

Issues in Energy Policy

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Books by the same author:

- 1. Pakistan's Nuclear Dilemma: Energy & Security Dimensions.**
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- 5. Pakistan's Energy Development: the Road Ahead.**
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About Reap

This study has been done under the auspices of REAP. REAP, originally known as Research on Armament and poverty, has been rechristened as Research on Economy and Politics (of Pakistan). REAP was founded in early 1980s, and has organized and published many books and publications, including this author's previous books. reap@gmail.com.pk

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Preface

I wrote, “Pakistan’s Energy development; the road ahead “two years back which has been well received by the energy community and academia, and as well as the general public. That book being the first of its kind attempted to describe the whole sector along with problems, issues and policy prescription. This book, however, focuses on energy policy issues, taking into account the arguments that developed in response to the earlier book, and the debate that continues on the energy crisis faced by this country. Also there is more coverage and focus on renewable energy in this book than was done in the earlier one. Policy issues and prescriptions are consolidated, the ones which were made earlier, and the new ones that have been added. It is, however, an independent book that can be read without consulting the earlier one. For this, a modicum of background data has been provided as well, along with full data on the argument that is being made. Finally this book is much briefer than the earlier 500-pages compendium, if you like.

This book may contain here and there criticism on companies, agencies and regulatory bodies which has been done in good faith in a spirit of constructive dialogue with the aim of improving performance and efficiency and resolving or ameliorating problems that emerge in some of the worst energy crisis in the history of this country. No disrespect or ill will is meant towards individuals or organization. I would apologize for any sharp edges that may have erupted in the discussion.

The current energy crisis is almost universal or at least is being faced by most non-oil developing countries. The crisis has affected different countries in different ways. With us it is all kind of problems and its manifestations; lack of adequate planning, faster growth of demand, lack of local energy resource development, political economy issues, spiraling oil prices and growth in prices of other imported products and commodities, recession and stunted overall economic growth, poverty and unaffordability etc all put together and mutually reinforcing . This also means that opportunities of improvement are also many. If there is a problem, there is normally a solution. And with us there are many possible solutions and initiative that may prove useful and effective. The tallest among these is the development of indigenous energy resources like Thar coal and others.

We have used many publications and internet resources for data and examples. I would like to thank the following organizations in particular; Hydro-Carbon Development Institute of Pakistan(HDIP), NEPRA, OGRA, PSO, INOC and CERC(India), Energy Information Administration (EIA-USA), International Energy Agency(IEA), International Atomic Energy Agency(IAEA), Nuclear Regulatory Commission(NRC-USA), EU Energy Portal, FERC and CERC of USA, Euro-Coal, NREL, CSP, Solarbuzz, Renewable Energy(magazine), to name some of the sources. Others are acknowledged within the text where their data has been utilized.

I am grateful to IEEEEP, its executive committee and Chairman Mr. Tahir Saleem for having frequently invited me for presentations in their conferences and seminar under pressure of which some of the material in this book has been developed. I am also grateful to the dailies DAWN and BUSINESS RECORDER, especially Mr.Wamiq Zuberi editor of the latter, for publishing my articles which provided an additional reason to write.

List of Abbreviations

AEDB	=	Alternate Energy Development Board
BCF	=	Billion Cubic Feet
COGE	=	Cost of Generating Electricity
CPPA	=	Central Power Purchase Authority
DISCOs	=	Distribution Companies
DOE	=	Department of Energy (USA)
EEX	=	European Energy Exchange
EIA	=	Energy Information Administration (USA)
EU	=	European Union
GENCOs	=	Generating Company's
GJ	=	Giga Joule
GOP	=	Government of Pakistan
GW	=	Giga watt = 1billion watt = 1000MW
GWh	=	Giga watt hour = 1000 MWh
IAEA	=	International Atomic Energy Agency
IEA	=	International Energy Agency
IRR	=	Internal Rate of Return
KESC	=	Karachi Electric Supply Corporation
LCOE	=	Levedised Cost of Electricity
LESCO	=	Lahore Electric Company
LNG	=	Liquified Natural Gas
LPG	=	Liquid Petroleum Gas
MCF	=	Thousand cubic feet
MMBtu	=	Million British Thermal Unit
MMCFTD	=	million cubic feet per day
MPNR	=	Ministry of Petroleum & Natural Resources
MTOE	=	Million Tons of Oil Equivalent
Mtpa	=	million tons per annum
Mtpd	=	million tons per day
MW	=	1 million watt = 1000kw
MWh	=	Mega watt hours = 1000 kwh
NEPRA	=	National Electric Power Regulatory Authority
NTDC	=	National Transmission & Dispatch Company
OGDCL	=	Oil & Gas Development Gas Company Limited
OGRA	=	Oil & Gas Regulatory Authority
OIL	=	Oil India Limited
p.a.	=	per annum (year)
PAEC	=	Pakistan Atomic Energy Commission

