billion USD per year in terms of interest, profit and repayment (at a composite cost of capital of 10%).This is a massive cash-out flow requirement, call it debt or whatever. It is a GoP liability, affecting current account. Infrastructure debt would require 1.5 Billion USD for equivalent servicing over 20 years and 2.5%.This adds up to 7.9 USD per year. The previous government had a political interest in calling everything to be well

which the current government is under no obligation to replicate. The real payment problems will start surfacing in a matter few years only, when the full brunt of repayments would be due.

A strong, prosperous and self reliant Pakistan is a better strategic partner than a weak and poor one. China is getting a bad publicity, deserved or undeserved with respect to its investment and lending policies. CPEC is a show-case project. In Pakistan, we take it as a game changer, which is not Chinas fault, if some people ties undue expectations.

Pakistan problem is, however, permanent and multi-dimensional. Its increasing trade gap is a reflection of inadequate production base both in terms of quantity and quality. Energy to be a useful input would have to be utilized by the industry. Some argue that industrial sectors energy consumption has been going down recently. Residential sectors consumption and demand alone will not enable Pakistan to repay its liability. It has to produce and sell abroad. If one cannot be of help in this respect, it may be appropriate to loan more judiciously.

In the long run, it would be better for the partners, exporting and importing in equal amounts and in an increasing and sustainable mode. Present government has expressed its goals and targets in this respect and China has agreed to modify and adjust the scope of the programme accordingly, although changing the terms of loans and returns can be contentious and more difficult. With good will and fair play, it can be done to the advantage of both the countries.

Other Proposals

1. The quickest way to increase exports is to start with minerals. Pakistan has vast mineral resources. At least, to the extent of Copper, it has been deposited. China had already installed a copper mining and processing facility in Balochistan (Saindak) which seems to have finished its useful life. Copper exports have been marred by the legal issue unnecessarily created by an unholy alliance of uniformed judicial activism and erstwhile communist coterie and others. China has considerable and continued interest in copper and other minerals imports. Legal issues should be sorted out in Rekodek and the resource be utilized either within the Rekodek framework or CPEC be introduced into it on area not covered by the earlier litigant company. There are other ores like Zinc, Chromium etc both in Balochistan and in northern tribal areas. Even Marble and Granite sector could be improved. More geological explorations and proving should be made under CPEC and mining production should be increased to industrial level, while it is currently relegated to artisan level mostly. It is estimated that 5 billion USD of mineral exports can be mobilized in a matter of 5 years, half of which could come from Copper alone. We have converted a blessing into a curse due to inappropriate attitudes and policies.

2.China is a big economy with a population of 1.6 Billion and developed technology situated adjacently with Pakistan. If China adopts a helpful strategy than just milking the profitable energy sector, it can do a lot for mutual benefit. Its own market alone is sufficient to take Pakistan out of debt as well as trade gap crisis. There are many proposals on the table which can be thought through and designed in a way that Pakistan emerges more as a trading partner than a weak strategic ally always in need of help and assistance.

3. Cooperation in Agriculture is already under consideration. Pakistan has a high agricultural potential, not only to feed its own population but also to export to other countries such as China and the Middle East. Being a Muslim country, its agricultural products are received well in Muslim countries due to Halal issues. Agricultural productivity is falling in Pakistan. Agro-processing industry is very small. Supply chain is under developed. The menu of cooperation in this sector as revealed is quite attractive and should be expedited.

4.Pakistans Textile exports have been dwindling. Except for its cotton linkage, there isn't much in the sector to be able to compete in external markets. Pakistan textile competes in low end market where price competition is strong. China with a population of 1.6 Billion has a large demand of textiles and apparels. China is developing its textile sector in the border area with Pakistan. It can both be a threat and opportunity for Pakistan. Cooperative supply chain and products can be developed in the area which can emerge as a major supply center of textile and apparel centre.

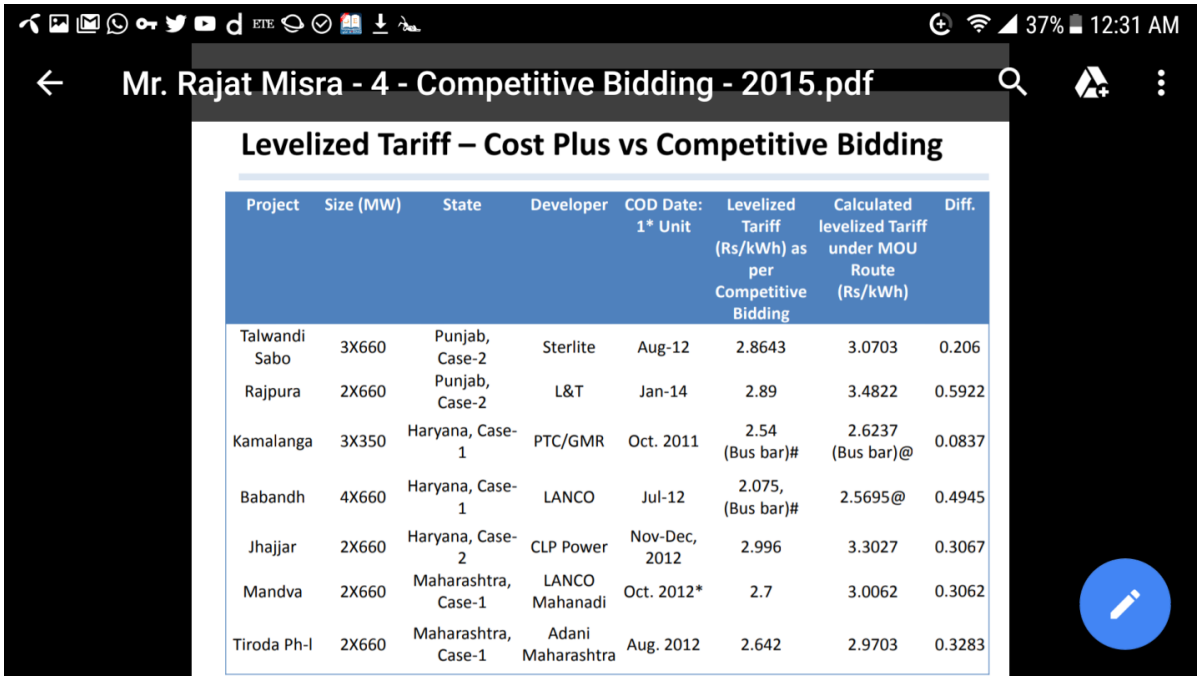
5.World market of Electronic goods is very large, much larger than of textiles. All South-East Asian countries esp Singapore, Malaysia and Vietnam are thriving on co-production and exports of these products. In Pakistan, there is also a good potential of domestic market as well. However, we have a small fledgling industry in this sector producing fans, low-end manual washing machines etc. In special economic zones, such production can take place entirely for exports and possibly for some sales into Pakistan domestic market as well.

6. There are two phases in Pakistan economy where major technology input has been introduced in Pakistan, one in Ayub Khan period and the other in Z.A. Bhutto's period which continued into General Zia period, wherein major projects of Pakistan Steel and Heavy industries in Taxila and elsewhere were made. Except for Pakistan Steel, all others have been made by China. It is more than 40 years now. Most of these projects have become sick and outdated after playing a major role in spreading technology in Pakistan giving rise to local entrepreneurs in the allied areas. Later regimes have not made similar initiatives and have relied on short term approaches of utilizing existing capacities in construction sector and automotive industry. A new and major technological impetus is required. It can be launched by rebuilding the earlier industries but not necessarily limited to these. Earlier, there used to be a problem of lack of demand. Now in the form of CPEC, there is a big source of demand. It should be our objective that 50% of the power equipment required in CPEC projects is produced in Pakistan through the installation of the proposed new plants under the 3rd CPEC component. One need not be too strict about special economic zone. Facilities should be utilized wherever nuclei are available and where work can be started without further loss of time. This proposed technology initiative will both increase export capabilities and would help reduce imports. A trade impact, including exports and import substitution of 5 billion USD in initial years need to be targeted in this respect.

7. Although, private sector has been consulted on and off, there should be an institutional space provided to the private sector in CPEC deliberations. Bilateral contacts among Chines and Pakistan entrepreneurs should be promoted. Policy and projects should not be forced on the heads of the private sector. There is a need to change the scope and terms of CPEC.A credit line may be added to CPEC for lending to Pak-China JVs in industrial and agricultural sector. China has played a major role in building local capacity in Pakistan, especially, in the engineering sector. Pakistani present crisis is not of making of China. But the next one will be ascribed to China due to loan servicing, when its full brunt would be felt in a few years.

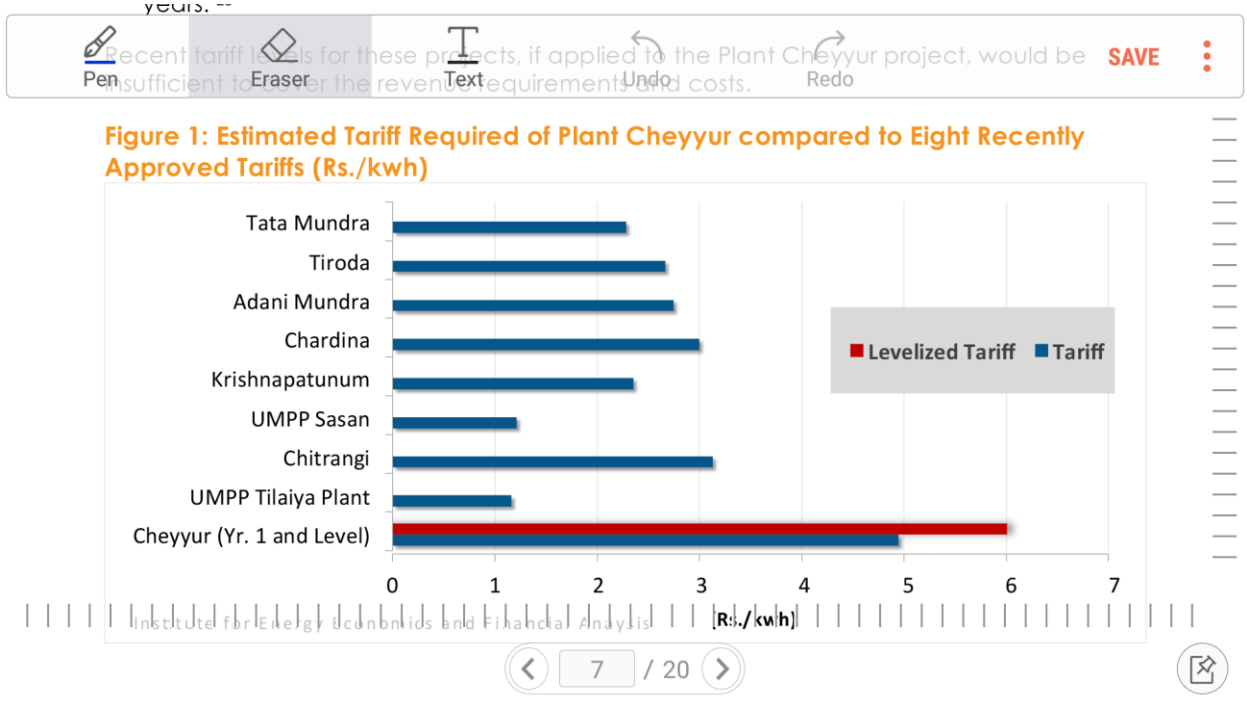
8. It is therefore necessary to consider the two proposals of our respectable advisor commerce, Dr. Razzak Dawood, who is highly experienced and successful entrepreneur, especially, in technology areas. He has made two proposals; one of a thinking period of one year to think through the allied problems and workout a new amended programme; and second to reschedule the projects with a delay of 5 years so as to ease the import and debt burden and also to be able to implement proposals such as that have been made in the above and I am sure there are other ones. NEPRA has forecasted a surplus of 14000 MW if all the proposed projects are implemented. Some pruning may be required to avoid payment problems. Already, there is a circular debt volume exceeding 1 trillion Rupees.

9. Present administration does suffer from a problem of its anti-CPEC stance taken before elections. Any proposal by it of a nature of making some adjustments and including some new initiatives and asking for some time immediately sends wrong signals to the stake-holders, especially, related to the strategic issues. There is sensitive strategic cooperation between China and Pakistan, which is feared to be affected by any tinkering with the project. However, China will understand that an economically strong and independent strategic partner would be better than the one which is always in need of urgent help. An improved CPEC design is in interest of all. Let us redesign it.



Levelized Tariff – Cost Plus vs Competitive Bidding

Project	Size (MW)	State	Developer	COD Date: 1* Unit	Levelized Tariff (Rs/kWh) as per Competitive Bidding	Calculated levelized Tariff under MOU Route (Rs/kWh)	Diff.
Talwandi Sabo	3X660	Punjab, Case-2	Sterlite	Aug-12	2.8643	3.0703	0.206
Rajpura	2X660	Punjab, Case-2	L&T	Jan-14	2.89	3.4822	0.5922
Kamalanga	3X350	Haryana, Case-1	PTC/GMR	Oct. 2011	2.54 (Bus bar)#	2.6237 (Bus bar)@	0.0837
Babandh	4X660	Haryana, Case-1	LANCO	Jul-12	2.075, (Bus bar)#	2.5695@	0.4945
Jhajjar	2X660	Haryana, Case-2	CLP Power	Nov-Dec, 2012	2.996	3.3027	0.3067
Mandva	2X660	Maharashtra, Case-1	LANCO Mahanadi	Oct. 2012*	2.7	3.0062	0.3062
Tiroda Ph-I	2X660	Maharashtra, Case-1	Adani Maharashtra	Aug. 2012	2.642	2.9703	0.3283



12.Towards an alternative Gas Governance System

Electricity system has undergone many reforms from erstwhile monopoly to a mixed IPP system having a variety of actors and players. Gas sector has defied any meaningful reforms with falling efficiency and increasing losses and theft. The only panacea that has been discussed is privatization. Except for privatization in manufacturing sector in 1990s, any further privatization has not happened. Political consensus is lacking and there have been practical issues as well. PIA, Pakistan Steel and energy sector all have defied privatization despite efforts of varying intensities. First ECC meeting held under the new government could not take any decision on a proposed summary asking for increase in gas tariff in the context of increasing financial difficulties of the two companies, SNGPL and SSGC. Naturally, it is a difficult decision for a new government to increase prices, although willy-nilly, it may have to do it in near term. While part of the problem is the difference between cost of purchase and selling prices, there are other issues of losses and efficiency. In this space, we will propose an alternative system that may be implemented gradually and some of the organizational steps of which can be implemented immediately. Some of the proposed steps have been discussed earlier, while some are kind of new. Let me first state the alternative system point-wise and later on discuss the pros and cons.

Separating Gas Supplies from Transmission and distribution functions

- Make Pakistan LNG as Pakistan Gas Supplies Company dealing with both Local Gas and LNG; Pakistan LNG Buys from Local Producers and sells to SNGPL and SSGC at a uniform Weighted average price; It can later commingle LNG with Local Gas and announce a commingled price, as and when, it is decided; Later on other Private sector Gas suppliers can be added as Gas and Pipes are separated.

Separating Transmission and Distribution

- $Separate Gas Transmission ala NTDC as independent company; Merge SSGC and SNGPL ;Make it a Holding company until privatization;$ Smaller Gas DISCOs ala proposed for Power companies

Gas Pricing and Tariff: Replace Annual RR by three year Price CAP on capacity charge ala Electricity DISCOs, excluding losses; Capacity charges can be different for different customer categories; Consumer prices can be adjusted monthly ala Fuel adjustment charge in case of DISCOs; Only three tariff be retained in residential category; lifeline, Middle and High income; Loss calculated and imposed separately for every district; Gas Price+ Capacity charge +Loss% +cross subsidy adjustment

Separate Gas from Pipe: One unified Pakistan Gas Transmission company (PGTC) merging SNGPL and SSGC Transmission assets; PGTC acts ala NTDC, not involved in purchase; Gas DISCOs may initially act as electricity DISCOs buying and selling gas as well as providing distribution services i.e. Gas and pipe together; Ultimately gas supplies may be taken away from GASDISCOs and national level competitive suppliers may sell directly.

There are two major peculiarities in gas pricing system; SSGC and SNGPL buy gas from various gas fields owned by various gas producing companies, private, public and international. All gas fields have been

awarded gas prices under different systems prevailing at the time of discovery and development. There are about 50 gas fields, each having a different well-head price. This results in different gas prices for SNGPL and SSGC which are balanced in an obtuse manner. There are other issues as well. A better way of doing it is pooling at national level ala CPPAG in power sector which buys from more than 50 producers and sells to DISCOs. Pakistan LNG can perform this function, as it is already engaged in an allied business of LNG buying and selling. Presently, LNG is ring-fenced and being sold at international prices which are almost twice the locally produced gas. At some stage, if a decision is made to commingle the local gas and the imported one, Pakistan LNG, may be rechristened as Pakistan Gas Supplies Company, will be able to handle it. This can be done almost immediately with some reorganization and transferring gas procurement personnel from SSGC and SNGPL to Pakistan LNG. This would also entail some changes in tariff system which we will take up a little later in this space.

Gas sector reforms could not be done mostly due to the panacea of privatization. There have been general difficulties including political ones in privatization. And in case of Gas sector there have been additional difficulties and differences of opinion; whether selling the two companies as it is would fetch more prices or after reforms and restructuring and vice versa. What is being proposed here is does not require privatization. It may require making a holding company (Pakistan Gas holding Company-PGHC) .A separate Pakistan Gas Transmission Company (PGTC) is carved out and Gas DISCOSs are made initially as part of the holding company. At-least 20 Gas-DISCOs are proposed to enable management to look after the field affairs closely. Elsewhere, we have made similar proposals for smaller power sector DISCOs. Privatization can be done later as the opportunity and consensus emerges. It may be able to attract local investors or JVs at better prices.

All this except Pakistan LNG/Pakistan Gas Supply Company (proposed) would require changes in Tariff structure and procedures. At present annual revenue requirements are determined by application to OGRA, which if divided by Gas sold, gives average prescribed gas prices for the forthcoming period. We are proposing here what is called Constant Price System-CPS. Under this system, a distribution tariff per unit of gas sold is awarded for one to three years based on the company accounts of the last three years and projections thereof. Periodic gas price, monthly, or quarterly etc is charged as it occurs. This is a small variation to the existing power disco system of tariff. In Power system, Transmission and Distribution tariffs are calculated separately. This can be done initially, even without any organizational change and can be undertaken by cost-centre accounting.

Currently, aggregate loss of gas is 12.5%.It hasn't been controlled largely due to the big empire syndrome implicit in large organizations which it is hoped that proposed fragmented smaller companies may be able have success in this respect. There are other steps that are required in loss and theft reduction, which will be discussed elsewhere later. Here, it is proposed that instead of allocating losses centrally, gas losses should be calculated proposed DISC wise and applied accordingly at that level. Eventually this should be done at sub-station level, as we have proposed elsewhere loss measurement and allocation at 11-kV level and later even ay DT level.

All of this should not be difficult. It is happening in most parts of the world. Monoliths and monopolies like SNGPL and SSGC are rare. Reforms may, however, be constrained by provincial issues and 18th amendment. Every system may have unequal consequences for different regions. Although, I don't foresee such issues, but consultations with provinces would be required and negatives may have to be balanced by adding positives for the losers and vice versa for the ones who may incidentally benefit.

Before closing it would be of interest to discuss some aspects of gas governance and pricing. In India, there are several transmission companies, but bulk of the market share is held by a public sector company named GAIL India. Transmission tariff is issued by the regulator PNGRB for individual pipeline segment, project by project. Interesting thing is that new GAS DISCOs are auctioned to bidders who bids distribution tariff along with programme of work, detailing network length, number of connections etc. Thus distribution is highly fragmented, although companies can bid for more than one DISCO region. Secondly, Gas prices are not low in India, as it is generally, argued by some. We will produce here gas price data of Gujarat state which is quite competitive and progressive state in India and is geographically adjacent to Pakistan.

Gas Prices-Gujarat

	CNG(kg) IRs/kg	Domestic IRs/MMBtu	Industry IRs/MMBtu
Basic Gas Supply Cost	14.85	307.443	307.443
Network or Distribution cost	16	280.205	280.205
Margin	5.38	16.517	16.517
Retail	36.23	604.165	604.165
VAT	11.27	90.625	130.835
Retail with VAT	47.5	694.79	735
Exchange Rate-USD	70.52	70.52	70.52
Retail with VAT in USD/kg	0.6736		
Retail with Vat USD/MMBtu	13.4714	9.8524	10.423

1 kg CNG=0.05 MMBtu;1 MMBtu=25.2 SCM;
Source: Gujarat Gas

One could see here that average gas price in Gujarat is around 10 USD per MMBtu, out of which 4 USD per MMBtu is distribution cost excluding taxes. There is a very small tariff difference between industry and domestic. There is no special concession in tariff for the poor and no slabs. Although, in electrical sector, there are more tariff slab in India than there are in Pakistan and an especially low electrical tariff for the poor. In Gujarat, most of the industries including textiles use locally available Lignite, which is cheap and abundant there, unlike high priced Lignite here in Pakistan. It appears that there is quite some rationale in the gas price enhancement proposal which the current administration should look into favorably, before circular debt disease also captures this sector as well, although it is already there in one form or the other.

Towards Monthly Gas Tariff System;

Reforming Energy Pricing and Regulators

Energy sector in this country is embroiled in contradictory systems and approaches. For example, Petroleum Products pricing is done monthly and costs are passed on monthly. In Gas Tariff system, unnecessarily long gas tariff system is in vogue and gas tariffs are changed only when the gas companies cannot take it anymore and are close to shut down. Electricity system is perhaps in between, where both short term and long time price adjustments are made. Resultantly, there is an accumulation of a circular debt of Rs. 1.3

Trillion Rupees and is expected to increase. Fundamental issue, though, is that cost of supplies are more than what consumers are able to afford and pay. Cost of supplies is high for both legitimate and illegitimate reasons. Regulatory processes are supposed to control the illegitimate reasons and bring about and implement a fair pricing system that walks midway between consumer and producer interest. Inefficiency, incompetence and capacity and capability issues are at the core. Innovation has to be encouraged and brought by the leadership that is brought forward by the political process. Conventional bureaucracies are least equipped to do that.