PEPCO	=	Pakistan Electric Power Company
PML	=	Pakistan Muslim League
PPIB	=	Private Power & Infrastructure Board
PPP	=	Pakistan Peoples Party
QESCO	=	Quetta Electric Company
ROA	=	Return on Assets
ROE	=	Return on Equity
RT	=	Refrigeration Ton = 8000 Btu/hr
SNGPL	=	Sui Northern Gas Pipelines Limited
SSGC	=	Sui Southern Gas Company
TCF	=	Trillion Cubic Feet
TOE	=	Tons of Oil Equipment
WAPDA	=	Water & Power Development Authority
WCI	=	World Coal Institute
WEC	=	World Energy Council

1 Introduction

Pakistan is passing through an energy crisis has become more of a cliché. The crisis, however, is of such a magnitude that it cannot be allowed to continue the way other crises have become part of our national life. It has to be tamed or ameliorated as early as possible. The problem is that demand keeps increasing continuously with the increase in population and almost doubles itself in ten years and quadruples in twenty years. The lack of inaction may not be felt immediately, as has happened in the reign of last military regime. Supplies take longer times to build. Also unfortunately, the institutional and socio-political system has not and may not correspondingly progress and grow in capability to provide for the bulging demand. In the current decade, as much new electrical capacity (15-20,000 MW) may have to be installed as it has been done in the last sixty years. And it is not the electrical energy alone; there are demands of primary energies as well for house-hold, transportation and industrial and commercial sectors. This is certainly a challenge which will continue unabated. Supplies have to be provided at affordable costs, preferably lower or competitive with other countries. Pakistan has indigenous energy resources that can make it possible. The challenge can be met. Institutional and policy environment must be streamlined and fine-tuned to remove bottlenecks, attract domestic and foreign investment, and bring into play the market forces replacing fiat, command and political power. The purpose of this book is to examine in detail the underlying issues at overall and at more practical sub-sector level. We will undertake a perusal of some of the major issues and problems here in this chapter in the following before reverting to the discussion on energy policy.

Last oil price hike was among one of the major factors of devastating Pakistan's economy. What will another hike do is any body's guess? Great risk lies in there. Our dependence on oil is increasing despite such impending and known risk. Pakistan is importing oil worth 10-11 billion US dollars in a year, which amounts to be one-third of its total imports, causing trade gap resulting in IMF loans and assistance that bring alone draconian demands that tend to destroy social peace. Almost all power plants that have come on stream recently run on oil; more are to come. Domestic oil production is not increasing, despite some potential. Gas production is going down and in the process of being used up. New

exploration and discoveries are hampered due to political and law and order problems in Balochistan and elsewhere. Despite Balochistan package and other palliatives and offers, political situation in Balochistan has only worsened. And do not think that only military can solve this problem. It can only make it worse.

There is no serious break through on Thar Coal despite great potential. It is difficult to imagine for outsiders like us as to what stalls progress on Thar coal. And now it is appearing to come close to a failure. Some new initiative is required to cause a breakthrough. On the other hand federal bureaucracy, barring some settlement on "joint development", seems to be searching for options except Thar coal. Chinese have been prevailed to supply more nuclear reactors, which are three times more expensive in capital costs and associated with many other hurdles and political difficulties. We must be clear in our minds that only Chinese can possibly develop Thar coal in the remote and scorching heat of Thar Desert. No other country or company can handle the risks involved in this size of the project. One can sign nth MOUs, nothing would happen. As a token World Bank has withdrawn support among criticism of financing dirty coal. It is hoped that we manage to put our act together before it is too late and financing coal is stopped altogether in the nearing prospects of solar power. The solution may lie in awarding a 5000 MW project to Chinese to include all the infrastructure development costs. Chinese may agree to it on suitable terms.