Electrical Power sector has been a subject of gradual reform process which has changed the scenario from a monolith WAPDA control to IPPs, GENCOs, NTDC,CPPAG and DISCOs etc. Oil and Gas sector ,unfortunately, has not been subject to a similar and corresponding reform process wherein there is a strong control and monopoly of the Ministry of Petroleum , which is now a division under a unified Ministry of Energy. The later, infact, is the greatest change that has occurred and may be undone eventually by the disgruntled and affected quarters. Not too early in the past, the then MPNR made a funny proposal of launching many new companies, including power generation companies. Fortunately, the proposal was blocked with a disdain.

However, they managed to make two LNG companies, one Pakistan LNG and the other Pakistan LNG Limited PLL. Both dealing with LNG; one dealing with Engro terminal and Qatar LNG and the other dealing with another PGPL terminal; unnecessary duplication which is almost impossible to justify and antagonists and opponents call it to be the ulterior motive. Reportedly, the two terminals are competing at cross purpose; expensive one is being operated at full capacity and the cheaper one at lesser capacity, resulting in a loss of several billion rupees per year. This kind of extreme waste of resources indicates the urgency of reforms and restructuring in the Petroleum sector. As a first step, there is to be an operational merger of the two companies and finally a legal and financial merger.

Many other complications have erupted due to the advent of LNG. Now there are two types of gases; one conventional local gas and the other imported Liquefied Natural Gas.LNG is expensive, as it is imported and has to be liquefied and ,transported through special LNG ships and Regasified at LNG terminals. However, the price difference between the local and imported gas is reducing.LNG prices are more volatile, while local ones are less volatile. In order to, probably, soften the opposition to LNG, LNG system was kept separate and was so called ring-fenced. Otherwise, no particular logic seems to be there to keep a separate accounting and pricing system. One can have a commingled pricing system and still have widely varying policy pricing. And this is what, we are proposing here in the following.

It is proposed to form a Pakistan Gas company by the merger of Pakistan LNG and PLL and expand its role to include the purchase and selling of local gas as well. Presently, the two Gas DISCOs, are purchasing gas from E^P companies and LNG companies. Pakistan Gas Company becomes a supplier of all gas, including local gas and imported LNG. In the parlance of electricity system, this is akin to some kind of CPPAG. This is what we have been proposing earlier also and have repeated it for the sake of continuity. Pakistan Gas calculates and announces average selling price ala CPPAG under the guidelines of the regulator. We have also proposed fragmentation of the two Gas DISCOs into smaller companies as well. The regulator will work out the tariff of various end-users, however, in a different way which is that of NEPRA system. Firstly, a performance based tariff system ala KE is introduced in GASDISCOs. Currently, it is Annual Revenue Requirement system which is time consuming, wasteful and does not encourage performance. Secondly, Gas prices are to be announced monthly ala electricity MFPA, wherein monthly variations in gas prices against a reference price are computed and charged in the monthly bills.

So, essentially, it is the transformation of gas organization and tariff system on the pattern of electricity. It is well understood and practiced, although performance based tariff is only practiced in case of KE.I wonder why, the same has not been applied on all DISCOs. This leads us to another proposal, which has long been there on the table, merger of NEPRA and OGRA. It is only in South Asia that there are separate regulators for Oil and Gas and Electricity. Elsewhere, almost everywhere, there is one combined regulator due to the interconnectedness of all energy resources and commonness of tariff methodologies. For this reason, even there is the concept of a consolidated Ministry of Energy, which we have also adopted finally. Earlier, the two regulators opposed the idea of merger and proposed to postpone it till the formation of a unified Ministry of Energy, thinking that such a day may never arrive.It is not uncommon to come across status quo forces and fiefdoms. And there can be only one chairman, instead of two and similarly other positions. There is a clear cut cost and operational synergy argument which has impelled almost all countries on earth to have one energy regulator with the noted exception as mentioned earlier. In case of India, there is a rationale of a large country where we see Ministries for minute subjects. Size justifies fragmentation there. In our case, that argument does not hold. There is no denying that there may be some counter-arguments as well, which we leave to the imagination and ideology of the reader.

However, it is not the intention here to show NEPRA and Electrical system in a good light and Petroleum system otherwise. However, the fact is that the Electrical Power system has received a lot of reforms and restructuring. However, there is no denying that there are many problems in the NEPRA system which are , however, common with OGRA. For example, NEPRA has announced a public hearing to consider changes in the Rate of Return on Investments. There has long been a complaint that unnecessarily high RoR have been awarded by NEPRA which has resulted in high cost of generation. However, NEPRA did not accept the argument and even increased RoR, possibly under the pressure of the government (PMLn) of the time. It is now undoing it and revising it down, not because it thinks so, but because the views of the new Finance minister are widely known. There are other issues which NEPRA recognizes but does not act to reform it; Unseriousness of EPC processes, CAPEX exaggeration, padding in other costs etc. Merger may create pressure and synergy against the vested interest to do away with the weaknesses professionally and not under the thumb of politicians. There is a counter-argument that governments have the right to invoke their ideology and policy principles which may have to be respected by the regulators and the stake-holders.

So what we have proposed is simple but has a potential to cure a number of problems; trying to achieve what has already been achieved in other areas and sub-sectors. To some, it may appear to be a tall order; Merging LNG companies and converting them into full-fledged gas company; commingling LNG with conventional gas ;fragmenting GAS DISCOS; monthly gas pricing; performance based tariff; merger of regulators, NEPRA and OGRA. This may require an independent cell of Reforms and Restructuring which would enable the government the afore-mentioned and would enable to implement many other pending reform proposals pertaining to control of theft, receivables and others. Certainly, this can be done, only with a small amount of courage and commitment on the part of the new government. It appears that these won't be in short supply under Insaf and Tabdeeli.

13. Reforms in Thar Coal

1. It is a matter of great pleasure that Thar coal project has achieved a critical stage and has reached the coal surface and the reported quality appears to be up to the mark. At this happy moment, however, several issues have emerged that need to be examined. The project developers have filed a scheme for tariff revision. It gives us a good opportunity to examine the underlying issues in the background of data and evidence that has emerged till now.

As we will see later in this space, Thar coal costs around twice that of international and regional prices (including on the other side of the Border in India's Thar desert area) of Lignite under more or less identical conditions. Similarly, Thar coal based electricity is more than 50% higher than Lignite based electricity elsewhere. People had thought that Thar coal would resolve their difficulties and make cheaper electricity available only to be disappointed as they are in case of hydro electricity wherein most still believe that Hydro is the cheapest energy source, when actually it is the most expensive one, forgetting the lost case of Neelum Jehlum Hydro Power Plant. There are some avoidable measures which can reduce the cost of generation in Pakistan. Although, we will be discussing a particular case, the lessons from it would mostly be applicable in other cases generally. Let us in the following discuss the new Thar coal tariff application.

2.A two-part integrated Thar coal tariff was awarded by TCEB(Thar Coal Energy Board)in 2015;one part related to a basic capacity of 3.8 MTPA(Million Tons per Annum) and the other for enhanced capacity of **7.6** MTPA.SCEMC changed its business plan to increase its second stage output to 7.6 MTPA .Hence the apparent need for revision. Total project cost of the coal mine only for 3.8 MTPA capacities is 731 Million USD .The new project cost after this revision would be 966 MnUSD for an enhanced capacity of 7.6 MTPA.

3. Financial cost plays an important role in project and product costs. Interest Rates of LIBOR +4% have been allowed by NEPRA under project-recourse guarantees, and not sovereign guarantees. Under CPEC, Sovereign loans for transport sector have been given at 2%.There is no reason, Thar coal mine loan of 700 million USD should not be at the same rate. LIBOR at the time of loaning was 0.5 % which now has gone beyond 2% and may pass 3% in near future. This would greatly upset the tariff to become unaffordable and unsustainable. And the least that could have been done was to negotiate a longer repayment period of 20-25 yrs which is not uncommon in such projects. Longer repayment period would have smoothened the unit product cost along with lowering the foreign exchange outflow. It is suggested that possibilities of renegotiations and refinance in this respect under CPEC framework be pursued .There are other issues in CPEC terms and practices that Federal government has been urged to take up with Chinese government.

4. Even initially, an IRR of 20% was unwarranted. And now that Lignite has surfaced and has been found to be of the required quality and no major episode has happened, there is an extra case of bringing down the IRR rate on Equity, risk being reduced. A good rate is 14-15% which is a usual and normal rate in the industry and in the region (Gujarat Lignite Mines and NLC lignite mines, TamilNadu).

5. Both in the region and as well as in Europe, Lignite prices are around 25 USD per ton, (proof documents and links provided) while in case of Thar coal, the cost/prices are almost double than this benchmark.

SECMC shows a cost diagram showing costs going down with higher production levels. I cannot vouchsafe for their scale economy curve, but I would develop my own in a simple exercise.

As per current SECMC petition, CAPEX of 731 Million USD is required for the first 3.8 MTPA and for expansion (doubling the capacity) only 235 Million USD of incremental CAPEX is required, totaling to 966 MnUSD for a capacity of 7.6 MTPA. For a CAPEX of 966 Mn. USD, unit capacity cost of 30.47 USD/t of levellised cost is required. If another project of 7.6 MTPA is launched in the form of SECMC expansion, only 470 Million USD would be required instead of 966 Million USD. And for this reduced CAPEX, Capacity cost would be 50% of the original i.e.15.25 USD/ton. Adding Variable cost of 16.37 USD/t, one gets a total cost of production of 31.62 USD/ton, which somewhat nearly competes with international and regional costs and seems to make some sense.

6. A related issue is whether there is a scope for another project under these circumstances, as several Blocks have been awarded LOI and one project SINOSSRL has been issued tariff by TCEB and at the same tariff as that of the pioneer SECMC. And should new projects get the same terms such as IRR of the pioneer which bore more risks.

SINOSSRL proposed CAPEX is almost identical to SECMC figures at 951.64 Million USD for a capacity of 7.8 MTPA.As discussed in Para 5, incremental investment of SECMC expansion for the same capacity as that of Sino-SSRL (7.8 MTPAA) is only 470 million USD, resulting in a 50% saving in CAPEX and associated capacity charges.

However, these issues have to be examined in more detail. A third-party study (by independent foreign experts, as the country experience is lacking) may be commissioned for investigating the underlying issues including the plausibility of the current SECMC petition. Such an important issue of resource sustainability must be examined independently outside the purview of individual corporate interests.

7. Mining Experts have indicated that the expansion of BOX may not be necessary and that the same Box could be utilized for mine expansion. Higher speed equipment could have provided the same result. There is a tendency in Pakistani projects to maximize CAPEX unduly. It may be desirable that TCEB examines such possibilities.

8. As has been stated earlier that if the current cost trends continue in Thar Coal, and measures are not taken to control this trend, there is a great risk that Thar coal will become uncompetitive. This precious resource may go unexploited as we have already started late when coal appears to be ending its market life cycle. The local cost and foreign exchange savings argument may not apply as well, as most costs (Diesel, equipment, spares, Tires etc) all appear to be in foreign currency. Thar coal electricity will be costing twice as much as wind and solar. With mounting opposition to coal, domestic and international, Thar coal activity may not go beyond 10,000 MW at most. It is therefore urged that keen attention be paid to bringing the CAPEX and variable costs down.

9. One wonders, why SECMC production costs are high, much higher than elsewhere# .IRR and interest rates have been identified earlier. There is a remaining issue of technology. There are three technologies of excavation and coals handling that are available:

1. *Shovel and Truck, as are being employed by SECMC.*
2. *Draglines, spreader and conveyors*
3. *Bucket Wheel Excavators and conveyors*

Truck Shovel are the most expensive in terms of production cost and possibly least capital intensive and least technology intensive and simple.NLC India has been using BWE for the last 50 years from the very start of their Lignite mining operations. In Europe, also BWE are ubiquitous in Lignite mines in Germany and lesser countries like Poland, Czeck, Greece etc. There are 34 BWEs currently employed by NLC. There is a scaring misunderstanding in Pakistan circles that BWE are unaffordably expensive. BWEs come in all sizes and capacities; the largest one of 240,000 M3 per day in output costing around 80 million USD. But there are lesser of 8-10,000 M3 per hour that cost one-tenth of that amount. For a project with a foreign loan of 700 million USD CAPEX, buying a few of them would not have been unfeasible. Moreover, alternative technologies like electric Draglines and spreader and conveyors would offer possibilities of utilizing electricity should also be examined to replace imported Diesel. This will improve project economics, save foreign exchange and foster independence. It is therefore requested that the petitioner be required to undertake such a technology evaluation or share the same with stakeholders, if it has already conducted such an evaluation.

10.Also of interest is that Senhua ,perhaps the largest company in this sector, offered a tariff of 5 Usc per kWh ,some ten or more years earlier. In the meantime, machinery costs appear to have come down due to market conditions created by coals near-exit projections. International rates for Lignite based electricity are also around the same and even lower. Obviously, Senhua was not making a charity offer. CPEC was not there and advent of CPEC should have resulted in better terms.

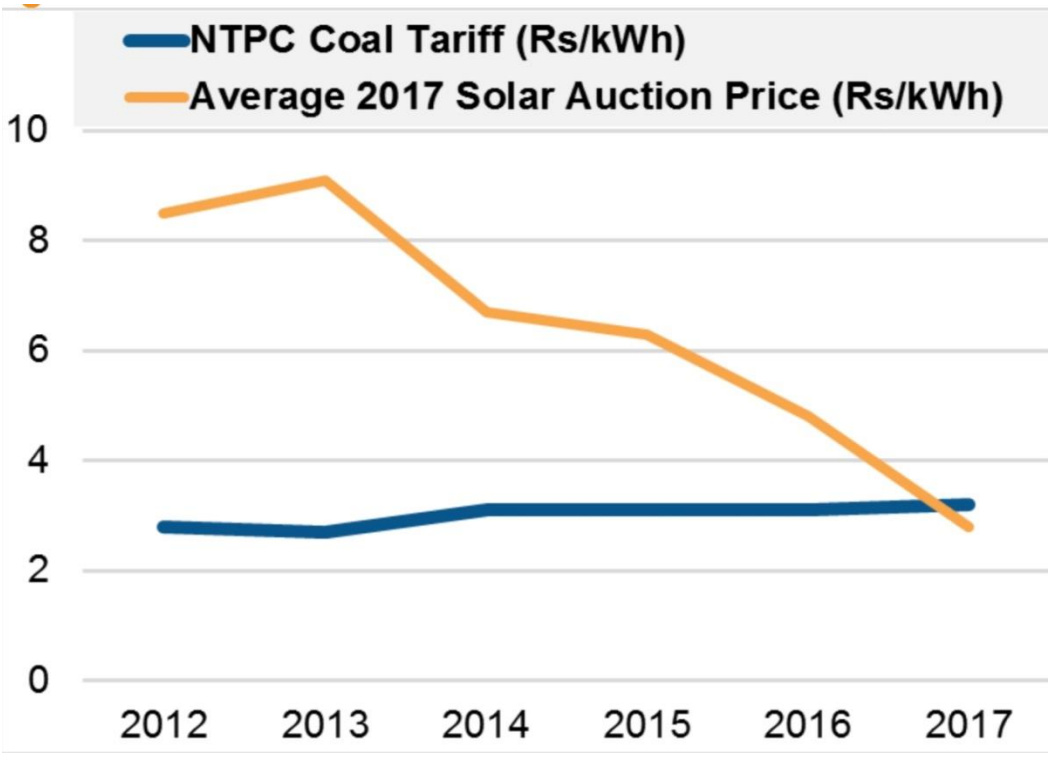
11. One Billion USD of investment for a modest capacity of 7.6 Million Tons per year does not have money to buy adequate machinery and equipment, it is difficult to believe and understand. India started its mining with advanced equipment like BWE some 50 yrs ago and It has now 34 BWE,15 spreaders and 250 kms of conveyors with 25 MTPA of output with a unit cost half that of our Thar project. Sometimes technology is cheaper. It is cheaper and faster today to use Suzuki loaders than Donkey carts. These days, it is not uncommon and impossible today to dig out a comparable mine in 15 to 18 months with adequate investment which survives for 50 years, as against Trucks and Shovels which do not go beyond 10 years. More time and money seems to have been lost in inferior technology. It is not late yet. However, it appears that we would remain victims of low technology syndrome for a long time under a regulated non-competitive regime.

12. Although, current Thar project has been able to make Thar coal a reality which may be its lasting but expensive contribution, the dream and ambitions of a cheap local energy source remain unfulfilled and may remain so. Let competition be given a chance. Earlier, Peoples Party government had plans to launch 5000 MW coal projects on Thar coal. It may not be a bad idea to revive this. India launched several such projects earlier and Egypt has tendered recently for a 6000 MW project. A 5,000 MW concession type project to be implemented phase –wise in 7 to 10 years will attract bidders. It is highly likely that Tariff-based bidding would be able to get a fixed price of 5 Usc per kWh. We have reported elsewhere that recent coal projects in UAE and Egypt based on imported coals have been able to get around that much. A mine-moth project should certainly be able to do that.

13. One would like to utilize this opportunity to recommend to TCEB for exploring further options of promoting and expanding the utilization of Thar coal. A large quantity of coal is imported resulting in foreign exchange drain which we are getting quite short of in the light of expanding trade gap. Cement, Bricks, Tiles and Ceramic industry uses coal. End-users can be broadened by local availability. Also, there are environmental and a congestion problem at Karachi Port and the Supreme Court has ordered shifting coal unloading to Port Qasim, the latter itself has issues reportedly. Pulverization of coal at mine mouth may

enable Thar Lignite to be used by the general industry. Also Briquetting may offer a cheaper fuel for rural areas.

14. Concluding, GoS and TCEB are requested to explore the possibilities of introducing alternative institutional and market structures. Instead of project based resource management, one could examine floating a commercial organization under GoS ala Coal India, PSO and Pakistan LNG etc. Also, should be explored introducing competition in mining and replace regulation. It is wrong to say that nobody was interested. Senhua was and many European companies closing coal businesses in Europe may like to shift to this region with their equipment. Inviting Bids for future projects on coal price basis may be an idea worth considering.



14. Chemicals and Fertilizers from Thar Coal

Thar coal has finally surfaced and all uncertainties with respect to coal availability and its properties have been removed. Although, the present mining project is relatively small with a capacity of 3.2 MTPA, there is a huge resource of 180 billion tonnes buried under the desert of Thar which is almost unlimited with respect to the prospects of its utilization. At present, the only focus is electricity. In near future, 10,000 MW of electrical power capacity may be installed in Thar. Also, eventually, other power plants currently based on imported coal may have to be converted to the local Thar coal eventually due to rising trade gap and current account deficit issues.

Pakistan being an agricultural country having to feed more than 200 million people has a substantial demand of fertilizers. Presently, there are 6 plants producing 6 MTPA of Urea, the main fertilizer product. All of these plants use Natural Gas as a raw material to produce Urea. Gas has been cheap and abundant in Pakistan which encouraged large scale fertilizer production in the country based on gas. Circumstances have, however, changed. Cheap local gas deposits are dwindling and are expected to be exhausted in the next ten years, if new deposits are not found. Expensive LNG has come in the market with a price tag double that of the local gas.

Cheap local and abundant gas in the past has prevented other sources of raw materials like coal to come into the market. In fact, there used to be a fertilizer plant based on local coal under the name of ….. in the area of …… which was closed down with the advent and competition of natural gas. Expensive LNG and being imported has opened new horizons for the Thar coal.

There is another market that is opening up which may have a relevance with coal as a raw materials which is chemicals. Although crude oil or gas is used as a feedstock, for chemicals production, coal is also a potential feedstock material which may have to be included in the studies that are currently at preliminary stage .Reportedly, there is a market of 5 to 12 billion USD of chemicals which are annually imported into Pakistan. A Petrochemical Complex has been proposed to cover these imports. Petrochemical complex has been touted as a basic industry such as a steel mill in the context of industrial development in a country. A petrochemical plant of 1 to 2 million tons per annum has been proposed based on imported crude oil in order to be able to make the following products which market size has been estimated to be as per following.

- *Polyethylene (PE): 422,000 MT, USD 554 million*
- Polypropylene (PP): 348,000 MT, USD 385 million
- Para Xylene (PX): 150,000 MT, USD 258 million
- Ethylene Glycol (MEG): 211,000 MT, USD 202 million
- Di Ethylene Glycol (DEG): 7,800 MT, USD 11 million
- Propylene Glycol: 7,800 MT, USD 12 million
- Styrene: 34,000 MT, USD 56 million

- Total: **1,180,600** MT: USD **1,478** billion

Petrochemical complexes are expensive capital intensive business costing in excess of 5 billion USD and going up to 20 billion USD. However, smaller complexes with a narrower products stream have been proposed as well. It is doubtful that many investors would be interested in making an investment in such a project. Normally, raw material base and market considerations are a deriving factor. It would be highly unadvisable to make an investment under tariff protection which would make downstream industry uncompetitive. There is a basic argument against creating basic industries first, as typically being uneconomic at small scale, such industries create problems for downstream industries. The counter approach is to start with market relevant products and go backwards in building the supply chain and install the basic industry if it is found feasible. Also, power sector and transport infrastructure projects have almost consumed the bulk of the investment capacity under CPEC programme and questions are being raised as to the payback capacity of the economy.

The only possible rationale and attractiveness Pakistan may be able to offer is the raw material base in the form of Thar coal. However, current high production cost of Lignite in current Thar projects would militate against development of such projects. For producing one ton of chemicals, about 6 tons of normal coal is required which translates into almost 12 tons of lignite. Thus one million tons per year of Petrochemical project would require a lignite mining capacity of 12 MTPA. For such a volume, an independent mine may perhaps be initiated with reasonable and competitive lignite production cost.