One keeps hearing some provincial leaders continue spitting venom on hydel power dam, despite being drowned in flood water. What more rationale and justification can be given of excess water to be stored in dams than these horrific floods in which 45 MAF (million acre feet) of water has over-flown in a few days as opposed to a normal flow of 100 MAF over the entire year? The combined storage of all the dams proposed to be built is smaller than this flow. It is hoped that barring exceptions, people in Sindh in general are not going to block dams any further. If they do they would be drowned again and again and resultantly the whole of Pakistan. Dams have long been used throughout to store water and prevent floods. Americans, Chinese, Brazilians, Indians and others have done it successfully. There is no colonialism about it. Let us hope that sense prevails ultimately.

And as for the pricing, GOP has been subsidizing electricity amounting to Rs 150 billion per year. It has not been able to pay it however, along with the non-payment of electricity bills by the provincial governments. This has given rise to circular debt of Rs 200 billion. It does not get paid

off, as more amounts are added to it successively. And IMF is also requiring do away with these subsidies. If these subsidies are withdrawn, along with the uniform subsidized tariff, electricity rates in Sindh, KP and Balochistan would increase. In Punjab electricity rates are expected to go down? Why? Is it another so called "machination from Punjab" as many nationalists would be akin to term it? Not really the story is as follows. About 25 % of electricity is lost in T&D losses; a large part of it is theft. This T&D loss (theft mostly) is not uniform through out Pakistan. In Punjab, it is the lowest around 12% in northern and central Punjab and 15% in southern Punjab. Everywhere else, these losses are in the range of 35-45%. Currently these excessive losses are hidden and averaged out in uniform tariff. Without electricity subsidy borne out by the GOP, every province and user would pay for its losses. Thus Punjab having lesser losses would end up in lower tariff and the opposite will happen to the users elsewhere.

As it is electricity is expensive and kind of unaffordable for most of the people and even businesses, a Pandora box will open up. The issue may not end up in terms of the aforementioned cool and cold logic. The issue is far more complicated. KP will argue that you take away our (it is not theirs' solely) cheap hydro electricity at one Rupee a unit and sell it back to us at 6-7 Rupees. In Balochistan cost of gas fired electricity is Rupees 4 per unit and similarly Sindh produces a lot of gas for electricity production. What is the way out? Balochistan's consumption is quite low and could be jangled in a variety of ways. In Sindh, problems would be further compounded due to KESC vs rest of Sindh. More thinking is required on this.

However KP issue can be at least partly resolved by resolving the Hydel Profit/Royalty of Tarbela Dam produced electricity. No permanent solution has been implemented. Our suggestion is simple; 12% of Tarbela generated electricity to KP free as royalty or alternatively pay 12% royalty at CPPA whole sale price. Both are more or less equivalent, transparent and simple to understand and not mired by the complicated calculations of AGN Kazi. It is being done in India, a country not disliked by Sarhadi Gandhi to say the least? Elsewhere the royalties are lesser. This maximum should be acceptable to the government of KP and even the other distracters. An early decision should be made in this respect in consultation with the stakeholders. These royalties should go towards adjustments of tariff increases. I would tend to support 12% free electricity which has a larger public appeal and would be politically attractive.

Finally energy conservation and efficiency issues should receive government support and attention. A unit saved is a unit produced and even worth more due to environmental reasons. In order to remain out of technical complexity, let me propose here a simple solution that may go a long way to reduce the demand of air-conditioning to a more acceptable level. Two or even three piece suits have become unduly popular in Pakistan government and business circles, requiring chilling while the outside temperature may be 45 degree C or more. This is awfully expensive. Instead Bu-shirts should be promoted, as one Japanese P.M. reportedly proposed for his country in the context of rising cost of energy.

GOP has already taken steps towards Demand Management that have worked with varying levels of impact and effectiveness. More could be done, like banning air-conditioning use during peak hours. This should not sound too draconic. An efficient country like Malaysia has similar rules in this respect.

Energy has been wasted traditionally due to being cheaper in earlier days. There are upper limits to enhancing residential tariffs due to generally low consumer incomes. In the meantime Tariffs have been on the rise inducing consumers to be careful and control the energy usage. Energy saver bulbs and other devices have replaced the earlier types of bulbs. The cost of energy saver bulbs is still too high for the poor .GOP has rightly taken steps to provide free or low cost energy saver bulbs to the poor. Energy saving can be promoted also by inducing the manufacturers to produce energy efficient devices. Washing machines, air-conditioners, refrigerators, fans, water pump and motors etc can all be more energy efficient. Energy labeling programs certifying and grading electrical devices and equipment have been introduced in the advanced countries. In addition to introducing such programs, capacity building programs for producer SMEs may also be launched.

Incentives or coercion may be needed for industrial sector as well. Price does not work always, if awareness and sensitivities are not there. All saving effort may be diverted towards reducing labor cost and the government dues. Most energy efficiency programs require infusion of capital and pay off beyond the current years. Tax and cheaper credit incentives for making energy efficiency investments have proved useful elsewhere and the same may be tried here as well.

Curing the ailing Energy sector; some humble submissions

Pakistan is facing the worst energy crisis of its history. Perhaps no other crisis or difficulty has caused as much damage to Pakistan's social and economic conditions as energy issue has. It has caused trade and foreign exchange deficit, currency devaluation, decline in economic out and exports and has caused massive unemployment. The Energy issue merits highest attention of the government in developing and implementing short term and long term measures. Here are some of the suggestions in this respect.

1. Development of Local Energy Resources

Pakistan has imported 10-11 billion USD worth of oil per year over the past few years. High and volatile oil prices have damaged Pakistan's economy. The continuing reliance on oil for producing electricity is a highly dangerous trend. Most projects that have come on stream in the last few years and the ones in pipeline are IC engines running on RFO. The danger stems from three directions; one is increasing cost of generation of electricity (COGE) and the other raising the foreign exchange import bill. The oil price hike of 2007-8 virtually destroyed the economy and damaged electricity / energy sector. Thirdly, oil based IC engines are less efficient than other options.

Thar coal is larger than the oil resources of our rich brothers of the Middle East. Total Middle East Oil and gas resources add up to equivalent of 385 billion tons of Brown coal, out of which Iran and Saudi Arabia own 110 billion tons of coal equivalent each. Pakistan's Thar coal is 185 billion tons. There is an urgent need to develop THAR coal, without which Pakistan's energy problem can not be solved. Federal Government (GOP) and its institutions must support THAR coal development. Only coal is provincial subject, but electricity remains a federal subject even after 18th amendment. Similarly, Hydro and Wind potential offer near term solutions.

2. Financing Thar Coal

The residual issue as it stands today is not the financing issue of the mining and power parts of the projects, however difficult it may itself be, it is the financing of infrastructure part which is proving to be a stumbling block. Various estimates put these requirements to between 1

to 2 billion US dollars. More money is required for infrastructure, than the first coal mine and power plant itself. Government of Sindh, obviously would not have such resources, nor would the federal government. And in these days of emphasis on provincial autonomy, where is the appetite for common projects. There are also issues as to the technical and management capability of the provincial bureaucracy, as the project continues to be run from the narrow confines of the Sindh secretariat. Apparently, there is no shaft of light at the end of this tunnel, although it is not the only one.

There are two options. One is to tender for a large project of 5000 MW or so, which may be able to assume the infrastructural development costs. The cake becomes big enough to absorb all kinds of interests. This is not new. In India, this size of coal projects are being planned already. The feasibility of this proposal in Pakistan context can only be tested once it is actually tendered. The second option would be to float tenders for establishing a mining development company that undertakes to develop and finance the infrastructure and manages the Thar coal operations on behalf of the Sindh government, within the framework of the relevant rules and regulations. The company recoups its investments by granting mining leases and charging a fee on coal production by individual companies. Obviously such a company would be a multinational which may have a joint venture with local private sector and government of Sindh's share in it. Such a company would offer many advantages. First of all to bring in finances, which appear to be well-nigh impossible for Sindh government to finance? Secondly, the operations would be more commercial like and would be on fast track.