Admittedly, except in China, most Fertilizer and chemicals are being produced either on crude oil or natural gas. China, however, is a market leader in international fertilizer market and produces a large quantity of fertilizers on coal. All coal based fertilizer and chemicals follow a coal gasification route. In Pakistan, unfortunately, coal gasification has earned a bad name due to the earlier failure in this respect. However, that was underground coal gasification which is a rather nebulous approach. As above ground, coal gasification is, however, an established technology being offered by such big names as GE, Texaco, and Lurgi etc. China has developed its own technology itself.

Perhaps a surer way would be to start fertilizer production on Thar coal by converting existing fertilizer plants on Thar coal. Later on additional chemicals production can be added as well in the production programme. It is expected that Thar coal will be competitive with the more expensive LNG.

15. Power Sector-towards reducing Cost of generation

NEPRA Report for the year 2017 is out. NEPRA State of Industry Report as its formal name is, is one of the most authoritative sources of data and information and is relied upon by a wide variety of users including policy makers, private sector, academia, media and other research groups. We would take this opportunity to apprise the reader of the salient information and issues that have been highlighted by the report. However, let us first take a quick review of the variations over the period July 17-June 18 in electricity fuel cost which forms on the average half of the total generation costs. We will also review the share of various fuel sources. The recent monthly data has not been covered by NEPRAs Annual Report for obvious reasons.

Here we are comparing the monthly electricity results of July 2017 vs. June 2018.It has been an interesting and eventful period. Electricity generated on LNG has gone up to 25.18% from negligible in July 2017. While RFO based generation has come down from 25.59% to only 13.12%.This has been a contribution of new power plants on LNG and Coal. The two imported coal power plants have a share of 11.76%.Hydro was a few percentage points lower this June due to weather effects and contributed 27.79% instead of usual 30% plus.

Let us come to generation cost-fuel component only. There has been a 17% price increase in unit fuel cost, increasing from Rs 4.784 per unit to Rs 5.60 per. Adding fixed costs of Rs.4-5 per unit, the total unit cost of generation should have remained almost constant at Rs.10.00 per unit. Many factors should have contributed positively and negatively, but the major influence appears to be of exchange rate increase. Local gas based electricity fuel cost has come down from Rs. 5.67 to Rs.4.71 per unit, the cheapest source. This indicates a need for rationalizing the tariff of locally produced gas for a variety of reasons .LNG based electricity is 40 % cheaper than that of Furnace Oil. This seems to be due to cheaper LNG and higher thermal efficiency of the new RLNGCC plants.

Comparative Share and Fuel cost of electricity over June 17-18

	2018(June)		2017(July)	
	Price Rs/kWh	Share%	Price Rs/kWh	Share %
Hydro		27.79		30.79
Coal	5.7585	11.79	4.2616	2.95
HSD	11.7631	0.03	14.0424	2.69
RFO	13.1236	9	9.306	25.59
Gas	4.7141	15.69	5.6723	29.29
RLNG	9.3116	25.18		0
Average	5.6072	100	4.784	100

Source-NEPRA

While there is persistent lamentation on some issues that have almost become apparently incurable like bad DISCO performance and no improvement in T&D losses and the associated circular debt, the report points out some new issues like rising capacity cost and the danger of further increase in it. And there is an expression of new intent of NEPRA on solving and correcting some long standing irritants in interest rates,

debt-equity ratio, various overheads like insurance rates, financial and legal fee etc, which have also played a role in rising capacity charges.

For those who may not be aware of the term Capacity charges or payments are kind of fixed costs like capital costs, interests, Return on Equity and fixed components of the Operation and Management costs. Bulk of it is interest and Principal repayment and RoE. The report warns that the capacity payment has increased from Rs.4.1 per unit to Rs.5.0per unit and is poised to increase further. For an almost depreciated power plant park size, this appears to be rather high. Average and typical capacity payments for individual plants range between Rs 1 and 2.0 per unit. Capacity payments and circular debt are two big sinks, a detailed audit and analysis of which is overdue. The interim government had promised to release a white paper on circular debt, but it appears that the initial enthusiasm is gone with time.

On a conceptual level, following are the possible reasons; lesser capacity utilization and higher capital costs of the new power plants, both of which seem to be applicable in the instant case. A third possibility can be all kinds of sundry expenses, bad debts, overheads that have been heaped on it. To give the reader a comparison, ROE in India is 14% as opposed to 17-20% in Pakistan; Local loan spread in India is specified by Bank of India at 0.5%,while NEPRA allows as much as 3%.There are many other excesses in allowing huge finance and legal fee and insurance costs.

A big question is economy growth rate and the associated electricity growth rate? Also, it would depend on strengthening and expansion of the T&D network; demand growth does not emanate only from existing consumers. There are host of other issues that would affect electricity costs. Furnace oil could not be eliminated due to existing refineries product mix issue, although Furnace Oil imports have been stopped .NEPRA MFPA June 2018 reports only 9% share of F.O. based electricity generation in place of 30% share earlier. May be, some ways may be found to export the furnace oil, albeit at a loss. We have been earlier exporting gasoline for some time. Another opportunity could be examined for undertaking BMR of existing NGCC plants having efficiency of less than 40%.Current efficiency of newer plants is 60%.Existing asset value has to be balanced against potential saving of efficiency increase.

Losses would increase due to increase in sales contributing to more of circular debt. Exporters want reduction in electricity tariff in order to be able to export. . Average electricity cost generation in India is 5 cents and industrial tariff is less than 10 cents. It wouldn't be easy to oblige exporters .Textile sector says it has an export potential and capability of 45 billion USD. Their demands cannot be ignored in view of the mounting trade gap.

NEPRAs bench mark capacity factor used to be 60% for individual plant tariff determination which has been increased to 80% over the last 5-7 years. Average capacity/load factor at the grid level is around … %. A number of furnace oil based power plants are not run by the government due to financial reasons and that is why there is continued load-shedding despite adequate power plant capacity. Thus lesser production and capacity utilization contributes to higher capacity or fixed charges.

Secondly, the new power plants, especially, coal have high fixed charges of 4 or more cents per units, while on the average the total coal power tariff typically in most part of the world is around 5 cents as opposed to imported coal power plant tariff of 8.4 cents plus. Even local Thar coal does not produce cheaper electricity. It is equally expensive. And moreover, in the initial years, the tariff is 25 % higher than the levellised(levellised is a kind of average which equalizes higher costs in the beginning and lower costs which occur in later years after 10-12 years when debt payment is over) .

What is the solution, for existing projects, there is hardly anything that can be done. All out renegotiation or reopeners are only possible under a catastrophe or a revolution. However, it may be possible to try getting the loan repayment periods to be extended to 20 years.IPP loans are bilateral IPP loans and government is only involved only indirectly .Yet, it may be possible due to the peculiar economic and political system that prevails in China. Why are these capacity charges high anyway? It is a long story. High CAPEX allowed by NEPRA and lobbied by GOP and associated financial terms such as high returns up to 17-20% are largely responsible. The same Chinese were ready to sell Thar coal based electricity in 5.3 cents, some days earlier, under a purely commercial arrangement. And under CPEC, which is supposed to be an assistance package, the rates are higher, some of which we (GOP and NEPRA) are largely responsible for.

NEPRA has expressed intention to correct and adjust the issue of high financial and overhead costs (like RoE, bank spread, insurance cost etc), but a little late in the day, after approving some 20,000 MW of investment. Not much is left for the time being. Ki meray qatl ke baad us ne jafa se tauba_hai us zood pasheman ka pasheman hona

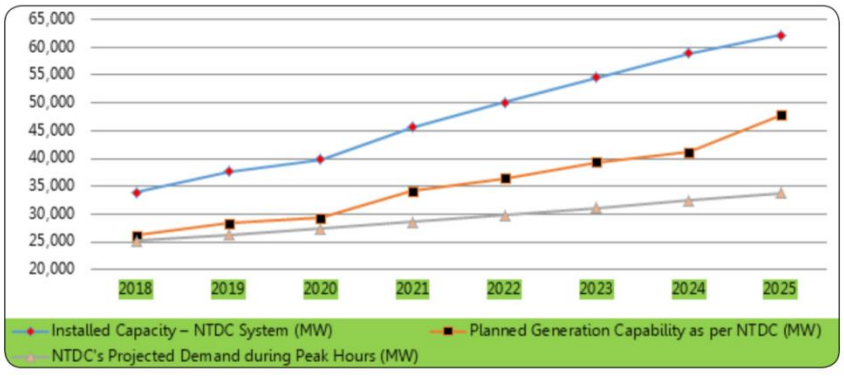
Also, the competitive regime is on the verge of becoming the order of the day in which competition decides all these factors rather than the regulator. There is an overwhelming consensus `over competitive tariff bidding and reverse auction. Full competitive market in the style of western countries may take a while. The new electricity law, as per NEPRA Report, has provided for marketing players and agents.

Another solution to fix the problem and bringing the electricity supply cost would be to induct a package of low priced and low CAPEX energy such as Solar Power. At 5 cents and without any fuel cost and no imports, this is really a good deal. Existing plans may have to be amended to the extent possible to bring a package of, say, 10,000 MW of solar energy in the next 5-7 years. If this capacity distributed throughout the country proportionally, say, 100 MW on the average in and around 100 districts on the average, there would be no transmission bottlenecks. One of the lurking problems today is transmission and distribution.

NEPRA projections indicate an overcapacity of more than 10,000 MW by the year 2025? .It would depend on how economy proceeds ahead and the associated power demand develop. There is no sure way to predict how economy would behave and how the linked power demand would. Late Mehbbobul-Haque argued that some load-shedding and under-capacity may be optimum as it would save expensive peak electricity costs. Times have changed. At-least day-time peak electricity is cheaper in the form of solar. In his time, it was diesel or gas turbine. Perhaps, he was partly right as we are seeing the problems of high investments in power sector resulting in high capital goods imports and the foreign exchange crisis and budgetary difficulties.

Year ending 30th June	Installed Capacity (NTDC System) (MW)	Planned Generation Capability as per NTDC (MW)	NTDC's Projected Demand Growth Rate (%)	NTDC's Projected Demand during Peak Hours (MW)	Surplus/ Deficit (MW)
2018	33,961	26,135	4.51	25,227	908
2019	37,633	28,357	4.44	26,348	2,009
2020	39,821	29,314	4.07	27,420	1,894
2021	45,622	34,124	4.31	28,601	5,523
2022	50,156	36,422	4.27	29,822	6,600
2023	54,556	39,345	4.27	31,095	8,250
2024	58,881	41,197	4.29	32,429	8,768
2025	62,184	47,750	4.28	33,816	13,934

Source: NTDC



Generation Source	GWh	%	Mlns. Rs.	Rs./kWh
Hydel	4,478.41	31.95%	-	-
Coal	1,343.77	9.59%	8,630.52	6.4226
HSD	6.07	0.04%	106.23	17.4975
RFO	1,643.75	11.73%	23,778.88	14.4663
Gas	2,039.67	14.55%	10,170.03	4.9861
RLNG	3,187.48	22.74%	33,060.15	10.3719
Nuclear	628.27	4.48%	601.00	0.9566
Import Iran	48.83	0.35%	564.96	11.5709
Mixed	58.00	0.41%	397.22	6.8491
Wind	439.30	3.13%	-	-
Baggasse	80.27	0.57%	498.37	6.2089
Solar	63.67	0.45%	-	-
Energy Generated	**14,017.47**	**100.0%**	**77,807.37**	**5.5507**
Previous Adjustment/ Supplemental Charges	-	-	7,640.50	0.5451
Sale to IPPs	(10.00)	-0.07%	(266.97)	(26.7065)
Transmission Losses	(374.80)	-2.67%	-	0.1715
Net Delivered to DISCOs	**13,632.63**	**97.25%**	**85,180.89**	**6.2483**

Electicity Generation ,fuel-mix and cost thereof

Electricity Consumption Projections-GWh

			end 5 yrs	end 10 yrs	end 15 yrs	end 20 yrs	%
Domestic	48698	6.5	66720	91413	125244	171594	56.57
Commercial	7856	6.5	10763	14747	20204	27682	9.13
Industrial	24010	6	32131	42998	57541	77003	25.39
Agriculture	9221	3	10690	12392	14366	16654	5.49
Others	5745	3	6660	7721	8951	10376	3.42
Total-I	95530	4.5	119048	148355	184878	230391	
Total-II			126964	169271	226306	303310	100.00
T&D Losses			20	16	12	10	
Gross Consumption			152357	196354	253462	333641	
Load Factor			60	60	60	60	
Number of Hours			5256	5256	5256	5256	
Gross Installed Capacity-MW			28987	37358	48223	63478	

Source: Compiled by the Author, data HDIP

16. Power Tariff Reforms

In the last two weeks, two important developments have taken place in electricity sector; one is reduction in Rate of Return for new electricity generation projects, and the other is announcement of new retail tariff. We will try to explore, in the following, the impact of these two steps on the electricity sector and the economy.

High rates of return (RoR), for power projects have been a source of major contention and controversy among the stake-holders. Previous government induced NEPRA to increase RoRs to an unreasonably high level, which many knowledgeable persons opposed. The present finance minister Asad Umar, then in the opposition, even filed a review petition to NEPRA opposing high rates. The impact of high rates had devastating effects on cost of generation which were pushed to an unaffordably high level contributing to circular debt, reduced exports and consumer misery. The high rates will continue to have its harmful effect for quite some time, as many projects have already been awarded these high RoRs and the new reduced RoRs will be applicable to the new projects; needless to say that the RoRs have been reduced under pressure or instructions from the present government. Nevertheless, the step is to be appreciated by all. The utility and impact of the decision, however, would be limited, as there is a consensus now among the policy making circles that competitive bidding would be adopted as much as possible. CPPAG has announced this in its presentation in the public hearing. Tariff based competition has been followed in case of RLNGCC projects and have yielded quite good results. It appears that Hydro projects only may remain in the domain of cost-plus regulatory tariff.

Technology	Proposed Return		Current Return	
Thermal	US$	Eq. Rs.	US$	Eq. Rs.
Imported Coal	12.50%	15.67%	17.00%	20.30%
Imported Gas RLNG	13.25%	16.44%	15.00%	18.24%
Local Gas	14.00%	17.21%	15.00%	18.24%
Thar/Local Coal	14.00%	17.21%	18.00%	21.33%
Bagasse	14.00%	17.21%	15.00%	18.24%
Renewable				
Solar/Wind	14.00%	17.21%	14.00%	17.21%
Small Hydro (Take or Pay)	14.25%	17.47%	17.00%	20.30%
Small Hydro (Take & Pay)	14.50%	17.73%	17.00%	20.30%
Large Hydro (Take or Pay)	15.00%	18.24%	17.00%	20.30%
Large Hydro (Take & Pay)	16.00%	19.27%	17.00%	20.30%

This is a misplaced argument that high RoR necessarily attracts investment in the sector and is the sole way to attract investments. More important are the ability of consumers and governments to pay and send profits to investor countries. High RoRs and especially unreasonably high RoRs increase cost of generation, hurt consumers and economy and thus increases the payment risks. RoRs of 10-12 % are common in western countries and 14% in India. Before 2013, average RoR were around 15%.In 2014, with the advent of CPEC and possibly under developer's undue pressure, RoRs were increased. For Thar coal projects, it was almost scandalously high at 20% and for other projects it was increased to 17%.

As a result, the obtaining cost of generation became too high, although not only due to high RoRs alone. Other factors were high CAPEX and high interest rates and other factors as well. Thar coal electricity which should have been produced cheap electricity has a generation tariff almost 60% higher than comparable projects elsewhere; 8.4 Usc as opposed to 5 Usc per kWh elsewhere. Similarly, imported coal projects have higher tariff. People used to think that hydro power is cheap, but with such policies, the latter also became at-least 20% more expensive than would have been possible otherwise.

In order to correct the phenomenon of high cost of generation, other steps may have to be taken as well. NEPRA, itself has promised in its State of Industry yearbook-2017, to correct and adjust other factors as well. It is hoped that, they will initiate those actions as well. Following factors have been indicated; a) Banking spread; debt and equity ratios; financing fee and insurance etc. There are also varied opinions on a single non-differentiated banking spread/risk margin over LIBOR of 4.5% .It is argued that this spread should be lower for bilateral G-to-G contracts and for other situations. There should be a differentiated approach in keeping with risk situation. One would expect that NEPRA would pay attention to streamlining the EPC bidding process which happens to

suffer from grave transparency issues. CAPEX prices come out to be unusually high due to these issues. In hydro projects, turbine prices vary among various projects by a factor of three in terms of USD/MW, while it should not vary more than 20%.There are other glaring instances as well.

It may also be appropriate that NEPRA reviews the current practice of cost-plus/Revenue Requirement approach and substitute it by Performance tariff. If one reviews NEPRA website, it is DISCO tariff which occupies more space. It is apparent that too much time and resources are occupied by current tariff approach. Performance tariff is widely used approach these days for DISCOs .The example is, KE tariff developed by ADB consultants which is working satisfactorily and comparatively much lesser regulatory effort is required in its application and maintenance. Performance based tariff may also create an incentive for DISCO management to improve performance. Also as a first step towards freeing the sector, generation licensing or certification requirements may have to be reviewed and done away with for small power generation, transmission and distribution. Specific cases are net-metering, small and micro-grids and even wheeling.

New Electricity Tariff

Let us now come to the new notified tariff. For those who may not be aware of the process, let me explain some details. NEPRA works out consumer tariff in each DISCO area which is different for every DISCO due to differing T&D losses and other factors. Based on NEPRA cost calculations, GoP does it own working with two objectives in mind; firstly, to have a uniform tariff throughout Pakistan and secondly to reduce the tariff through subsidies. Earlier, GoP used to notify uniform tariff on MoWPs website, however, this time NEPRA has been involved, possibly to give semblance to the authority of NEPRA. Frankly, when GoP provides subsidy, it has the right to determine prices.

Average selling rate has been increased by Rs.1.27 per unit, from Rs.11.71 to Rs.12.98 per unit. For small domestic consumers of up to 200 units, there is no increase. For large domestic consumers, there is an increase of 15%;for commercial consumers, the increase it at its highest at 20-25%;industrial tariff has been increased by 5-6%;bulk supply rates have been increased by 20-25%;agricultural tariff has been reduced to almost half of the 2014 rates to Rs 5.35 per unit.

Average cost of supplies is Rs.15.53 per kWh, while average of notified tariff is Rs.11.95 per kWh, giving a deficit of Rs 3.58 per kWh. Total deficit depending on the eventual sales, say of 100,000 GWh, would amount to Rs.372 billion. GoP expects that some of this deficit would be decreased due to efficiency improvements such as reducing T&D losses. Pessimists may not take efficiency improvement seriously. If GoP does not have the required cash to finance the deficit, this would amount to an increase of Rs 372 billion in circular debt.

Unfortunately, more than 90% of the cost of supplies is in US dollar terms. And if we convert the notified tariff in USD terms, the retail tariff in fact has been reduced in USD terms. However, people do not get salaries and incomes in US dollars; hence comparison is to be made in Rupee terms. In cost terms to GoP, the comparison is to be in US dollars. However, notified tariff is not the final

one. It is increased or decreased monthly, as the fuel cost increases or decreases from the Reference tariff. People may, thus, be happy. But IMF is not happy, for obvious reasons.

Although, there does not appear to be much scope for improvement in the proposed tariff, there are some innovations that may be possible. Capacity (fixed) charge has been projected to increase to Rs.5.00 per kWh, an increase of more than 25% over the current rate, which indicates the need of more sales to reduce unit cost. Electricity consumption during midnight to 6 oclock in the morning is the least. It may be feasible to incentivize electricity consumption in this time slot for industrial sector. It may be reciprocally beneficial. And possibly a surcharge can be levied on consumption by house dwellers of 500 sq.yds living in posh areas, should there be need for more revenue, which evidently is there.

Summary of New Power Tariff

1.Average Power Tariff is Rs.11.95 against cost of supplies of Rs.15.53 per kWh, creating a deficit of Rs.3.58 per kWh.

2.Total subsidy requirements/deficit amounts to Rs.364 Billion.

3.Residential sector creates most of the deficit amounting to Rs.275 Billion, out of which Rs.142 Billion is created by tariff slab of 1-100 units;Rs.84 Billion by the slab 101-200 units; and Rs.53 Billion by 201-300 units. Lifeline slab consumes Rs.30 Billion , with a maximum subsidy requirement of Rs.13.53 per unit. Residential share in electricity consumption is 46.1%. There is a case for gradually increasing the rates in these categories.

4. Agricultural sector creates subsidy requirement/deficit of Rs.113 Billion against a share in electricity consumption of 11.44%.

5. Surplus is created by Commercial, Bulk Supply, Public Lighting and General services. A surplus of Rs.25 Billion is provided by these categories against a share of 15.61% in Electricity consumption.

6.Perhaps there was no need of reducing Tariff for Life line consumers from Rs.4 to Rs.2.00 per unit which would have halved the deficit in this category saving Rs.15 Billion.

7.If very high reduction in Agri-tariff was avoided,50% of the subsidy requirement could have been saved ,saving Rs.56 Billion. Lower agri-tariff has been done to boost agri sector. However, it would reduce incentive to switch to Solar Pumps. Receivables from this sector are the lowest, esp in Balochistan.

8. ***Tariff slab of 201-300 units has been decreased from Rs.12.09 to Rs.10.02 per unit, resulting in a decrease of 15.63%.Had a 10% increase been done, one could reduce the subsidy in this slab by Rs.30 billion.***

9.An increase of 15% has been made in Tariff slab of large residential consumers.

10.There is a general 5% increase in Industrial tariff, except B1 Peak wherein there is a50% increase bringing the tariff to normal of Rs.18.84 per unit from Rs.12.00.This slab was reduced unreasonably, perhaps. However, there would be Tariff subsidy to export sectors which has not been reflected in this tariff proposal. It will require, reportedly, a subsidy of Rs.25 Billion.

10.There is 20-25 % increase in commercial and Bulk Supply categories.

11.If the above adjustments are made, there is a subsidy saving potential of RS.100 billion, reducing the subsidy from Rs.364 Billion to Rs. 264 Billion. There is some confusion in the reported reduction of Life Line consumer tariff. This estimate would be affected by it.

Notified Electricity Tariff over the years	16-5-2012	11/10/2013	1/10/2014	10/6/2015	change%	11/18/2018	change %
upto 50 units	2.01	2.01	2	2	0.00	2	0
01-100 units	5.79	5.79	5.79	5.79	0.00	5.79	0
101-200 units			8.11	8.11	0.00	8.11	0
201-300 units	8.11	8.11	12.09	12.09	0.00	10.2	-15.63
301-700	12.33	16	16	16	0.00	17.6	10.00
above 700 units	15.07	18	18	18	0.00	20.7	15.00
peak tariff more than 5kw	13.99	18	18	18	0.00	20.7	15.00
off peak	8.22	12.5	12.5	12.5	0.00	14.38	15.04
COMMERCIAL							
less than 5 kw	14.77	18	18	18	0.00	18	0.00
Regular above 5 kW	9.72	16	16	16	0.00	19.68	23.00
peak tariff more than 5kw	13.2	18	18	18	0.00	21.6	20.00
off peak	8.01	12.5	12.5	12.5	0.00	15.63	25.04
INDUSTRIAL							
B1-upto 25 kW	10.51	14.5	14.5	14.5	0.00	15.28	5.38
B2-25 to 500 kW	9.14	14	14	18	28.57	14.78	-17.89
B1-Peak	13.99	18	18	12.5	-30.56	18.84	50.72
B-1 Off Peak	8.22	12.5	12.5	14	12.00	13.28	-5.14
B2-Peak	12.77	18	18	18	0.00	18.78	4.33
B2-Off peak	8.01	12.3	12.3	12.29	-0.08	13.07	6.35
B3-Peak	12.68	18	18	18	0.00	18.78	4.33
B3-Off Peak	7.75	12.2	12.2	12.2	0.00	12.98	6.39
B4-peak	12.37	18	18	18	0.00	18.78	4.33
B4-off PEAK	7.46	12.1	12.1	12.1	0.00	12.88	6.45
BULK SUPPLY							
C1-less than 5 kW	11.55	15	15	15	0.00	18.68	24.53
C1-5kWabove	10.35	14.5	14.5	14.5	0.00	18.18	25.38
C1-Peak	13.01	18	18	18	0.00	21.6	20.00
C1-OFF Peak	8.01	12.5	12.5	12.5	0.00	15	20.00
C2-11kV	10.25	14.3	14.3	14.3	0.00	17.98	25.73
C2-Peak	12.6	18	18	18	0.00	21.6	20.00
C2-Off Peak	7.75	12.3	12.3	12.3	0.00	14.8	20.33
C3-Supply above 11 kV	10.1	14.2	14.2	14.2	0.00	17.88	25.92
AGRICULTURE							
SCARP	10	13.01	13.01	12	-7.76	15.68	30.67
Agri-Tube wells	6.77	10.35	10.35	8.85	-14.49	5.35	-39.55
SCARP 5W above		17	17	8.85	-47.94		-100.00
peak tariff more than 5kw		10	10	11.5	15.00	18.6	61.74

off peak		17	17		-100.00	11.35	
Agri-5 kW and Above		10	10		-100.00		
Peak	13	10.35	10.35	10.35	0.00	5.35	-48.31
off peak	8	10.35	10.35	8.85	-14.49	5.35	-39.55
Average Selling Rate						11.95	
Average Cost of Supplies						15.53	
Deficit						3.58	
	100	100	100	102		133	

Electricity Tariff Slabs -Consumption and share(%)

	Total Gwh	Share %	Nepra rates Rs/kWh	Gov.Tariff Rs/kWh	Tariff diff-I Rs/kWh	Tariff Diff-II Rs/kWh
upto 50 units	2211	2.167	4	2	-2	-13.53
01-100 units	14577	14.28	13.85	5.79	-8.06	-9.74
101-200 units	11303	11.07	15.86	8.11	-7.75	-7.42
201-300	9991	9.793	16.83	10.2	-6.63	-5.33
300-700 units	5150	5.048	18.54	17.6	-0.94	2.07
700 plus	1596	1.564	20.94	20.7	-0.24	5.17
above 5kw peak	597	0.585	19.33	20.7	1.37	5.17
Off peak	3007	2.947	12.8	14.38	1.58	-1.15
Temporary supply	4	0.003	20.84	20.84	0	5.31
Total Residential	47444	46.50	15.5376	9.7327	-5.8049	
Commercial A2						
Peak load less than 5 KW	2837	2.781	19.26	18	-1.26	2.47
exceeding 5 KW regular	98	0.096	18.01	19.68	1.67	4.15
Peak load more than 5 KW	825	0.808	20.09	21.6	1.51	6.07
Offpeak	3516	3.446	13.48	15.63	2.15	0.1
Temporary supply	135	0.132	18.39	18.39	0	2.86
Total Commercial	7411	7.264	16.5778	17.30	0.72	
General Services	2981	2.922	17.56	17.56	0	2.03
Industrial						
	409	0.400	18.32	15.28	-3.04	-0.25
	396	0.388	20.14	18.84	-1.3	3.31
	3057	2.996	13.46	13.28	-0.18	-2.25
	208	0.203	15.79	14.78	-1.01	-0.75
	1384	1.356	19.93	18.78	-1.15	3.25
	7300	7.155	13.23	13.07	-0.16	-2.46

	1022	1.001	20.39	18.78	-1.61	3.25
	8999	8.821	12.61	12.98	0.37	-2.55
	490	0.480	20.27	18.78	-1.49	3.25
	3227	3.163	13.27	12.88	-0.39	-2.65
Temporary supply	15	0.014	16.36	16.36	0	0.83
Total Industrial	26507	25.98	14.011	13.8000	-0.2106055	
Bulk					0	
less than 5 kw	10	0.009	21.32	18.68	-2.64	3.15
more than 5 kw	132	0.129	20.13	18.18	-1.95	2.65
Peak	71	0.069	21.52	21.6	0.08	6.07
Offpeak	321	0.314	14.99	15	0.01	-0.53
at 11 kv regular	308	0.301	15.61	17.98	2.37	2.45
Peak	351	0.344	19.73	21.6	1.87	6.07
Offpeak	1565	1.5	12.57	14.8	2.23	-0.73
above 11 kV regular	121	0.118	14.42	17.88	3.46	2.35
Peak	131	0.128	18.49	21.6	3.11	6.07
off-peak	529	0.518	11.59	14.7	3.11	-0.83
Total Bulk Supply	3539	3.469	14.3864	16.3848	1.99	
Agricultural Tube well						
Scarp-Regular	408	0.399	23.17	15.68	-7.49	0.15
Scarp-Peak	69	0.067	20.87	18.6	-2.27	3.07
off peak	435	0.426	14.03	11.35	-2.68	-4.18
Agri-tube well Regular	4481	4.392	14.56	5.35	-9.21	-10.18
Peak	1050	1.029	20.27	5.35	-14.92	-10.18
off Peak	4896	4.799	13.04	5.35	-7.69	-10.18
Total Agri	11674	11.44	14.3367	5.8594	-8.47	
Public Lighting-G	2002	1.962	18.78	18.68	-0.1	3.15
Total	102015	100.0				
	100					
Average Rates-Rs/kWh			15.53	11.95		-3.58
Sales Value-Million Rs			1584292	1219079		-365213
Sales Value -Million USD			12186.87	9377		-2809

Electricity Tariff Slabs -Consumption and share(%)

	Total Gwh	Share %	Nepra rates Rs/kWh	Gov.Tariff Rs/kWh	Tariff Diff-I Rs/kWh	Tariff Diff-II Rs/kWh
Total Residential	47444	46.51	15.5376	9.7327	-5.8049	-5.7973
Total Commercial	7411	7.26	16.5778	17.3057	0.7279	1.7757
Industrial	26507	25.98	14.0106	13.8000	-0.2106	-1.7300
Bulk Supply	3539	3.47	14.3864	16.3848	1.9985	0.8548
Agricultural	11674	11.44	14.3367	5.8594	-8.4774	-9.6706
Public Lighting-G	2002	1.96	18.7800	18.6800	-0.1000	3.1500

General Services	2981	2.92	17.5600	17.5600	0.0000	2.0300
Total	101558		15.53	11.95	-3.5800	-3.5800

Deficit /subsidy Reqd

Cross Subsidy

Net External Subsidy Required

***Subsidy -I is the amount reqd if diff between NEPRA and Gov Tariff is the reference**

****Subsidy-II is the amount reqd if average tariff of Rs 15.53 Rs/kWh is the reference**

Electricity Tariff Slabs -Consumption and share(%)

	Total	Share%	Nepra rates	Gov.Tariff	Subsidy-I*	Subsidy-II**
	Gwh		Rs/kWh	Rs/kWh	Mill. Rs	Mill. Rs
Total Residential	47444	46.51	15.5376	9.7327	275406	275048
Total Commercial	7411	7.26	16.5778	17.3057	5394	13160
Industrial	26507	25.98	14.0106	13.8000	-5583	-45858
Bulk Supply	3539	3.47	14.3864	16.3848	7073	3025
Agricultural	11674	11.44	14.3367	5.8594	-98965	112895
Public Lighting-G	2002	1.96	18.7800	18.6800	-200	6306
General Services	2981	2.92	17.5600	17.5600	0	6051
Toal	101558		15.53	11.95		363578

Deficit /subsidy Reqd

Cross Subsidy

Ne External Subsidy Required

***Subsidy -I is he amount reqd if diff beween NEPRA and Gov Tariff is the reference**

****Subsidy-II is the amount reqd if average tariff of Rs 15.53 Rs/kWh is the reference**

Gujarat Electricity Tariff vs Pakistan

	Gujarat-India		Pakistan		Pakistan higher
	Irs/kWh	Usc/kWh	Pk-Rs/kWh	Usc/kWh	Times
Residential-BPL	1.5	2.1271	4	3.8095	1.791
Residential small	4.15	5.8849	9.52	9.0667	1.541
Residential above 250 units	5.2	7.3738	16.04	15.2762	2.072
Industrial LT	4.2	5.9558			
Industrial -HT-Peak	4.2	5.9558	16.04	15.2762	2.565
off peak	3.78	5.3602	9.16	8.7238	1.628
Avg.Tariff	4.3	6.0976	10.88	10.3619	1.699
Industry-midnight	2.6	3.6869			
Agricultural Pumps	1.8	2.5525	10.35	9.8571	3.862
Exchange Rate 1 USD	70.52		105		

Source: Gujarat Electricity Regulatory Commission, LESCO website

Comparative Electricity tariff in major European countries(USc/kWh)and South Asia

	Domestic	Industry
France	19.24	8.38
Spain	26.15	11.50
Italy	24.39	9.44
Germany	34.71	8.67
U.K.	20.11	10.62
India-USC/kWh-off peak	7.37	5.40
Pakistan-off peak	9.0	8.7238

Source: EU Energy Portal, LESCO,GERC India

Enhancing DISCO Performance

By Syed Akhtar Ali

The status of Power sector is really deplorable with accumulated circular debt of Rs.1.23 Trillion and a continuing deficit which does not give any indication of reduction in problems. The recent and upcoming increase in power generation capacity may prove to be a double-edged sword; on the one hand, increased supply may support the economy and on the other deficit may increase in absolute terms if per unit deficit remains the same. DISCOs have played a lot of role in this deficit and conversely their betterment has a potential to solve the problems to the extent these are related to the latter. In this space, we will discuss the DISCOs performance comparatively among themselves and also with those of some similar companies in the region, e.g., India. This way, one would be able to speculate on the possible potential and limits of improvement in performance.

We have two sources of data. NEPRA has issued a study as late as 2016. I wish, they would have published more recently. Then, fortunately, we have access to a benchmark study on the same subject pertaining to Indian DISCOs, which are called DISCOM in India. So we will be referring Indian distribution companies as DISCOM hereafter and Pakistan companies as usually DISCOs. For a good comparative study, one needs to have more than 30-40 variables, which are fortunately available for DISCOMs only. We are comparing only a few parameters and releasing only partial findings, as data on comparable parameters on Pakistani DISCOs is not readily available, which would be dug out in due course and presented in part II of this brief.

Comparative DISCOM Performance-India

DISCOM Name	DGVCL	UGVCL	MGVC	PGVCL	UPMVV	DVVNL		
Ranking within Indian DISCOM	1	2	3	4	33	32	Wrst	Best
T&D Loss-%	11	10	11	25	48	50	50	8
Recovery-%	98	101	101	99	67	78	67	101
SAIFI	128	24.41	18	43.84	370	566	1557	18
SAIDI	32	35	16	54	2342	1281	2527	16
Safety- Fatalities-no/yr	64	78	20	102	87	155	1846	3

Comparative DISCO Performance-Pakistan

DISCO Name	IESCO	GEPCO	LESCO	MEPCO	QESCO	HESCO		
Ranking within Pakistan DISCOs	1	2	3	4	10	9	Wrst	Best
T&D Loss-%	9.02	10.2	13.8	16.9	23.1	30.8	37.8	9.02
Recovery-%	100	98	100	96.21	43.5	95.2	43.5	100
SAIFI	0.02	3.26	37.4	160.6	96.92	188	601	3.26
SAIDI	0.79	55.0	5596	2041	8310	1279	2041	55

Safety- Fatalities-no/yr	15	16	29	10	11	3	29	3

Source: NEPRA, Bench Mark Study-India

Admittedly, DISCOM performance in India is not good at all, however, it has good and bad examples and more importantly, performance there is improving due to the launching of a number of schemes and initiatives. While, DISCO performance has been more or less stagnant, data fudging being apart. It can be used for both purposes: those who do not want to improve performance, they have bad examples to find solace, while those who want to improve, they have better examples to emulate and look forward to.

We have selected top performing 3 DISCOMs in India which are all located in Gujarat and have selected 2 worst performers which both falling in UP. In Pakistan we have taken top 3 performers (IESCO, GEPCO, and LESCO in order of rank), one mid performer (MEPCO) and 2 worst performers, QESCO and HEPCO.

The most important parameters are AT&C losses and Recovery from customers. Both are lacking in Pakistan and in the region. Aggregate AT&C loss in Pakistan is 20%; 17% for DISCO distribution and 3% for NTDC transmission. AT&C losses in India used to be much higher at 30% and have come down to 20% gradually over the years. The worst company is in India with 50% losses, which pertains to DVVNL, a DISCOM in UP-Uttarpradesh with and worst in Pakistan is 37.8% which pertains to SEPCO. The best performer in terms of AT&C losses is 8% which incidentally pertains to a DISCOM in India with an overall lower ranking of 3, but has the lowest losses. In our sample companies, DGVCL, a company located in Gujarat with an overall ranking of 1,has the losses of 11%.By comparison, IESCO losses are 9.02%.I hope, IESCO figures are correct and if so, they should be congratulated tongue-in-cheek, although they have a higher number of 8% to achieve, if they want to get the top rank in this respect in the whole region.8% is perhaps the lowest possible AT&C losses that could be achieved in the kind of social and technical environment, DISCOs and DISCOMs are operating.

Many companies both in DISCO and DISCOM are claiming 100% (and even more?) recovery; IESCO and LESCO are claiming 100 % recovery, while several other lower rank companies have claimed 100% recovery; rank I company-Gujarat-DGCVL claims only 98% recovery.98-99 % recovery may probably be taken as standard, when all numbers are correct and comparable. The worst performer in terms of Recovery is QESCO with only 43.5% recovery. However, it would be comforting to note that the worst performer in India in this respect is having a 67% recovery. It is UMPPV in UP. There are areas in India with a very bad law and order situation including poverty and political issues. Mineral producing areas generally fall in this category.

SAIFI is an index which aims to measures average number of interruption a consumer faces in a period, usually one year. It is defined as the best and the lowest SAIFI of 18 pertain to MGCVL, a rank 3 DISCOM located in Gujarat. The best in Pakistan is 55, if one omits IESCO figure of 0.02.(0.02 interruptions per customer in a year appears to be unrealistic).The worst SAIFI number is of 1557 in India, while in Pakistan it is 601 belonging to SEPCO. Median figures lie between 37 and 91.In India corresponding number lies between 37-43.It appears that there are problems both in DISCOMS and our DISCOs in computing these numbers. Hence, we leave further consideration of other numbers like SAIDI to the readers' discretion.

NEPRAs Report itself indicates doubts on the accuracy of some aspects of the data. More attention ought to be given in collecting data and preparing such reports. Action Plans and Policies and targets are usually based on such reports. Timely preparation of such reports is required**. *Following is recommended; 1. Monthly performance data should be prepared and published with a time lag of one month at the***

maximum.2.Aggregate company wise data is not enough. In order to be useful in performance improvement, most such data should be for locations e.g. Divisions, Subdivisions, Circles, and feeders and transformers.3.No of parameters must be extended.

TABLE III. SUMMARY OF GROSS UTILITY-REPORTED SAIDI AND SAIFI WITH MAJOR EVENTS INCLUDED AND NOT INCLUDED

	SAIDI						SAIFI					
Census Division	With Major Events Included			With Major Events Not Included			With Major Events Included			With Major Events Not Included		
	N	Avg	Std Dev	N	Avg	Std Dev	N	Avg	Std Dev	N	Avg	Std Dev
New England	7	260	196	17	148	88	7	1.40	0.66	17	1.26	0.61
Middle Atlantic	7	399	239	21	156	97	7	1.54	0.73	21	1.13	0.44
East North Central	19	498	895	15	150	60	19	1.46	0.48	15	1.24	0.19
West North Central	6	256	263	12	107	84	6	1.58	0.87	12	1.25	0.64
South Atlantic	15	350	207	18	212	111	15	1.94	0.65	18	1.50	0.40
East South Central	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
West South Central	10	114	47	18	126	58	10	1.24	0.50	18	1.33	0.46
Mountain	5	126	68	5	112	60	5	1.22	0.61	5	1.20	0.58
Pacific	9	332	238	12	156	71	9	1.93	1.21	12	1.59	0.95
U.S.	78	292	269	118	146	79	78	1.54	0.71	118	1.31	0.53

17.Energy/Power System Losses - Reduction Strategy

Power system losses, according to latest HDIP Report-2017, have reached a level of 19.8 %.Electricity consumption should have crossed a level of 100,000 GWh by now, which is a good news. This, however, pushes the absolute loss numbers up also. It has been estimated that Total Energy System losses amount to 2168 Million USD per year, out of which electrical system losses are 1400 Million and Gas system losses are 768 million USD. These losses can be reduced almost half the present level, saving about 1186 Million USD per year. In this space, we will focus on how to reduce these losses in power sector, although there are some commonalities that would apply to other sectors such as gas.

Energy losses have been high in many developing countries including in our region, where India and Bangladesh also suffer from the same syndrome. However, countries and their utilities are on a continuous path of loss reduction. And a lot of literature documenting successes and the strategies and methodologies has come to the fore in this respect.

Comparative T&D data in Power sector in Countries

	Transmission	Distribution	Total
Developed countries, OECD, China etc	2	4	6
Developing Countries	3	9	12
South Asia	10	10	20
Pakistan	3	17	20
Pakistan target	2	8	10
	Technical	Commercial	Total
Developed countries, OECD, China etc	5	1	6
Developing Countries, ME, SE Asia etc	10	2	12
South Asia	10	10	20
Pakistan	10	10	20
Pakistan-Proposed Target	8	2	10

Source: IEA, NEPRA, Authors Estimates

It may be of interest to have a review of similar losses prevailing in other parts of the world and make a judgment as to the improvement level that may be possible in this respect in Pakistan. World average T&D losses are at 8% , while in developed world, the average is 6%;2% for transmission and 4% for Distribution and almost all of it is technical loss and very little(negligible) commercial or theft etc. In other parts of the world in Africa, East Asia and Middle East, the average

figure is 12%, in Latin America 17% and in South Asia, the average is the highest at 20%.Pakistan lies at this average figure. T&D losses have been decreasing over time due to advancement in Electrical Technology, e.g., in 1926 in the USA, these losses were almost the same as of Pakistan and came down to 6% by the year 2008. It can be conjectured that currently, technical losses are 10% and commercial losses are 10% in Pakistan. In Pakistan, we can assume a target level of improvement to 8% for technical losses and 2% for commercial losses, totaling to10%.It is vital that improvements are made to this level in order to make the power sector sustainable and viable. However, what is not certain is that it can be achieved in next 5 years,7 yrs or 10 yrs or cannot be achieved at all(God Forbid).It is good to know that the P.M. is giving targets to his ministers and it is hoped that an adequate target will be given by the P.M. in this respect. In near future, we will discuss the possible target levels in other aspects of the energy sector, especially with respect to losses and inefficiencies.

In Pakistan, although apparently, there has been realization and sensitivity among successive governments to reduce these losses, at best there is stagnancy in electrical sector and in gas sector there is generation. Energy losses and specially theft are a complicated affair. All type and kind of people consume more than they can afford or would like to pay for and indulge in stealing energy; rich and the poor, weak and strong, industry, commercial or domestic, religious or secular or less-religious etc. The issue becomes more complicated by the technical losses creeping into theft and vice versa and the collusion of the insiders with the outsiders and the associated mafias.

A common theme in the utility sector is its hugeness and geographical expanse which makes it quite obtuse and abstract, difficult to monitor and control. A possible but partial solution may be to fragment the larger DISCOs into smaller organisations. Privatization does not help in a cost-plus regulated environment in the absence of a competitive market which may reward efficiency. An example is KE, which has comparable loss levels, although some marginal improvements have been made. In KE, most losses of earlier times(1990s) of 40 % were due to poor law and order which has since been improved with almost 50% reduction in losses, but the credit goes to the law enforcement agencies than to anybody else.

There is, however, light at the end of the tunnel as evinced by the success of many countries and utilities in this respect. A DISCO (called DISCOM in India)APSPDC in the state of Andhrapradesh has managed to reduce its T&D losses from 12.98% to a level of 10.68% in a matter of 4 years and subsequently to 6%.In Gujarat, MGVCL has managed to reduce its T&D losses from 14.51 % to12.41%,a reduction of 2.10 % in the same period of 4 years .In Delhi, TPDL/BSES reduced its losses from 40% to 16.06% and then to 10.63 % under a franchise system operated by Tata. In Maharashtra, MSEDCL managed to achieve the highest reduction of 6.6% in 4 years, from a level of 20.6% to 14%.