3. Importing Coal

Uncertainties over Thar Coal implementation have compelled investors to think about imported coal. Several projects have been proposed in the past based on imported coal. Imported coal although cheaper than oil, it is no less volatile than Oil in terms of price variability. In the oil price hike of 2000-7, coal prices also rose proportionally and came down proportionally. It is not coal per se, but the local resource development and controllable prices offered by local coal that is to be a preferred option. If at all, permission may be granted for imported coal for an interim period, and conversion be required to be built in when Thar coal becomes available. Permitting imported coal project would send a final signal for closing off Thar coal resource.

4. Conversion to Coal

Many oil-fired (Steam Turbine) power plants were converted to coal in the wake of Oil crisis of 1973, and the trend continues till to date despite heightened environmental opposition. The dilemma that, however, is to be faced is whether it is local coal or imported one. Coal is already being imported for non-utility industrial purposes and local Hard coal is being mined locally as well, although under low productivity and inefficient environment. Hard coal production, although with smaller deposits, could be fast tracked by installing modern mining equipment and management practices. Utilities use of this coal would spur such conversion. In Punjab, 50 MW coal based power plants have already been proposed under provincial domain. Conversion to imported coal should also be subject to the same provisos as has been proposed in the earlier para.

5. Controlling High Cost of Generation of Electricity (COGE)

All efforts must be made towards controlling the electricity cost and tariff. The full brunt of high cost projects has not yet been felt, due to the availability of one –third electricity from old hydro project like TARBELA at Rs. 1.30 per unit. There are three aspects that need special attention.

1. Capital costs esp of power generation projects.
2. Thermal efficiency
3. Reduction of technical and non-technical losses.

6. Capital Costs

There is a general consensus among experts in Pakistan that capital cost of generation projects are high. In the adjoining table, we provide data on comparative capital cost, which is self explanatory. There, may be both technical and commercial reasons for this. Regulatory effort and capability in this respect need a lot of improvement. In developed countries of all market size, electricity generation prices are market driven. In India there is a big market and local industry and sufficient domestic market data is available. CERC India is able to announce benchmark rates for capital cost with much less difficulty. In Pakistan NEPRA does not have recourse to such inputs. Neither does NEPRA seem to have made adequate efforts to enhance its capability in this respect. It relies on simple brow beating the proponent into some downward

adjustment based on some input form in adequately informed interveners, and EPC quotes.

In this respect, we make the following recommendations:

1. **NEPRA** announce bench mark capital cost for three years (indexed) based on external / foreign consultant recommendations.
2. **EPC** for turnkey projects is replaced by a package approach, where by a project is tendered in 5-6 packages.
3. **PPRA** procurement rules must be made mandatory for all regulated projects, including energy and electricity.
4. **NEPRA** invests in acquiring and subscribing to 3rd party data source on capital costs, instead of constructing buildings for its offices.

A case in point is the remarkable difference in capital costs and COGE of wind power, among India and Pakistan. In India the capital cost of wind projects is half that of Pakistan, 1200 USD per kW vs 2500-2700 USD per kW in Pakistan. A part from potential and ubiquitous padding, local production of wind turbines in India and total imported content in Pakistan, many have resulted in such a large cost differential.

7. Opening up of electricity market

Consideration may be given for introducing an element of open market and liberalization in the electricity sector. Some of the feasible steps may be the following:

1. promoting consumers choice for large customers (1MW+).
2. opening up electricity transmission by allowing 3rd party access on pre-determined wheeling tariff.
3. doing away with generation licensing requirements for up to 3-5 MW. Mandatory filing may be continued for 1M and upwards.
4. promotion and permission of open market operations among producers and large consumers on mutually negotiated tariff utilizing open transmission regime.
5. promotion of independent electricity marketing companies.