T&D loss Reduction Programme in DISCOMs India

	Loss-2008 %	Loss 2012 %	Reduction %
Uttarkhand-UPCL	24.53	19.18	5.35
Gujarat-MGVCL	14.51	12.41	2.1
Pnjab-PSPCL	20.12	16.44	3.68
Maharashtra-MSEDCL	20.6	14	6.6
Andhrapradesh-APSPDCL	12.98	10.68	2.3
Delhi-TPDL/BSES	16.06	10.63	5.43
Kerala-KSEB	17.71	15	2.71

Source: Forum of Regulators, India

The need for a Strategy and Action Plan

For improving anything, one has to know where he stands and where he wants to go and what ways and means have to be adopted and are available. In technical terms, it is called Strategy and Action Plan. Thus GoP may do well by asking all the DISCOs to develop a Strategy and Action Plan. Although, targets would vary among companies, a 50% reduction and a 5-years time-frame should be a general target. And this should be done without a loss of unnecessary and fancy schemes costing billions and saving millions.

It is essential that Loss Reduction Cells are formed which should coordinate and manage all of this activity; primarily, it has to be at DISCO level and at proposed PEPCO level. PEPCO is there, it has to be energized from its ventilator status. An Action Plan without monitoring is of no use. An element of third-party involvement may have to be there due to the existing insider mafias. Alas, third-parties are also absorbed in the system as we have seen in the case of FBR.A wider anti-corruption drive is required to curtail these tendencies which is well discussed and is being improved upon by the new PTI government.

It is alleged that the current loss figures are underestimated, although third-party studies have been commissioned by NEPRA to get the real numbers. It is not sufficient to have one magic number of loss percentages, but a complete hierarchy of losses at all levels and regions are to be assessed as a first part of the exercise. In the appendix, we provide details.

An important assisting tool in all these exercises is IT. Currently, manual computing is practiced wherein most data is manually entered causing intended and unintended errors. A first step in improvement may be improvement in IT system providing a backbone that connects almost all major assets and collects data, including metering data and generates reports seamlessly under a well designed MIS. In many companies, the basics may already be there in terms of computer hardware and software. Companies may have varying levels of know-how and infrastructure. A need assessment study may have to be done. A common IT Cell at the proposed PEPCO level may be established to serve as knowledge pool and mutual sharing of know-how.

Easier said than done; a complete asset integration may not be financially feasible. For example, a smart metering scheme connecting all hierarchies, from Meters to Transformers to feeders and substations and finally to control center may be costly. The scheme may cost in excess of 5 billion USD and possibly a decade. We don't have time or money or have very less of the two and thus may have to adopt optimization and prioritization. A smart meter project, proposed and funded by Asian Development Bank is there on the table, but suffers from excessive cost and inappropriate project design, promising low benefit cost ratio and low outreach and impact. This project could be redesigned to cover all Distribution Transformers in all utilities or most of these along with selective installation of consumer meters in high loss regions and consumer segments. It can be done and should be done.

There are several technical steps that may have to be taken beyond the Strategy and Action Plan without which all of it may remain a paper-full bureaucratic exercise. Several of which like amending the law and support system of law enforcement strategies, removal of DTs from high loss areas, removal of Kundas and unmetered electricity, proportional and higher load shedding in high loss areas with varying levels of success. This has to be improved, institutionalized and brought into a formal framework of the Action Plan and Monitoring.

Energy and Loss Auditing should be a monthly feature which would identify trend and target and would enable focusing; this analysis has to be at several levels, company, Grids, sub-stations and 11 kV feeders. It is possible to do this kind of analysis at existing level of infrastructure and instrumentation. Manual reports can be generated currently, which with time may become automated and seamless report generation. With Smart Meter project, its level can be extended to Distribution Transformers (DTs), later on.

It is important here to have a review of various types of losses. We are focusing here only on Transmission and Distribution losses to exclude generation sector where there are losses as well and can be avoided. In T&D sector, losses can be divided broadly in two categories, Technical and Commercial.

Technical losses are due to various technical inefficiencies, these are; 1.energy losses due to wires and cables being of poor quality or being thinner or longer than standard requirements or being partly burnt due to over-usage and overload; in rural areas, it has been observed that every large house of one canal or more has a DT fixed outside the house on a pole, which reduces LT wire lengths. It is a good step reducing losses; such opportunity does not seem to be there in urban areas due to congestion, resulting in large ST installations and longer LT cables resulting in higher losses2. Magnetic and induction losses in Transformers and over loading of transformers; normally, more than one-third of technical losses are due to Transformer inefficiencies. Any loss reduction plan cannot afford to give it a high priority; imbalance between phase loadings also causes losses; poor workmanship in installations and splicing; low power factors due to inductive loads result in losses which can be taken care of by installing capacitors. Good practices in this respect involve housing transformers in a box which contains a Capacitor and a Meter (smart or otherwise) in addition to the transformer.

It is not easy to identify problematic assets which are spread over a wide area, especially, in companies like PESCO and MEPCO.KE has been able to identify faulty cables and has replaced these. However, it has to be a continuous activity. Overloading of transformers can be done rather easily and much better with smart meters installed on it. Orderly repair, maintenance and replacement of DTs and transformers can be organized under a formal system. Additional requirement of Transformers must be worked out annually and funds provided. Easier said than done, most technical losses reduction activity requires CAPEX. Almost all DISCOs have liquidity issues. However, funds have to be arranged through IFIs and ADB. Fortunately, payback of most technical improvements is very quick.

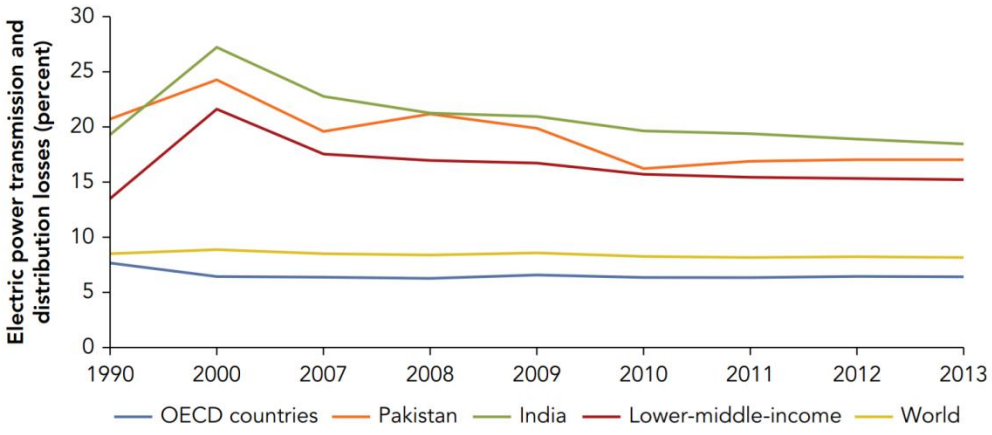
Commercial losses are as follows; A. Consumer caused losses; 1. Outright theft, using Kunda or bypassing meter or tinkering with Meter; 2. not paying despite billing causing receivables which to-date stand at 7% of sales;3.misuse of lower tariff, e.g., commercial user registered under residential or industrial tariff; land-owners and agriculturists using lower subsidized rates for tube-well purposes(current rate of Rs.5.00 per unit) for residential purposes; in some cases, load of Air-conditioners may be more than that of tube wells.

Consumer caused losses of theft are the most difficult to identify and control. Kundas can of-course be removed outright, assuming law and order situations under control. There was a time that in Karachi, it was not possible, also in Tribal areas and in large parts of Balochistan, it may not be possible even now to eliminate Kundas. There may be some technical solutions to control Kundas by installing ABC cables (Aerated Bundled Cables).In Karachi, KE has used this approach with success. Separating feeders say of Industries in urban areas and of agricultural users in rural areas may solve the issue of misutilization of cheaper tariff slab, as indicated earlier. Smart meters are very good but very expensive. We have discussed this issue elsewhere indicating the need of redesigning, optimizing and prioritization in ADB project.

Identification of theft is a difficult task but not impossible. It is important to narrow down theft areas and identify high loss areas. Within the identified areas, a number of approaches can be used. Mobilization of the neighborhood against theft, higher load-shedding which is already in vogue these days and rewarding the whistle-blowers. Punishment of the insiders and lineman colluding with defaulting consumers and rewarding the honest ones can have salutary effect, once the campaign is launched with vigor and action is taken. Metering of Distribution transformers can help narrow down the high loss areas, pending that 11-kV feeder accounting can be used to identify high loss feeders and campaign initiated.

Concluding a formal and high profile loss reduction activity backed by Strategy and Action Plan as discussed in the aforementioned is a must to take the energy sector out of its sustainability issues. Both Power and Gas loss reduction involve identical planning and management systems, notwithstanding the technicalities of the systems; Electricity is carried by wires and transformers and Gas by pipes and compressors. It is hoped that the leadership and managers of the Ministry of Energy (Power & Petroleum) would redouble their efforts in more organized and persistent manner. (*The writer has been Member Energy, Planning Commission until recently).*

FIGURE 1.4 Transmission and distribution losses substantially exceed the world average in India and Pakistan



Source: World Bank (2018).
Note: OECD = Organisation for Economic Co-operation and Development.

Table 3 - Electric power transmission and distribution losses (% of output) [8]

Country Name	2005	2006	2007	2008	2009	2010
Arab World	12.41	11.49	12.37	13.24	13.24	12.41
Caribbean small states	8.58	9.29	7.26	6.06	4.34	11.60
East Asia & Pacific (all income levels)	6.35	6.18	6.01	5.96	5.92	5.89
East Asia & Pacific (developing only)	7.42	7.06	6.78	6.60	6.41	6.46
Euro area	6.09	5.34	5.41	5.34	5.29	5.09
Europe & Central Asia (all income levels)	8.57	8.03	7.95	7.89	7.97	7.68
Europe & Central Asia (developing only)	13.29	13.09	13.05	12.68	13.07	12.43
European Union	6.67	6.08	6.12	6.07	6.08	5.86
Heavily indebted poor countries (HIPC)	17.18	16.41	16.10	16.96	16.27	17.67
Latin America & Caribbean (all income levels)	16.18	16.37	16.24	15.95	16.23	15.31
Latin America & Caribbean (developing only)	16.57	16.80	16.76	16.44	16.63	15.74
Least developed countries: UN classification	14.91	13.35	13.49	13.47	12.31	12.03
Middle East & North Africa (all income levels)	13.04	12.46	13.19	13.48	13.16	12.29
Middle East & North Africa (developing only)	16.13	16.23	17.35	17.65	17.08	15.41
North America	6.37	6.44	6.45	6.17	6.93	6.58
OECD members	6.48	6.34	6.32	6.21	6.60	6.33
Other small states	22.08	21.68	24.84	21.51	23.09	20.45
South Asia	24.93	23.41	21.83	21.24	21.06	20.66
Sub-Saharan Africa (all income levels)	11.26	11.63	10.23	10.57	11.00	11.79
Sub-Saharan Africa (developing only)	11.26	11.63	10.23	10.57	11.00	11.79

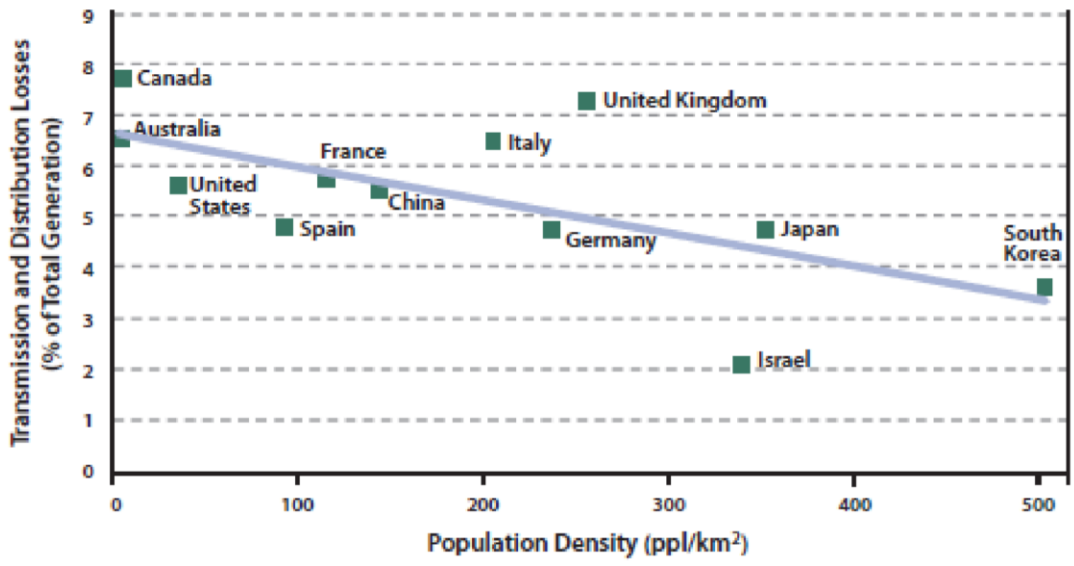
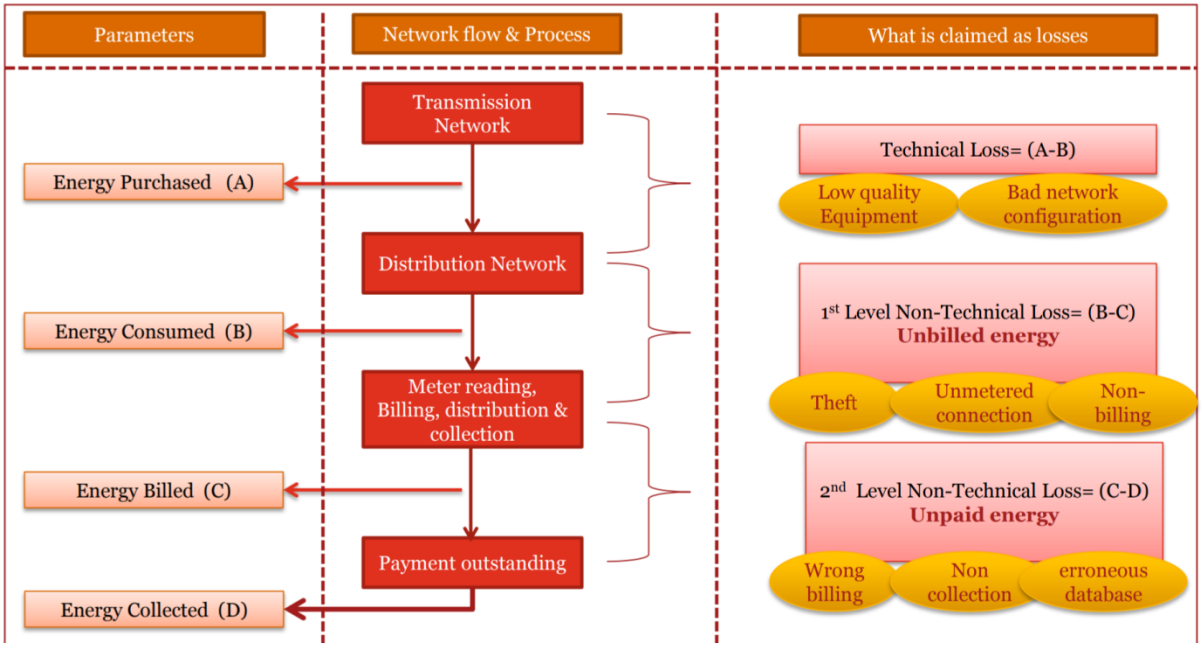


Figure 6 - Transmission and distribution losses for selected countries, 2008 [10]

Figure 8 Measurement of loss



1. **Define 'as-is' loss situation and desired 'to-be' state -** The Discoms should define a detailed loss reduction trajectory for each type of loss, along with the current levels of losses for the utility.

2. **Measurement of loss and verification -** Various types of losses can be measured as follows:

   - ***Technical Loss*** = *Energy input in the Discom periphery – Energy Consumed in the Distribution Network, or*

     Technical Loss = *[Energy input at the discom periphery – (DT level consumption+ sum of sales to consumer on HT)] + LT technical loss*

   - ***Non-Technical Loss (occurring due to incorrect energy accounting)*** = *Energy Consumed in the Distribution Network – Energy billed to consumers, or*

     Non-technical loss (occurring due to incorrect energy accounting) = *Energy input in the discom periphery – (technical loss + energy sales)*

   - ***Non-Technical Loss (occurring due to non-recovery)*** = *Energy billed to consumers – Energy collected from consumers, or*

     Non-technical loss (occurring due to non-recovery) = *100% - [billing efficiency (%)*collection efficiency (%)]*

     Where billing efficiency=100-distribution losses (%)

   The losses can be verified by concerned state regulators as follows -

18. Reducing Transmission and Distribution Losses in Power and Gas sectors

The country is going down under all kinds of losses and leakages. It is high time that something is done about it. Circular debt has crossed a level of Rs.1.23 trillion Rupees. There is no reduction in sight, practically speaking, in power sector and gas sector losses. We will deal with both in this piece as there is a commonality, which is of theft and inefficiency. The difference is in treatment of technical losses.

The most frightening prospect is of increase in these losses in absolute terms as the energy supply increases, now that we seem to be at fag end of the energy supply crisis. Even earlier they avoided running all the capacities for saving cash which was not there. Losses cannot be eliminating altogether, especially technical ones, but total losses can be reduced to as much as by half.

At 10 Rs per unit, Electricity losses amount to 240 Billion Rs and Gas Losses at 10 USD per MMBtu Opportunity Cost, amount to 125 Billion Rs. Put together, the losses amount to 3.5 Billion USD. This loss can be reduced to about 1 billion USD ultimately over a period of five years. Power sector can be improved with a lot less difficulty, as it has undergone restructuring and reorganization to a suitable level. The only further issue is further fragmenting the DISCOs. Gas sector has, however, escaped any reforms or restructuring. Panacea and prospect of privatization has largely prevented reforms and the consequent debate on reforms and restructuring before privatization or vice versa, a chicken egg problem. KESC lack of performance and lack of success in privatization in general has brought more realism in the minds of the stakeholders and reforms and restructuring may receive priority now.

Electricity Distribution Companies Coverage

	Area	Customers	Max Demand	11 kV feeders	D.Transformers	T&D Losses
	Sq.kms	No	MW	no	no	%
KESC	6500					
HESCO	77134	1,008,713	1134	463	35996	30.75
SEPCO	56300	690,472	1252	462	35875	37.9
LESCO	19064	3,900,000	5034	1650	100718	13.77
MEPCO	105000	5,963,337	4098	1241	156460	16.91
GEPCO	17207	2,900,000	2335	805	61661	10.23
FESCO	36122	3,850,000	3062	998	11276	10.57
IESCO	23160	2,400,000	2206	1058	46359	9.03
PESCO	77474	2,900,000	2718	946	72078	32.6
TESCO	27220	400,000	379	203	16612	15.40
QESCO	334616	500,000	1468	628	55770	23.08
Total		24,512,522	23686	8454	592805	

Source: NEPRA, SOI Yearbook 2017

Some degree of technical losses may go down. If the Transmission and Distribution system is improved and overloading of transformers and cables is removed. Similarly in Gas sector, there are pipelines and pipe leakages that are considerable which can be reduced by improved efficiency and investments. Corruption and collusion of the company employees is a major factor which only can be partly handled by good and honest management, but it is a larger problem. Hopefully, the measures adopted by the new government would make a difference in general climate in the country which would also affect the gas and power sector.

There are two types of companies in electricity sector, high loss and low loss. Among high loss companies are PESCO, QESCO and SEPCO, and MEPCO. All these companies are spread over large areas and there is DadaGeeri of the feudal and the powerful groups and individuals. Poverty is also a factor which induces some ordinary families to indulge in theft and illegal connections, which also has political support. Law and order is under provincial governments, which are least bothered, as energy companies are in federal control. How can they take action against powerful elite who are politically associated even if these companies are transferred to provinces? In-fact they may be at more liberty to take a lenient view and ignore it, as it would be their own money and they are autonomous. There are problems of capacity and political structures in smaller provinces. At-least, in the short run, provincial transfer may shift the load but may not solve the problem.

There are no messiahs or revolutions around to solve the problem in one go. Solutions and efforts are small and incremental and if applied consistently and systematically, results accrue. With this preface let me forward some solutions, now that I have ousted the doubting Thomases from the field.

Small distribution companies, other than metropolitan areas, are a norm in many countries in Europe and even in the region. It is not possible for a hands-on management interested in problem identification and solution to manage companies from distances. Large companies are liked by bureaucrats and scions to rule upon with a “comfortable” distance and never to face the problem in its face. There is a strong case to fragment these companies. Power sectors situation is a little better with 9-10 companies which also need to be doubled in number. Especially, PESCO, MEPCO and QESCO need to be fragmented in 2-3 companies each. We have dealt with the reorganization of gas sector separately, where there is a Shahanshahiat of two large companies which better be called kingdoms. Gas distribution companies also should not cover more than 3-4 districts, generally speaking. There may be a case for 10 Gas DISCOs, as it is a smaller sector than electricity. Apart from sales and number of consumers, an additional criterion should be distance. Higher management from the head office should be able to travel to the farthest point within half a day or so and return back to his office and home. It is said that Angrez also resorted to a similar criteria in allotting Jageers and limited the jageer size to an hour’s or two of travel on Ghori. It worked well for them and should work for us as well.

The other tool is of cost-centering, measurement and monitoring. Smart Meters solution was proposed of which I accept the blame of opposing and contributing to fizzling it out. My argument was that it was too expensive; at 250 USD installed cost per meter, it would have cost in excess of 7.5 billion USD and would have taken a decade. Covering one or two less loss giving companies that also partially would not have solved the problem. Even Germany is going slow on it and by 2027, Germany plans to have a smart meter coverage of 25% only. In most developing countries beset with similar loss issues, have not adopted this expensive recipe. India also has a modest programme. There could be several cost effective approaches.

One is for installing Smart Meters on Distribution centers and 11kV grids. There are only 8000 11 kV grids and 650,000 Distribution transformers. Covering these nodal points is much smaller a job as compared to 3.5 million consumers. *More than 50% of Gas substations are already covered by smart meters.* They have to

complete it by 100 % installation.ADB loan is still there. Reportedly, they are insisting that loan be taken. There could be additional features of distribution transformer monitoring which would bring in Distribution Automation as well. Remote condition monitoring would improve service and power quality along with reducing maintenance and replacement cost of transformer. All Urban areas can be covered under this scheme under the present ADB project budget.ADB should consider redesigning the project on the suggested lines.

Other cost effective approach could have been to install a pilot programme under contractors and then entrusting the full programme on DISCOs themselves to install and handle. DISCOs are overstaffed anyway and that staff could have been utilized effectively at their own pace. Lutto te Phutto approaches are expensive. Thirdly, add-on communication module could have been installed on electronic meters and Mobile Communication system could have been used to make the work simpler to install and maintain.ADB project design made it too big, bulky, costly and unmanageable.

This would enable both the power and gas companies to do cost-centre accounting, measuring and comparing supplies of the commodity with the money received. This would enable closing on the electricity and gas loss and theft. Combined action against these areas can be taken. I would propose adding a surcharge on the consumers of the defaulting areas identified through this system. Three % of fines may be added, small, medium and large depending on the intensity of the problem. This would be opposed, as higher load-shedding on defaulting areas has been opposed. However, combined punishment of consumers alone is not recommended. Internal controls, charge sheeting and even rewards system may also have to be introduced.

Lastly, there is a conundrum here on regulatory allowance of distribution losses. Regulators, both NEPRA and OGRA have been rather strict in allowing these losses in order to control and discourage losses. However, this has caused liquidity crisis in these companies and has contributed to other problems such as Circular debt. In gas sector also, it is there in one form or the other. The losses have not been reduced due to regulatory stringency and have caused liquidity issues. Companies cannot reduce and control losses without investments. The measures proposed above require cash. If it is borrowed, debt is to be serviced.

Gas distribution tariff is less than 1 USD per MMBtu, which is really a very meager amount compared to regional and international, rates which are double or even more than that. The proposed Russian Gas pipeline asking tariff is 1 USD per MMBtu. If taken in totality, there is a strong case for increasing the service charges of these companies. It can take many forms including cost-plus approach in loss allowances, or pass-thru treatment of gas loss reduction investments or some mix of incentives.

In my opinion, Regulators may have to loosen the leash a bit in this respect and award an incentivized and realistic allowance for losses. In gas sector, a study has been completed which can serve as a model for the electricity sector as well. The study has been based on two companies-SNGPL and SSGC-without restructuring, which may not lead to anywhere. Despondency and pessimism should not be allowed to support status-quo.

Finally, a counter point of view has to be said. T&D losses are common in most of the poor developing world. It may not be possible to altogether eliminate theft. Technical losses are there due to overloading and congestions. India has managed to bring down the losses from 35% 9in the year 2003 to only 23% in 2013.In Pakistan, KE was privatized hoping that T&D losses would be reduced which has not happened. However, things can improve gradually, if determination and consistency is applied. Technology and political structure and competition is increasing which would let us control if not eliminate the issue altogether.

A note on Smart Meters

After a lapse of a number of years, Smart Meters project has emerged again without any required adjustments of the stake-holders. The motivation of installing Smart Meters is primarily to control and prevent theft and receivables. Smart meters enable the utility to online monitor consumers meters and cut-off connection or release it, penalizing defaulters. Meters are read automatically without meter readers, which in advanced countries is a major motivation for installing smart meters.

Smart meters are expensive and more so as things are generally, as we see in most of the power and energy projects. Our resources are limited and there are other priorities in the power sector such as expanding the transmission and distribution system. Stake-holders therefore demanded a more cost effective approach in the project design. It was this reason that the project suffered from delays in approval. The lending agency did not show much sensitivity to the concerns of the stakeholders and did not rectify the project. Resultantly, the sponsoring ministry also went slow on it and decided to close the project. With the change in government, lending agency has managed to revive interest in the project. We would like to make some suggestions here to improve the project, make its cost effective and enlarge its impact to the whole country instead of being limited to two companies. The project being funded by the ADB, costs 800 million USD, selects the best companies of LESCO and IESCO and that not with complete coverage.

There are the major issues: a) selection and prioritization of the companies and consumers; b) costs; c) technology .The major problem is the project design. It aims to cover all consumers indiscriminately, irrespective of size or potential to achieve the objectives and selects the wrong companies. Instead of selecting high loss and theft companies, IESCO and LESCO have been selected which losses are much lesser than problem companies like MEPCO, PESCO, HESCO and SEPCO.

Similarly, all consumers are selected for smart meters installation even life line consumers with consumption of 50 or 100 units, which makes it very expensive. Even in Germany, the smart meters policy requires to select consumers with consumption of 500 units and similarly in India. With a selective approach, one could have a higher outreach and coverage with the same amount of money and resources and would be able to achieve targets in lesser time of say three years than the current design which appears to have no target or thinking about outreach and effectiveness or time. For example, in case of LESCO, more than 65% of the domestic sales in terms of units belong to the small consumer category of up to 300 units. Only 30% of domestic consumers may thus be selected for installation of smart meters, which can be a big saving. All categories of industrial customers and tube wells are to be covered 100 % due to their size and consumption. It is more profitable and convenient to contractors than to the consumers and utilities, it is widely believed. Under the current project design, it may require in excess of 5 billion Usd and a period of 10 yrs to have country wide coverage.

And then the unit cost is two expensive at 150 USD per meter installed cost; 50 USD for meter and 100 USD for installation. Under an ADB funded project in India, as per website of the bank itself, the installed cost is 70 USD; 35 USD for the meter and 35 USD for the installation and the overhead. EESL India is charging utilities IRs 70 per month for installation and maintaining the system for seven years. It is true that the final prices would depend on the bidding; the reference prices affect the bidding outcome and should not be too outlandish. In India, the theft and loss problem is even more severe. It has 250 million consumers and losses are more than 21% amounting to 44 billion USD. Cost effectiveness is a must, especially, that Smart Meters may not be able to eliminate all thefts such as in Kundas and due to other law and order issues.

Another approach for cost effectiveness could be limiting the installation to Distributed transformers, which may enable to close on the defaulting areas. This may reduce the project cost to and may be able to provide the coverage to the whole country in a matter of two to three years.

There are communications technology issues as well which would have to be reviewed. Main issue is Mobile/Cellular technologies vs. others. Mobile technologies make it much simpler and shifts responsibility of operations and maintenance to the mobile companies which are much more organized and efficient. However, it adds up to the operations cost. Other technologies require CAPEX and makes utilities responsible for their maintenance.

Our decision makers should not totally depend on the advice of the lending agencies and should use their own mind as well, keeping in view the peculiar circumstances in the country. We are suffering from a circular debt of Rs. 1.3 trillion and utilities are in weak financial conditions. Cost effectiveness and target achievement should receive utmost consideration.5000 MW of generation capacity is reportedly unutilized due to lack of concomitant transmission and distribution and capacity payments being made. Such is the magnitude of the issues. A review and revision of the project design is in order.

No of consumers in DISCOs in various sectors

(AS ON 30.06.2014)								
LESCO	3,052,906	524,702	75,006	57,313	2,154	501	4	3,712,586
GEPCO	2,419,361	304,496	57,965	41,583	507	141	0	2,824,053
MEPCO	4,278,334	455,088	49,599	75,484	1,365	422	4	4,860,296
FESCO	2,870,529	332,675	45,120	38,921	1,470	215	0	3,288,930
IESCO	2,013,175	340,920	14,534	8,052	1,659	962	0	2,379,302
Punjab	14,634,305	1,957,881	242,224	221,353	7,155	2,241	8	17,065,167
PESCO *	2,523,515	289,155	29,760	23,441	1,028	879	0	2,867,778
TESCO	400,600	28,202	4,081	8,548	0	55	0	441,486
K.P.K	2,924,115	317,357	33,841	31,989	1,028	934	0	3,309,264
HESCO	777,689	143,687	13,834	16,198	533	322	0	952,263
SEPCO	572,963	114,072	11,846	12,408	410	497	0	712,196
Sindh	1,350,652	257,759	25,680	28,606	943	819	0	1,664,459
QESCO	414,235	102,089	3,549	28,630	243	234	0	548,980
TOTAL	19,323,307	2,635,086	305,294	310,578	9,369	4,228	8	22,587,870

1. Residential 2.Commercial 3.Industrial 4.Agricultural

Towards an alternative Smart Meter project design

Original project design put the estimated cost per meter installed at 250 USD per Meter which was negotiated down by the Planning Commission by 20% against the latter's demand of a 40-50% cost reduction; this cost of 250 USD per Meter was against a meter cost of USD 50.00 per only. There were host of other project elements such as; 1.The project design is based upon a turn-key approach in which the contractor delivers a completely commissioned system to the DISCOs without practically any involvement or assistance of the DISCO personnel;2.installation of meters by the contractor instead of by the companies themselves. In any case, DISCO employees will have to accompany contractor's employee. It is unnecessary duplication;3. System software cost has been included, which is fair;4.However,Computing and IT tasks of conversion of existing database to the new system has been include, which is done by contractor as well;5.additional hardware cost is included because of the adoption of communication equipment like data

accumulators and transmitter. This would not have been required in adopting the cellular /mobile technology. Cellular would add to the operational costs of monthly payment to mobile companies but shifts responsibility to the better managed and equipped mobile companies.

An alternative and less costlier approach could be installation and commissioning (including training) of a pilot system in one of the circles or division of the DISCO; and leaving the rest on the DISCOs. Supply of hardware could be in stages at a realistic pace in phases and according to the priorities. A 20% of the total could be designated as Phase-I target. At best, an advisory support could have been provided. Under such an arrangement, almost all DISCOs could have been initiated with a Smart Meter system project according to their priorities. A 10 million Smart Meters programme would have not cost more than 700 million USD, as per cost data of 70 USD per meter of a similar project in India funded by ADB. The current project design as proposed by ADB is so lucrative and convenient to the contractors that it has attracted world market players and a lot of vested interest has reportedly developed involving all sorts of conspiracy theories. An intended or unintended consequence is that the local companies are automatically excluded due to the project size which would require tough prequalification conditions including large financial holdings. A smaller, phase-wise design would have been conducive and favorable to the local companies. Along with the prioritization of the target group in terms of DISCOs(PESCO,MEPCO ,HESCO and SEPCO in place of better performing LESCO and IESCO) and in terms of consumer categories(excluding the small consumers in the first phase),the afore-mentioned can make the smart project more viable and result oriented.

Project data

AMI Project Summary Data-LESCO & IESCO

	LESCO	IESCO	Total
No of Consumer Meters	1722302	1026024	2748326
Special Meters	81112	34665	115777
Total consumers	3942860	2537004	6479864
Coverage %	43.68	40.44	42.41
Cost-Million Rs-104 Rs Exchange	30275	16930	47205
Cost-Million USD-104 Rs Exchange	291.106	162.788	453.894
	104		
unit cost per meter installed	169.021	158.660	165.153
unit cost per meter installed-India			70.110
Total consumers Pakistan-million			30
Total Potential Cost-Million USD			4954.59

Source:Planning Commission-ECNEC

The AMI system shall have the following main elements:-

- Smart meters
- In-house display units
- Communications, based on either PLC, GPRS/3G, Fiber Optics or xDSL.
- Data Concentractor units (DCUs) (typically for PLC) or routers (typical for GPRS/3G, fiber optics or xDSL).
- Headend system (HES) software for liaison between meter and the MIS.
- Meter Data Management System (MDMS) software to undertake all analysis of data retrieved from the meters and for necessary recommendation of response actions.
- Interfaces between MDMS and other company systems (e.g.billing system, CIS, etc).
- Database to store the information.
- Time synchronization system

- Firewalls for data security.
- Billing and Customer Information Systems (CIS).

The Scope of LESCO project is given as under:

Equipment	Units in 2015	Annual Increase	Spare	Units in 2019
A1- 1Ø meters	1,004,003	1.0%	0.50%	1,019,292
A2- 1Ø meters	229,401	1.0%	0.50%	232,894
A2- 3Ø meters	488,898	2.0%	0.50%	501,434
Substations	45	0%	0.50%	46
Substations Feeders	512	1.0%	0.50%	520
Large customers	45,468	1.0%	0.50%	46,160
Distribution Transformers	25,288			34,432
Collective Transformers	26,036	1.0%	0.50%	26,432
Individual Transformers	406	1.0%	0.50%	412
Customer Centers	25			25
Sub Divisions(Total)	33			33
Sub Divisions(AMI circles)	164			164
Divisions	75			75
Revenue Offices	33			33
Total Customers.	3,660,000	1.5%		3,942,860

1722302 consumer meters(43.6% coverage)

81112 special meters

Annex-I

SUMMARY OF CAPITAL COST ESTIMATES LESCO

(**Rs. Million)**

S.No.	Description	Quantity	Local	FEC	Total
1	Meters, residential (A1-1Ø)	1,019,292	5,043	-	5,043

2	Meters, res./ com.(A2-1 Ø)	232,894	1,394	-	1,394
3	Meters, res/com (A2-3 Ø)	501,434	5,788	-	5,788
4	Meters, transformers	34,432	973	-	973
5	Meters, large customers	46,160	1,305	-	1,305
6	Meters, substations,	520	15	-	15
7	Boxes, res/com - 1 Ø	1,252,185	684	-	684
8	Boxes, res/com -3 Ø	501,434	562	-	562
9	Boxes, transformers	34,432	1,124	-	1,124
10	Boxes, large industrial	6,792	222	-	222
11	In-house displays	1,753,619	-	2,479	2,479
12	Concentrators.	31,789	-	2,308	2,308
13	Access points.	32,972	-	932	932
14	Communication/ servers rack	10	9		9
15	HES (Headend system)	1	-	262	262
16	MDMS(Meter data Management system)	1	-	442	442
17	CIS & Billing system	1	-	1,928	1,928
18	Deployment system	1	-	24	24
19	Consoles (x2)	558	68	-	68
20	Access infrastructure	274	77	-	77
	Sub-Total (A)	-	**17,265**	**8,375**	**25,640**
21	GST @ 17%	-	-	-	-
22	Equipment including GST	-	17,265	8,375	25,640
23	Erection/installation	-	-	1,531	1,531
24	**Project cost (excl. admin, finance)**	-	**17,265**	**9,906**	**27,171**
25	Administration charges	-	-	742	742
26	Insurance	-	-	146	146
27	Contingencies	-	-	2,216	2,216

	Grand Total	-	**17,264.90**	**13,009.76**	**30,274.66**

291.11 million USD(Rs 104-USD)

19. Let us have Bhasha Dam Surcharge?

A surcharge was imposed on electricity bills of 10 paisas which collected Rs50-65 Billion in a matter of 8 years. I wonder why a similar charge cannot be imposed for the construction of Bhasha Dam. After all, Bhasha is much more important providing water storage and electricity both. We are increasingly getting short of water. We will examine here the implications of the proposed surcharge for Bhasha dam and in passing also examine Neelum Jehlum issues.

Let us examine Neelum Jehlum Issues, although it should be understood as a bad example. It has been constructed at a cost of Rs. 500 Billion (twice the normal cost) in 8-10 yrs. Due to construction delays and bottlenecks, long construction time has added soft costs like Interest during construction, and currency exchange rate losses etc. *In addition to the aforementioned, relending charges have also contributed to the enhancement of construction costs. What happens is that Ministry of Finance, borrows at extremely low rates like 0.5 to 2% and gives it to projects such as Neelum Jehlum at exorbitant rates of 15%.In return, it undertakes to pay and assumes currency exchange losses. Such costs on the average amount to 5% per yr on the average. It is advisable that GOP does assume the foreign exchange risk and relend with a small surcharge. WAPDA has requested this and Planning Commission has been advising this. It is expected that NEPRA may also object to it and may not allow it. If relending charging system is removed, public sector energy projects would be saved of such unnecessary load.*

There are issues of contract terms and its execution both for contractor and consultants which may be too complicated for a lay reader to understand. Planning Commission and ECENEC had given conditional approval to the project subject to the results of a third-party validation study to be done by a credible consulting team. The study was supposed not only to find out the problems but to also make recommendations for improvement in contracts design and execution and other project implementation issues. The study has not been awarded yet due to interdepartmental football game. It is high time that such a study is commissioned and conducted and that NEPRA should also release its determination subject to the finding of this study.

Neelum Jehlum surcharge, as mentioned earlier managed to collect around 50-65 Billion Rupees with a surcharge rate of 10 paisas (increased to 15 Paisas) per unit on electricity bills. WAPDA is treating is as a

grant, while no decision to that effect has been made by the competent authority. Surcharge was supposed to be a public assistance in cash flow. It was not a voluntary donation as it is being done under the Supreme Court orders for Bhasha Dam. As I have argued in the public hearing, I would propose Neelum Jehlum surcharge as an equity share of the consumers. I am sure if somebody files a case, judiciary would award the same, for very good reason of justice and fairness.

I propose the same for Bhasha Dam. It would be emphasizing the obvious that Bhasha Dam is very essential for our increasing water requirements. Enough discussion has taken place on it and that there is a Supreme Court decision on it. Fortunately, Bhasha Dam is construction ready. Land acquisition has almost been completed. However, the problem is that the IFIs like World Bank and Asian Development Bank etc are treating Bhasha Dam site to be in disputed territory and have required that GOP obtains a NOC from India, which GOP finds it unacceptable. Thus financing from conventional sources is not possible. How about CPEC? Some people argue that CPEC in the very beginning should have included Bhasha Dam project along with other plum business opportunities having been agreed to.

Unfortunately, Chinese have not behaved in this project as one would have expected. They have proposed impossible conditions like awarding concession to almost the whole Indus Cascade and even selling of Ghazi Barotha to them, the argument being to synchronize the operations and optimizing electricity production. It is a sensitive issue. Indus water originates from somewhere in China. It may be too risky to put all ones eggs in one basket. GOP has declined the offer, and rightly so.

Thus, the only option remains is of self financing. WAPDA has proposed a reasonable project and financing plan. It has divided the project in two parts; one of water storage dam and the other of Power production. Water storage *component* costing *625 Billion* Rupees will have to be financed by WAPDA through its own and government PSDP resources.

Although the donations may not be able to able to collect any significant amount comparable to the task ahead, the surcharge approach may be able to do that. If 10 to 20 paisa surcharge is collected as Bhasha Dam construction surcharge on electricity tariff, on an expected 200 Billion kWh , an amount of 20 to 40 billion rupees can be collected per year, totaling anywhere between 200 to 400 billion rupees in the next ten years. However, as proposed earlier, it should not be extortion. Consumers should be made share holders in the project. This would yield a return of 17% per annum to the consumer on their surcharge payment. Adequate accounting may have to be done though.

Additionally, some funding may finally come through from Islamic Development Bank and other lenders in Islamic countries. Local and foreign bonds may be floated.EPC contractors may bring suppliers credit etc. And, if determination and consistency is shown, others may join in finally. Let the new government come in saddles, I am sure, it will give the project first priority as almost all of the political parties have given support to the project in their manifestoes and people would gladly accept the surcharge as it will earn them income as well as give them water to consume.

20. Promoting Renewable Energy

1. Solar and Wind Power have tremendously improved their competitiveness; their cost of generation have almost become 50% of the fossil energy based power. In Pakistan, their induction has been partly obstructed by unreasonable demands of the investor lobby. Hopefully, competitive bidding will break that circular situation and the Solar and Wind power would be available at its true cost and prices. A fresh thinking is to be given for a large scale induction of these resources to be able to bring down the cost of generation.

All existing power plans made by external agencies are outdated now due to the remarkable reduction in Solar and Wind prices under competitive bidding regime in many parts of the world including in our region. Least-Cost Generation Planning would certainly entail more induction of Solar and Wind Power than has been done in earlier workings. New studies must be commissioned. Intuitively, one could support an induction of 10000 MW in the period 2020-2030.This would come with the replacement of some coal and Hydro plants that are in current plans

Solar Plan

Most energy and electricity planning has focussed on demand, supply and economics. Logistics and spatial planning has been ignored. Distributed generation requirements of Solar and water requirements of fossil power plants should be factored in a Spatial Plan which allocates power generation capacities and water withdrawal quotas. Solar Power should not be generated in the manner and style of fossil power. It should be generated in a distributed manner.QA Solar Park may have been a good beginning. However, distributed solar generation close to population clusters should be preferred for which 50-100 locations should be identified in the proposed spatial plan. There is a strong case for planning a package of 5-10000 MW for 50-100 sites. Such studies should involve GIS technologies .Admittedly, this plan cannot be prepared in isolation. It

should be associated with load studies. As a result, long hauls in Electricity transmission should be and would be discouraged saving energy and financial resources.

Beyond Net Metering: Promoting Roof Top Solar

It is good to have launched Net Metering policy. However, it may not automatically boost solar roof top. India with the entire hullabaoo has managed to add some 2000 MW in RFT as against a total of 20,000 MW of solar currently. In the USA, only California has significant market share of 600,000 homes having RFT as opposed to other states of lower than 100,000 homes only. Significant financial and non-financial facilitation may be required. Only well to do consumer are being attracted currently or industry may adopt it. In fact, for export industries, solar roof top may be the only way to get hold of cheap and competitive electricity. GoP may consider subsidy in RFT to industrial sector instead of funneling into the bottomless pit of grid electricity suffering from theft and pilferage.

The Chattisgarh Model in India

France and California and may be in the meantime other jurisdictions have made RTS installation to be mandatory. Chhattisgarh has also done it but has added many useful features to this policy. Following are the details:

1. Chhattisgarh has made RTS mandatory for larger houses of one canal or more, a reasonable provision under the regional socio-economic conditions.

2. Several companies have been selected through competition to install the RTS under government supported policy to install RTS and handle the administrative process.

3. The policy covers systems starting from 1KW to 100 kW thus including commercial, industrial, and institutional and possibly government entities as well.

4. Financing is available to the extent of a loan of 80% with a payback period of 5 years, probably at concessional rates.

5. Current approved CAPEX rates are at 60,000 IRs (1000 USD) per kW for 1-5 kW and goes down for larger capacities up to 100 kW.

6. Under a separate system, a subsidy of 30% towards CAPEX is provided by the federal government of India in all parts of India. One is not sure whether Chattisgarh rates include this subsidy.

Thus all one has to do is to make an application to a competent authority and deposit 20% of the cost. In a few weeks, which involve site inspection and application processing and coordination with financing agencies and signing of contracts, one gets his RTS up and running. No hassle or requirement of technical knowledge and selecting the right vendor or approval of DISCO.

I suppose we can have the same system with minor adjustments in this country as well. This may start from Karachi where people are suffering under the mismanagement and rapacity of the KE. Apart from Karachi all major districts in Pakistan can be selected by the provincial governments for the scheme and eventually all the districts could be included.

Reportedly, public sector DISCOs have been more cooperative in Roof top solar than the private KE . DISCOs being in public sector are not as commercially driven as KE would be. Admittedly, Rooftop Solar is a competitor which eats into the sales and profit. Utilities call RFT as a free rider on their distribution investment.

Yet another model of third-party solar installers is there. Under this model, consumer signs a Power Purchase Agreement (PPA) defining quantity, rates and other terms. Solar Installer installs his own system under his own investment on consumers' rooftop. This model has attracted quite some market share in the west. In Pakistan also, this model is being implemented in commercial and industrial sector. Day time users and single shift operators are attracted more under this model.

Towards a Solar-Wind Hybrid Policy

Solar Wind Hybrid means integration of solar and hybrid energy production by installing both solar and wind power plants at one plot of land or at nearby plots utilizing common transmission facilities. India has released a policy in this respect recently and a captive hybrid project has recently been commissioned there. In Pakistan also, several investors are examining the feasibility of this useful mode of power generation. In the following space, we will examine the underlying issues and strengths.

Solar and Wind power suffer from intermittency and variability. In simple words, Sun shines in the day and wind starts blowing in the afternoon and continues till past mid-night, however, mostly in summers (in the western countries, it is the opposite; wind blows hard in winter coinciding with their energy demand peaks).Thus Solar covers one part of the daily peak demand in the day and Wind covers the second peak at night hours. In summers, it is handy for us.

It is said that some 25% of the costs go into land and transmission which is saved by the hybrid concept. Transmission facilities are under-utilized in case of individual solar and hybrid proportional to their capacity factors; solar 17% of the time and Wind about 35% of the time.

Hybrid accumulates it to the sum of the two minus some overlapping portions. Thus it is not uncommon to get a capacity factor (utilization) of 45 to 55% which is a much improvement.

Investment per MW remains to be low; weighted average of the individual investments minus land cost plus some additional investment in batteries. It has often been wondered as to why this very useful concept has not been installed even in advanced countries by now. The answer is perhaps the requirement of battery storage, the latter has been expensive and its cost has come down to somewhat affordable level only lately along with the availability of right technology. In India, a captive hybrid power plant (HERO) has been installed and commissioned recently. The plant has a wind power capacity of 50 MW and 28.8 MW of Solar. With a wind power capacity factor of 28% and 18.7 % capacity factor of solar, the combined capacity factor of the hybrid has come out to be 41.8%.In Pakistani wind sites and new technologies, capacity factor of 45% is becoming possible giving even better opportunities. Hybrid power plants should have a lower capex per MW and as well as lower production cost (in between solar and wind).

Unfortunately, Punjab lacks wind power resources. Hybridization would be possible in Sindh (Jhimpir and Gharo) and in Balochistan. Western Balochistan has many sites at which hybridization is possible due to the availability of both Wind and Solar resource of high quality. In the context of Gawadar, this hybridization possibility may be of special importance. Gawadar today suffers both from lack of water and energy. Presently, a coal power plant of 300 MW is proposed to be installed. An alternative concept could have been a hybrid solar wind power plant with some addition of oil fired power plant. However, one cannot continue proposing and contesting new concepts.

Rural Electrification

Some 30000 Villages are yet to be electrified out of a total of 125000 villages. This means a population of 30 million remains without electricity in rural areas. Thus a total of 4.6 million households are to be provided electricity in the rural areas. Although villages are electrified every year by DISCOs in their geographical domain by extending their network which draws electricity from centralized generation, there is no dedicated rural electrification programme as such on the lines of distributed local generation being implemented elsewhere in may part of the world ;provincial governments have been financing solar energy schemes for rural areas. An inception study has been done recently by UNDP to encourage GOP to implement Electricity for All programmes. It is hoped that GOP would be able to launch a unified and dedicated programme to achieve 100% access to electricity to all the citizens.

Before going into the possible solutions package, let us do some analysis of the energy needs and its characteristics, such as end-use etc.

Following end-users are identified;

A. Individual

- Household needs
- Lighting, fans ,mobiles and TV

B. Community needs

- Cooking ,Heating and water heating
- Corn-milling
- Irrigation and water pumping
- Social facilities e.g., Schools and Health facilities

Economics and Finance

In Pakistan under a similar programme, a 250 W solar system with deep cycle battery etc. should cost Rs. 40,000/-.Under 5-6% interest rate and 5 years payment, a monthly instalment of Rs 870/- may have to be paid. For a repayment period of ten years, it might be more affordable at RS.500/- per month. Under a DISCO plan, of 25 years, it may be as low as 250 Rs per month. This would mean a unit cost of electricity of Rs.5.0 per unit. If RS.250/- per month of cross subsidy for 50 kWh consumers is deducted, ironically, no due would be required? For larger consumers, however, say of 300 kWh per month, such subsidy would not be applicable.

Under the solar programme, 4.6 million systems may have to be installed, say, in a decade, which means an installation rate of 400,000 systems per year or 35000 systems per month. It should not be very difficult, as Bangladesh has already installed a comparable number of 4.1 million. Bangladesh installation rate has been 70,000 units per month which they want to bring to a rate of 400,000 units per month to meet their target of 2020.Pakistan, under the proposed programme, may be able to achieve Electricity for All objective by 2029 or even earlier, if the programme begins in 2019.

Table …: Estimated Electrification Requirements and Programme Size

Pakistan Population	million	200	
Villages		125000	
Electrified Villages		95000	
Unelectrified Villages		30000	
Average Village Population		1000	
Avg. Household size		6.5	
No of houses unelectrified		4,615,385	
Unit cost per KW	USD	1500	
Household Solar capacity		250	
Solar Capacity for 250 W per	KW		1,153,846
Solar Capacity for 500 WP per	kW		2,307,692
Total Programme Cost-one panel	USD		1,730,769,231

Total Programme Cost-2 panels USD 3,461,538,462

Table …:Economics of one or two Solar panels per household			
		System Capacity(Wp)	
		250	500
unit cost per watt	USD	1.5	1.5
System Cost	USD	375	750
Interest Rate	% per year	6	6
System Life or Financing period	yrs	25	25
Monthly Lease	USD	2.17	4.34
Monthly generation	kWh	41.25	82.5
unit Electricity cost	Usc	5.787	5.787

For cooking and heating needs, biogas and biomass solutions are there which can be installed for household clusters. This is being done already, commercially and as well as by NGOs like NRSP. However, its pace should be enhanced by launching appropriate financial packages by the provincial governments.

It should be possible to achieve 100% of rural electrification of 30,000 villages in a decade. Assuming an average of 20 KW per village, 600 MW of electrical capacity would be required which may cost 2.5 billion USD or 250 million USD per year. This is not a big sum and all of it does not have to come from government coffer. A substantial part of it should come from DISCOs. By the way of an example, India has recently launched a similar programme to provide electricity to 30,000 households by March 2019 under a budget of 2.5 billion USD. It is a rather ambitious programme in terms of time schedule. Perhaps, more interesting is Bangladesh's SHS programme under which 4.1 million households have been provided solar electricity, amounting to 12% of the population. They install 70,000 SHS systems every month which they want to increase to 300,000 per month to achieve Access for All targets by 2020.
For purpose of efficiency, we have proposed DISCOs to be the executing agencies responsible. For installation of facilities, DISCOs may be useful or efficient but for retailing and bill collection purposes, DISCOs may not be able to do a good job. There will be many types of electricity retailing dealing even in small change. Micro and small enterprises may have to be involved for which business models may have to be developed.

21. Handling Circular Debt

Circular Debt is not really circular? It is a matter of semantics, but does confuse those who come across this term of circular debt for the first time. It is a serial debt which is transferred in the electricity supply chain, as we shall see later. We will also discuss the scope and dimensions of the issue and possible means to handle and manage the circular debt.

The supply chain starts with fuel suppliers and ends at consumer and government in the following sequence; fuel producer or/and suppliers like PSO and gas companies sell fuel to IPPs and GENCOs who produce and sell electricity to DISCOs and DISCOs sell it to consumers. Government acts both as financier and a consumer also. If consumers do not pay in any form such as not paying bills, or steal or if NEPRA does not calculate the full cost recovery tariff or delays its determination etc, DISCO suffers a loss and has cash flow problems. As a result, it cannot pay its own bills due to the Electricity suppliers IPP/GENCOs; as a result, IPP have cash-flow shortages, and do not pay to fuel suppliers or pay partly. Fuel suppliers being government companies keep supplying until their own suppliers refuse to sell to them or LCs are not honored. The buck stops here and the GoP comes in which is an ultimate buyer and manager of the system comes into play.

GoP itself is a defaulter also in many ways. It has to pay accumulated subsidies of Rs.244 Billion. It orders reduced tariff to certain section of users and promises to pay on their behalf in the form of subsidies, but never quite pays up or pays only partly, which creates cash flow problems and debt. It is often convenient for government to funnel subsidies to other sectors such as agriculture through cheap gas or electricity, which otherwise would be impossible to give directly to farmers. Cheaper fertilizer is passed on through cheaper gas provided to fertilizer plants. These debts or shortages do not get resolved in a year or two but keep adding up over the years. Thus there is an accumulated debt of Rs.1196 Billion, call it circular debt or serial.

Senate of Pakistan has released a very informative and useful report on Circular Debt (here in after referred to as S.F. Report), after the name of the author Senator Shibli Faraz who is the convener of Senate Committee on Circular Debt. The author has been assisted by his fellow senators and a long list of experts and officials from the energy sector. The report while examining the issue of circular debt has come out with a lot of data, information and recommendations which makes it a compulsory reading for all those having interest in the power sector. The report draws partly upon the data published by NEPRA, but has produced a lot of data itself. In fact what the NEPRA SOI Annual Report lacks in analysis, S.F. report provides in many respects. It is difficult to summarize such an extensive report adequately in this space; hence I will focus on the following main points:

1. Circular debt stock is of Rs.Rs.1.196 There are two estimates going around with respect to the Circular debt. The other estimate is of Rs.500 Billion which excludes Rs 583 billion which have been financed and parked in Equity and debt financing in PPHL. Although, this kind of cleaning the balance sheet exercise is not abnormal. (For window dressing, yet another route is left which is to revalue the assets and finance the liabilities thru surplus created by the revaluation). However, from practical point of view, the payables to fuel suppliers like PSO, SSGC, SNGPL etc stand at around Rs.300 Billion; this is the short fall that GoP must look after in order to prevent bottlenecks in electricity supplies.

3.CPPAG/DISCO receivables(included in the Circular debt) stand at Rs.824 billion, out of which Rs.500 billion are owed by defaulters;5.3 million consumers are running defaulters meaning that they continue to consume electricity despite default and non-payment and only 1.3 Million defaulters have been disconnected. GoP has to pay Rs.244 billion which are actually various unpaid subsidies on account of AJK, Tariff differential, agricultural tube wells etc. 6.As against, an estimated circular debt of Rs.1196 Billion, defaulters due payment is Rs.500 Billion, bulk of which belongs to the three companies; QESCO, PESCO and SEPCO.T^D losses of Rs.187 billion appear to be much lesser compared to the defaulted receivables. So the bigger problem appears to be the receivables and not the T&D losses including theft. It appears that one may have to either write-off these more than 3 years old receivables or launch a major drive and policy to recover this amount. One may have to examine the bonafides of these numbers. It may be possible that leakages have been hidden under the carpet of receivables.

Second major component or cause of circular debt is announced but unpaid subsidies under various heads. Under this head, unpaid subsidies to agricultural pumps of Rs.44.4 Billion are there. In fact a major issue causing financial problems is agricultural consumers running tube wells. There is a default in payment by these users amounting to Rs. 188.5 billion. Agricultural

consumers operating tube wells require a major intervention. The S.F. Report makes a major recommendation in this respect.

4. As against, an estimated circular debt of Rs.1196 Billion, defaulters due payment as mentioned earlier is Rs.500 Billion, bulk of which belongs to the three companies; QESCO, PESCO and SEPCO.T&D losses of Rs.187 billion appear to be much lesser compared to the defaulted receivables. So the bigger problem appears to be the receivables and not the T&D losses including theft? It appears that one may have to either write-off these more than 3 years old receivables or launch a major drive and policy to recover this amount. One may have to examine the bonafides of these numbers. It may be possible that leakages have been hidden under the carpet of receivables. More dangerous indicator is that such receivables are on the rise. For example, for SEPCO for which, we have data ,such receivables have increased from Rs. 39.8 billion in 2013 to Rs.84.6 billion in 2017,more than doubled in the last 5 years. One would be sceptic of the correctness of these numbers, as mentioned earlier, it may be a convenient vehicle for hiding losses and leakage. A rigorous audit of these numbers is in order.

Following are some of the observations and recommendations which have most important and immediate policy requirements and consequences;

1. *Power sector lacks 3C; consensus, cohesiveness and continuity for which the report recommends creation of an institution.* Readers may have noted that we have been lamenting in this space of fragmentation of the power sector without some form of coordination or integration of sorts, which even in the private sector and multinationals are provided by Group companies and their head quarters. Utopia of so called independent and effective boards has been relied upon, which has not happened. Instead executive power has practically been exercised by the ministry. Ministry now Power division could not organize itself according to the challenge and vacuum created by the erstwhile PEPCO. On the other hand, its counterpart Petroleum division managed to create a modicum of organizational infrastructure in the form of Directorate Generals. One would like to wholeheartedly support the recommendation of the report of creating an institution. To give it a concrete picture, let us call it reviving PEPCO in an improved form with a progressive organizational structure and design.

2. *The report makes a very useful recommendation of treating AJK ala kpk in terms of NHP ,while doing away with providing electricity at subsidized rates.* The move will bring a sense of equality in AJK and will remove much financial confusion. It may almost have equal cancelling effect of direct subsidies with the new income for AJK in the form of NHP.A better way would be of 12% royalty in kind of free electricity ala India. The surplus, if any, may be sold by the AJK government at a specified or market rate. This may also be helpful in creating an energy market.NHP has become an outmoded concept, as Hydro power has become more expensive,

as mentioned earlier ,Hydro power cost for new projects is ……. as against Solar and Wind of Rs.5-6 per kWh or even lower.

3. *The Report makes a tentative recommendation of installing 500 MW of Solar capacities for providing free electricity to agricultural consumers with 30,000 Tube-wells in Balochistan*..However, this capacity may have to be distributed. An IPP may be created with a distributed mode wherein IPP installs Solar PV on the premises of agricultural consumer. DC system may be used so that use of Air-conditioners on subsidized electricity may be avoided or made more difficult. Either DISCO or IPP itself may collect the electricity bill at an agreed tariff. Surplus or deficit of the IPP may be accounted for by the two governments of Balochistan and the federation. There may be a number of options that may be evaluated by the feasibility study. However, this is a rather complicated issue; more electrical supplies may lead to more water wastage and withdrawal and further deepening of the water level and thus more demand of electricity. Some conservation measures like drip irrigation schemes may be associated as collateral. A deeper study may be required to develop an optimized proposal. Experience of neighboring countries in the region may also be investigated to collect best practices.

4. *The report predicts an excess capacity of 6779 MW based on a demand growth rate of7% and of 12,828 MW based on a demand growth rate of 4%.*This prediction should help GoP in rationalizing the Power Plan and do some pruning or advancing the schedules of some projects and divert the surplus to more required imperatives within the power sector and outside. The rationalization should ,however, include retirement of old plants which have lower thermal efficiency, inclusion of a Renewable Energy package, and a major initiative on Thar coal with an aim to reduce cost of generation from the current Rs 10.61 to 5 Usc. A 5000 MW package (but phased over next 7 yrs) on Thar coal may be considered.

5.*The report is critical of the recent power sector legislation and power policy, the later having been prepared rather hastily in the last days of the previous government* under a rather activist Minister of Power. Power of NEPRA has been reduced and provision of younger age requirements appears to be an attempt to block the entry of more powerful and experienced individuals who may resist untoward government-of-the –day directives. However, were the older men at NEPRA able to effectively resist tariff manipulation done for CPEC upfront tariffs, is an open question. Totally independent NEPRA may, however, be suitable for a situation when power sector may be financially independent and self-sustaining. If GoP is responsible, it has to have adequate powers as well. Nevertheless, there are many issues especially with respect to competitive regime and Power Planning that need further look into the matter. The new legislation is hardly read or discussed anyway. It may be done better in a revised form.

GoP would like to get this liability off its back, sooner or later and shift it to cross subsidies. However, upper limit seems to have reached in this respect as well. Export industry is demanding subsidy in the form of a reduced tariff of 7.00 cents per kWh. GoP cannot possibly avoid payment on the subsidies it announces and cannot reduce those either.

The real solution lies in reducing the gap between cost of supplies and the electricity revenue. There are following means which may enable to achieve this; Tariff reforms in the form of reducing excessive RoR and other parameters, introducing competition, changing fuel mix to cheaper ones in the form of cheaper solar, wind and Thar coal; reduction of T&D losses and theft along with collection of bills regularly; improving the law and order situation in major default areas of PESCO, SEPCO and QESCO, in cooperation with provinces. This is a tall order. Details of how to implement the afore-mentioned desirables have been discussed in various sections.

Concluding, on a lighter note, there is another point of view that debt is not that bad so long as you can service it and that financing business through retaining payables is a common business practice. However, excess of everything is bad. One should not be too scared of Rs.1160 billion Rs of Circular debt, but should be mindful of financing the payables to fuel suppliers like PSO and of IPPs which stands around Rs.300 billion which is no small sum. And the continued annual deficit is of the order of Rs.160 billion.

S.F. Report, however, appears to have two problems; despite providing a lot of data, it could not match the numbers and totals. Perhaps a better way would have been compiling a matrix of supply chain payables and receivables of all the parties involved. Secondly, the report omits the IPPs branch of payables and receivables. IPPs claim receivables of Rs.245 Billion, but GoP recognizes only Rs.121 Billion. Perhaps GoP is talking of net value. SNGPL s Payable stood at Rs 171.1 billion, while receivables are of Rs 123 Billion, with net payables of Rs.48.1 Billion. .SSGCs receivables are of Rs.203.6 Billion, and payables to Gas producers like OGDC and PPL to Rs.148.8 Billion, netting Payables of Rs.54.8 Billion. Thus there is a total of unaccounted sum of Rs.223.9 Billion in the S.F. Report. As mentioned earlier, a rigorous matrix accounting of payables and receivables could work out the net totals. Thus, the net cash injection requirements appear to be as follows;

1. PSO=Rs.300 Billion
2. IPPs=Rs.121 Billion
3. SNGPL =Rs.48.1 Billion
4. SSGC=Rs 54.8 Billion
5. Total= Rs.523.9 Billion

GoP has to pay RS 248 Billion in the form of various subsidies, thus a net of Rs 275.9 may be passed on to consumers in installments so as not to have an impact of more than Rs.0.5 per unit.

Recommendations: Years of accumulated problem cannot be wiped out from the balance sheets in one-go. A gradual approach would be required which in turn would require external financing. A concessional loan from Chinese banks or ADB to the tune of Rs.300 Billion may be obtained, if feasible. At 2% interest rate, the servicing cost would be Rs.6 Billion. The interest cost may be passed on to the consumer tariff, which would result in Rs.0.6 per unit addition to the latter.

DISCO Losses and Receivables-2016-17

	Rcvbles %	Rcvbles-Gwh	Losses %	Losses-GWh	Tot-Losses+Rcvbl	Sales-GWh
LESCO	99.2	142	13.77	2839	2981	17783
GEPCO	95.99	352	10.23	1001	1353	8778
FESCO	97.24	317	10.57	1359	1676	11499
MEPCO	96.21	502	16.91	2698	3200	13253
IESCO	91.87	783	9.03	955	1738	9628
HESCO	93.68	235	30.75	1648	1883	3711
SEPCO	109.98	0	37.9	1701	1701	2788
PESCO	89.29	903	32.6	4079	4982	8432
TEPCO	82.9	210	51.4	223	433	1227
QESCO	43.55	2514	23.08	1336	3850	4453
Total	92.65	5958	17.95	17839	23797	81552
Total Losses+Rcvables-%					29.18	
Source:NEPRA SOI-2017						
Unit Price-Rs/kWh	10					
Value-Million Rs.		59578		178390	237968	815520

APPENDIX

Select text

TABLE 19
Heat Rate and Plant Efficiency Data (GENCOs)

Power Station	Year	Heat Rate (Btu/kWh)		Plant Efficiency (%)	
		On Gross Generation	On Net Export to NTDC	On Gross Generation	On Net Export to NTDC
TPS Jamshoro (GENCO-I)	2012-13	10,912.00	12,250.00	31.27	27.86
	2013-14	10,534.00	11,580.00	32.00	29.00
	2014-15	10,679.00	12,051.00	31.96	28.32
	2015-16	11,352.00	12,590.00	30.07	27.12
	2016-17	10,823.00	12,008.00	31.54	28.42
GTPS Kotri (GENCO-I)	2012-13	12,946.00	11,433.00	26.00	29.84
	2013-14	10,993.00	n.p.	31.00	n.p.
	2014-15	11,520.00	12,023.00	29.63	28.39
	2015-16	11,682.00	12,107.00	29.21	28.18
	2016-17	12,124.00	12,612.00	28.14	27.05
TPS Guddu (Units 1-4) (GENCO-II)	2012-13	12,749.00	13,928.00	26.77	25.00
	2013-14	12,387.00	n.p.	28.00	n.p.
	2014-15	13,455.00	n.p.	25.36	n.p.
	2015-16	13,726.00	n.p.	24.86	n.p.
	2016-17	n.p.	n.p.	n.p.	n.p.
TPS Guddu (Units 5-13) (GENCO-II)	2012-13	9,733.00	12,551.00	35.14	27.00
	2013-14	9,939.00	12,648.00	34.00	27.00
	2014-15	7,195.00	n.p.	47.43	n.p.
	2015-16	8,796.00	n.p.	38.80	n.p.
	2016-17	n.p.	n.p.	n.p.	n.p.
TPS Guddu (Units 14-16) (GENCO-II)	2015-16	7,404.00	7,558.00	46.10	45.16
	2016-17	6,848.00	7,008.00	49.84	48.70
TPS Quetta (Isolated Generation) (GENCO-II)	2012-13	17,176.00	17,623.00	19.87	19.00
	2013-14	17,747.00	n.p.	19.00	n.p.
	2014-15	n.p.	n.p.	n.p.	n.p.
	2015-16	16,571.00	16,808.00	20.60	20.31
	2016-17	16,792.00	17,109.00	20.32	19.95
TPS Muzaffargarh (GENCO-III)	2012-13	10,475.00	11,513.00	32.81	29.64
	2013-14	10,358.00	11,528.00	33.00	30.00
	2014-15	10,467.00	13,723.00	32.61	24.87
	2015-16	11,494.14	12,738.54	29.69	26.79
	2016-17	10,378.41	11,465.99	32.88	29.76
SPS Faisalabad (GENCO-III)	2013-14	14,393.00	16,656.00	24.00	20.00
	2014-15	13,137.00	n.p.	25.98	n.p.
	2015-16	12,751.04	14,377.28	26.77	23.74
	2016-17	12,574.45	14,305.59	27.14	23.86
GTPS Faisalabad (GENCO-III)	2012-13	10,495.00	12,391.00	32.52	28.00
	2013-14	12,113.00	n.p.	28.00	n.p.
	2014-15	11,431.00	n.p.	29.85	n.p.
	2015-16	11,588.03	12,264.72	29.45	28.00
	2016-17	11,320.61	12,018.19	30.15	29.00
Nandipur (GENCO-III)	2015-16	9,106.00	9,498.00	37.48	35.93
	2016-17	8,280.00	8,614.00	41.22	39.62
FBC Lakhra (GENCO-IV)	2012-13	14,573.00	21,810.00	24.21	15.82
	2013-14	13,389.00	18,770.00	25.00	18.00
	2014-15	13,537.00	19,202.00	25.21	17.77
	2015-16	13,623.54	19,228.02	25.05	17.75
	2016-17	13,219.06	18,609.02	25.82	18.34

Source: NTDC/GENCOs

TABLE 36
Merit Order for Power Generation Plants (PEPCO System)
(Based on the revised fuel prices effective from 16-06-2017) (Rs./kWh)

Order in Merit	Plant Groups	Fuel Type	As on 16th June, 2017			Status in Last Year Merit Order (01-06-2016)
			Fuel Cost	O&M Cost	Specific Cost	
1	Uch (upto 152.375 GWh)	Gas	0.519	0.240	0.798	1
2	Liberty (upto 61.904 GWh)	Gas	0.868	0.333	1.201	2
3	Uch (+ 152.375 GWh)	Gas	2.298	0.240	2.576	3
4	Guddu 747	Gas	3.469	0.300	3.768	14
5	HCPC	Gas	3.259	0.511	3.770	22
6	Fatima Energy	Gas	3.981	0.000	3.981	--
7	Foundation Power	Gas	3.868	0.382	4.250	16
8	Guddu B-I (Unit 11-13)	Gas	4.267	0.069	4.335	19
9	Lakhra	Coal	4.266	0.195	4.461	4
10	Engro Power Gen.	Gas	4.156	0.337	4.493	21
11	Liberty (+ 61.904 GWh)	Gas	4.341	0.333	4.674	13
12	Sahiwal Coal	Coal	4.715	0.000	4.715	--
13	Altern (Phase-II)	Gas	4.061	0.690	4.751	25
14	Guddu B-II (Unit 5-10)	Gas	4.740	0.069	4.809	28
15	Uch-II	Gas	4.786	0.221	5.007	10
16	GTPS Faisalabad B-IV (Unit 5-9)	Gas	5.055	0.120	5.175	18
17	GTPS Kotri B-III (Unit 3-7)	Gas	5.119	0.093	5.211	36
18	Guddu B-III (Unit 3-4)	Gas	5.688	0.069	5.757	49
19	Jamshoro B-II (Unit 4)	Gas	5.806	0.093	5.899	54
20	Altern (Phase-I)	Gas	5.218	0.690	5.908	48
21	Jamshoro B-II (Unit 3)	Gas	5.934	0.093	6.026	58
22	Guddu B-IV (Unit 1-2)	Gas	6.095	0.069	6.163	64
23	Jamshoro B-II (Unit 2)	Gas	6.096	0.093	6.188	65
24	Muzaffargarh B-II (Unit 4)	Gas	6.695	0.120	6.815	42
25	Muzaffargarh B-I (Unit 1-3)	Gas	6.852	0.120	6.972	44
26	NGPS Multan B-VII (Unit 1-4)	Gas	7.057	0.120	7.177	68
27	Muzaffargarh B-III (Unit 5-6)	Gas	7.129	0.120	7.249	61
28	Nandipur	RLNG	6.925	0.455	7.380	5
29	Orient Power	RLNG	7.343	0.218	7.560	6
30	FKPCL	RLNG	6.81688	0.75613	7.57301	27
31	Sapphire Electric	RLNG	7.343	0.366	7.709	7
32	Saif Power	RLNG	7.343	0.370	7.713	8
33	Halmore Power	RLNG	7.343	0.372	7.715	9
34	QATP Bhikki	RLNG	8.057	0.000	8.057	--
35	Haweli Bahadur Shah	RLNG	7.763	0.323	8.086	--
36	KAPCO B-I	RLNG	7.901	0.267	8.168	11
37	Attock Gen.	RFO	7.279	0.949	8.228	23
38	Rousch	RLNG	8.332	0.282	8.333	12
39	KAPCO B-I	RFO	8.080	0.463	8.543	24
40	SPS Faisalabad B-V (Unit 1-2)	Gas	8.452	0.120	8.572	71
41	Jamshoro B-II (Unit 4)	Mix (**)	8.522	0.093	8.615	53
42	Guddu B-III (Unit 3-4)	Mix (**)	8.585	0.069	8.654	55
43	Jamshoro B-II (Unit 3)	Mix (**)	8.707	0.093	8.799	57
44	Muzaffargarh B-II (Unit 4)	Mix (**)	8.847	0.120	8.967	46
45	KAPCO B-II	RLNG	8.666	0.312	8.978	15
46	Jamshoro B-II (Unit 2)	Mix (**)	8.947	0.093	9.039	63

Order in Merit	Plant Groups	Fuel Type	As on 16th June, 2017			Status in Last Year Merit Order (01-06-2016)
			Fuel Cost	O&M Cost	Specific Cost	
47	Muzaffargarh B-I (Unit 1-3)	Mix (**)	8.975	0.120	9.095	47
48	GTPS Faisalabad B-VI (Unit 1-4)	Gas	9.039	0.120	9.159	78
49	Engro Power Gen.	Mix (***)	8.849	0.339	9.188	59
50	Nandipur	RFO	8.748	0.480	9.228	29
51	Nishat Chunian	RFO	8.309	0.932	9.241	33
52	Nishat Power	RFO	8.309	0.934	9.243	34
53	Liberty Power Tech.	RFO	8.225	1.042	9.267	37
54	Atlas Power	RFO	8.335	0.934	9.269	32
55	KEL	RFO	8.737	0.602	9.339	35
56	HUBCO	RFO	9.267	0.185	9.452	30
57	Japan Power	RFO	8.915	0.574	9.490	38
58	KAPCO B-II	RFO	8.868	0.651	9.519	31
59	KAPCO B-III	RLNG	8.963	0.602	9.565	17
60	Lal Pir Power	RFO	9.541	0.172	9.713	39
61	HUBCO Narowal	RFO	8.836	0.889	9.725	26
62	Pak Gen. Power	RFO	9.563	0.172	9.736	40
63	SEPCOL	RFO	8.835	0.902	9.737	43
64	Saba Power	RFO	9.622	0.172	9.794	41
65	Davis Energen	RLNG	9.333	0.517	9.850	20
66	Muzaffargarh B-III (Unit 5-6)	Mix (**)	9.818	0.120	9.938	66
67	Reshma PowerGen	RFO	9.17280	0.87070	10.04350	--
68	Gulf PowerGen	RFO	9.173	0.871	10.044	--
69	Jamshoro B-I (Unit 1)	RFO	10.506	0.093	10.598	45
70	GTPS Kotri B-IV (Unit 1-2)	Gas	10.401	0.090	10.491	85
71	NGPS Multan B-VII (Unit 1-4)	Mix (**)	10.638	0.120	10.758	75
72	Muzaffargarh B-II (Unit 4)	RFO	10.999	0.120	11.119	50
73	Muzaffargarh B-I (Unit 1-3)	RFO	11.098	0.120	11.218	52
74	Jamshoro B-II (Unit 4)	RFO	11.239	0.093	11.331	51
75	Guddu B-III (Unit 3-4)	RFO	11.482	0.069	11.551	60
76	Jamshoro B-II (Unit 3)	RFO	11.480	0.093	11.573	56
77	SPS Faisalabad B-V (Unit 1-2)	Mix (**)	11.463	0.120	11.583	76
78	Jamshoro B-II (Unit 2)	RFO	11.798	0.093	11.891	62
79	Muzaffargarh B-III (Unit 5-6)	RFO	12.507	0.120	12.627	67
80	KAPCO B-I	HSD	12.700	0.268	12.968	69
81	Orient Power	HSD	12.651	0.357	13.008	70
82	Halmore Power	HSD	12.538	0.532	13.070	73
83	Sapphire Electric	HSD	12.561	0.529	13.090	72
84	Saif Power	HSD	12.733	0.534	13.268	74
85	Engro Power Gen.	HSD	13.542	0.341	13.883	77
86	KAPCO B-II	HSD	13.939	0.361	14.299	79
87	NGPS Multan B-VII (Unit 1-4)	RFO	14.220	0.120	14.340	80
88	SPS Faisalabad B-V (Unit 1-2)	RFO	14.475	0.120	14.595	81
89	GTPS Faisalabad B-IV (Unit 5-9)	HSD	14.895	0.120	15.015	82
90	KAPCO B-III	HSD	14.415	0.911	15.326	83
91	GTPS Kotri B-III (Unit 3-7)	HSD	17.462	0.090	17.552	84
92	NGPS Multan B-VII (Unit 1-4)	HSD	26.632	0.120	26.752	86
93	GTPS Kotri B-IV (Unit 1-2)	HSD	35.482	0.090	35.572	87

(**) Mixed [50% FO and 50% Gas] *(***) Mixed [50% HSD and 50% Gas]*

Source: National Power Control Centre, Islamabad

Rs kWhs Variable Rates Only					**NEPRA Determined Tarif**								**Approved**
Description	**IESCO**	**LESCO**	**GEPC**	**FESCO**	**MEPCO**	**PESCO**	**HESC**	**QESC**	**SEPCO**	**TESCO**	**National \ Avg.**	**Deffered**	**Uniform Tariff**
Residential													
Upto 50 Units	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00		2.00
For Peak load requirement less than 5kW													
01-100 Units	11.03	12.09	9.52	13.27	15.34	18.04	23.54	12.13	17.41	11.53	13.85	3.48	5.79
101-200 Units	14.43	13.89	11.49	16.78	16.90	21.38	25.24	14.64	18.65	13.77	15.86	3.48	8.11
201-300 Units	16.00	14.89	12.75	17.52	18.32	21.69	26.74	15.49	21.35	14.72	16.83	3.48	10.20
301-700 Units	17.32	16.68	15.78	17.97	20.37	23.04	27.35	16.49	23.20	15.16	18.54		17.60
Above 700 Units	18.93	18.65	16.39	19.07	21.06	24.11	29.06	18.54	25.59	16.04	20.94		20.70
Load Exceeding 5kW													
Time of use (TOU) -Peak	18.36	18.61	16.28	19.07	21.04	24.04	29.05	18.54	25.59	16.04	19.33		20.70
Time of use (TOU) - Off-Peak	11.03	12.10	9.78	13.27	15.36	18.49	23.55	12.16	19.64	16.03	12.80		14.38
Temporary Supply	18.66	17.75	16.28	19.07	21.05	24.03	28.95	14.51	23.24	11.53	20.84		20.84
Total Residential													
Commercial A-2													
Load up to 5 KW	17.41	18.29	15.28	18.07	19.95	24.04	27.95	15.51	25.51	16.03	19.26		18
Load exceeding 5 KW													
Regular	14.41	15.32	11.78	17.82	18.47	19.49	25.95	14.51	23.4	14.03	18.01		19.58

Time Of Use (TOU) - Peak	18.36	18.6	16.28	19.07	21.05	24.04	29.05	18.56	25.59	16.03	20.09		21.6
Time Of Use (TOU) - Off-Peak	11.06	12.1	9.78	13.27	15.35	18.49	23.58	12.13	19.64	11.53	13.48		15.63
Temporary Supply	17.41	18.3	15.24	19.07	19.95	24.03	27.95	15.5	25.49	16.03	18.39		18.39
Total Commercial													
General Services A3	16.26	16.49	13.73	16.92	19.60	21.69	26.50	15.82	21.15	14.58	17.56	-	17.56
Industrial													
B1	14.46	14.30	10.92	15.09	17.95	19.55	25.45	13.33	22.99	12.03	18.32		15.28
B1 peak	18.36	18.60	16.28	19.07	21.05	24.04	29.04	18.54	25.60	16.03	20.14		18.84
B1 off peak	11.16	12.15	9.78	13.27	15.35	18.49	23.54	12.15	19.64	11.53	13.46		13.28
B2	13.96	13.80	10.28	14.59	17.46	19.04	24.95	13.54	22.49	11.53	15.79		14.78
B2- TOU (Peak)	18.36	18.60	15.28	19.07	21.05	24.04	29.05	18.54	25.59	16.03	19.93		18.78
B2- TOU (Off-Peak)	10.96	11.92	9.58	13.17	15.15	18.29	23.34	11.94	19.44	11.33	13.23		13.07
B3- TOU (Peak)	18.36	18.80	16.28	19.07	21.05	24.04	29.05	18.54	25.60	16.03	20.39		18.78
B3- TOU (Off-Peak)	10.76	11.72	9.48	13.07	15.05	18.19	23.14	11.84	19.34	11.23	12.61		12.98
B4- TOU (Peak)	18.36	18.60	16.28	19.07	21.05	24.04	29.05	18.53	25.59	16.03	20.27		18.78
B4- TOU (Off-Peak)	10.56	11.60	9.38	12.97	14.95	18.09	23.04	11.73	19.24	11.13	13.25		12.88
Temporary Supply	14.	14.	10.	19.	17.95	19.	25.	14.	22.	12.	16.3		16.36

	46	30	78	07		53	45	03	99	03	6		
Bulk Supply													
C1 (a) Supply at 400 Volts- up to 5 kW	14.96	14.80	11.28	15.59	18.45	20.04	25.97	14.53	23.53	12.53	21.32	-	18.68
C1 (b) Supply at 400 Volts- exceeding 5 kW	14.46	14.30	10.78	15.09	17.95	19.54	25.45	14.03	22.99	12.03	20.13	-	18.18
Time to Use (ToU)-Peak	18.36	18.60	16.28	19.07	21.03	24.04	29.05	18.53	25.59	16.03	21.52	-	21.60
Time to Use (ToU)- Off Peak	11.03	12.15	9.78	13.17	15.35	18.29	23.54	12.13	19.64	11.53	14.99	-	15.00
C2 Supply at 11 kV	14.26	14.10	10.58	14.89	17.75	19.34	25.25	13.84	22.79	11.83	15.16	-	17.98
Time to Use (ToU)-Peak	18.36	18.60	16.28	19.07	21.05	24.04	29.05	18.53	25.59	16.03	19.73	-	21.60
Time to Use (ToU)- Off Peak	10.63	11.72	9.58	13.07	15.00	18.29	23.34	11.93	19.44	11.33	12.57	-	14.80
C3 Supply at 11 kV	14.18	14.00	10.48	14.79	17.65	19.24	25.15	13.73	22.69	11.73	14.42	-	17.88
Time to Use (ToU)-Peak	18.36	18.60	16.28	19.07	21.05	24.04	29.05	18.53	25.59	16.03	18.49	-	21.60
Time to Use (ToU)- Off Peak	10.51	11.62	9.48	12.97	14.95	18.19	23.14	11.83	19.34	11.23	11.59	-	14.70
Agrilcutural													
Scarp	15.36	15.7	11.78	14.84	17.5	18.09	25.45	14.28	21.94	12.03	23.17	3.48	15.68
Time Of Use (TOU) - Peak	18.36	18.6	16.28	19.02	20.05	24.04	29.05	18.53	25.44	16.03	20.87	3.48	18.6
Time Of Use (TOU) - Off-Peak	10.68	11.7	9.48	13.22	14.55	17.34	23.14	12.13	19.19	11.23	14.03	3.48	11.35
Agriculture Tube-Wells	13.31	15.7	10.78	14.84	17.5	18.19	24.95	14.41	21.49	11.53	14.56	3.48	5.35
Time Of Use (TOU) - Peak	18.36	18.6	16.28	19.07	20.05	24.04	29.05	18.53	25.44	16.03	20.27	3.48	5.35
Time Of Use (TOU) - Off-Peak	10.76	11.65	9.48	13.27	14.55	17.34	23.14	12.13	19.19	11.23	13.04	3.48	5.35
Total Agriculture													
Public Lighting	16.30	17.90	10.64	14.82	18.35	19.84	26.90	13.58	22.59	12.03	18.78	-	18.68

Resid Colon all to ind	16.35	17.90	10.78	14.82	18.35	19.84	26.90	13.58	22.59	12.03	18.42	-	18.68
Railway Traction	-	17.90	-	-	-	-	-	-	-	-	17.90	-	18.68
Special Contracts - AJK	13.58	-	10.28	-	-	19.84	-	-	-	-	13.55	-	15.90
Time Of Use (TOU) - Peak	18.25	-	16.30	-	-	24.04	-	-	-	-	18.56	-	21.60
Time Of Use (TOU) - Off-Peak	10.55	-	11.01	-	-	18.29	-	-	-	-	12.20	-	14.70
Special Contracts Rawal Lab.	16.36	-	-	-	-	-	-	-	-	-	16.24	-	18.68
Special Contract-Tariff-J													
J-I for supply at 66 kv & above	14.16	11.77	10.48	14.79	17.65	19.24	25.15	13.75	22.69	11.73	16.14	-	17.88
Time of Use (TOU)-Peak	18.36	18.6	16.28	19.07	21.05	24.04	29.05	18.55	25.59	16.03	20.66	-	21.6
Time of Use (TOU)-off-Peak	10.51	11.62	9.48	12.97	14.95	18.19	23.14	11.85	19.34	11.23	14.33	-	14.7
J-II (a) For Supply at 11, 33 kV	14.26	14.1	10.58	14.89	17.75	19.34	25.25	13.85	22.79	11.83	16.46	-	17.98
Time of Use (TOU)-Peak	18.36	18.6	16.28	19.07	21.05	24.34	29.05	18.55	25.59	16.03	20.66	-	21.6
Time of Use (TOU)-off-Peak	10.51	11.72	9.58	13.07	15.05	18.29	23.34	11.95	19.44	11.33	14.44	-	14.8
J-II (b) For Supply at 66 kV & above	14.26	14	10.48	14.79	17.65	19.24	25.15	13.75	22.69	11.73	16.36	-	17.88
Time of Use (TOU)-Peak	18.36	18.6	16.28	19.07	21.05	24.04	29.05	18.56	25.59	16.03	20.66	-	21.6
Time of Use (TOU)-off-Peak	10.51	11.62	9.48	12.97	14.95	18.19	23.14	11.85	19.34	11.23	14.33	-	14.7
J-III (a) For Supply at 11, 33 kV	14.26	14.1	10.58	14.89	17.75	19.34	25.25	13.85	22.79	11.83	16.46	-	17.98
Time of Use (TOU)-Peak	18.36	18.6	16.28	19.07	21.05	24.04	29.05	18.55	25.59	16.03	20.66	-	21.6

Time of Use (TOU)-off-Peak	10.63	11.72	9.58	13.07	15.05	18.29	23.34	11.95	19.44	11.33	14.44	-	14.8
J-III (b) For Supply at 66 kV & above	14.16	14	10.4	14.79	17.65	19.24	25.15	13.75	22.69	11.73	16.36	-	17.88
Time of Use (TOU)-Peak	18.36	18.6	16.23	19.07	21.05	24.04	29.05	18.55	25.59	16.03	20.66	-	21.6
Time of Use (TOU)-off-Peak	10.51	11.62	9.48	12.97	14.95	18.19	23.14	11.85	19.34	11.23	14.33	-	14.7

Avg. Sales Rate (Rs./kWh)	13.46	13.99	11.85	15.35	16.17	19.5	25.1	14.77	20.72	13.64	15.53	-	11.95
Variable	12.83	13.52	11.35	14.78	15.65	19	24.66	14.19	20.38	13.5	15.02	-	11.14
Fixed	0.63	0.47	0.5	0.57	0.52	0.5	0.43	0.58	0.34	0.15	0.51	-	0.51
Revenue Requirement (Bln. Rs.)													
Variable	151	322	126	210	281	185	114	78	69	23	1559	-	1188
Fixed	7	11	8	8	9	5	2	3	1	0	53	-	53