8. Royalties

8.1. Hydro royalties:

A permanent solution to hydropower royalty / net profit issue should be finalized. Ideal and most practical solution may be giving 12% free

electricity (ala- India) to the producing province with provisions for sharing with local governments. An alternative is to compute royalty dues at the rate of 12% of CPPA price; both options are almost equivalent.

8.2. Wind power royalty:

It is unfair and even unconstitutional to drive benefit from provincial lands without adequate compensation or royalties. No royalty is being included in the NEPRA tariff calculations yet. A policy must be announced in this respect. Wind power royalty is to go to the land owner/lessor. If a government is the owner, Federal, Provincial or Local that government may get the royalty. If it is a private land, private owner gets it. A rate of 2% of sales has been popular in many western countries. This is also compatible with royalty formulae in mineral sector. At this moment only Sindh province would benefit from it.

Wind potential is there in other provinces as well, especially in NWFP and Balochistan and FATA who would benefit from it eventually. It may be worth noting that Wind Turbines use only 3-5% of the WIND FARM area, which can continue to be utilized for agricultural purposes. Based on 150 million kWh per year of electricity sales per year of a 50MW wind power plant, a royalty of 2% would mean a royalty income of 1.5 million USD per year that could be shared among local and provincial governments depending on the ownership status of the land. Fortunately wind power / costs are coming down due to emergence of solar option, and unsold inventories are building up. The additional 2% incidence of royalty would be tolerable now than ever before. NEPRA would be well advised to revise its determinations on WIND POWER in the light of recent downwards trend in wind power equipment prices world-wide

9. Reorganization of the Energy sector

Recent Energy Summit deliberations and its output have indicated the need to take a total and integrated view of the Energy sector, be it short term emergent needs or longer term planning and management. Following steps are recommended in this respect:

Merger of the Ministry of Water & Power and Ministry of Petroleum into one Ministry of Energy. After the 18th amendment, there is not going to be much federal involvement in mineral sector anyway. Except for India; many Federal countries have adopted this approach.

Merger of NEPRA and OGRA, which would enable the two organizations to learn from each others strength, cross pollinate the ideas, and facilitate a coordinated energy regulation. In most countries, this practice has been adopted including the USA (FERC), Singapore and elsewhere.

10. Reorganization and liberalization of the GAS sector

The current domination of the sector by two distribution companies (SNGPL & SSGC) must go and the sector and the two companies fragmented on the lines of electricity sector, namely replaced by one or two Transmission companies and several distribution companies like LESCO, GEPCO, and FESCO etc.

Open transmission access regime to third-party suppliers and gas producers along with consumer choice for large customers be instituted.

Gas market and a parallel unregulated gas sector, in addition to the existing regulated one, be instituted to promote investment, production and greater supplies in the sector. This should also cover and include the so called Tight or non-conventional gas exploration and production.

Draft Rules for Tight Gas, in the absence of the proposed de-regulation, seem to be adequate and forward looking. Consideration may be given to pegging the Tight Gas price to 75% of the oil price subject to 80 USD per barrel of upper slab, as has been the case of imported gas from Iran.

11. Demand Management

Recent energy summit has prescribed short term demand measure. Longer term rules are required to be put in place. Two most important ones are suggested in the following:

1) Restriction of air-conditioning load during peak hours for consumers having demand exceeding 100-200 KW, and obliging them either to install gas based air-conditioning of absorption chillers or buy-in chilled water from distributed cooling systems. A sufficient notice of two years be given to such users. Malaysia has introduced this provision for quite some time now. Distributed cooling through chilled water distribution has become quite well known in several middle Eastern and South East Asian countries.

2) Distributed and district cooling projects be promoted and mandated in co-generation and tri-generation mode which has a potential of a thermal efficiency of 75% as opposed to present average of 40% in good cases.

12. Revamping Existing Generation capacity.

1) Against an installed capacity of some 22000 MW, existing peak generation does not go beyond 14000 MW. Although circular debt and consequent financial problems of energy companies has had a role in lack of adequate electricity generation, it is widely recognized that some 3-5000 MW of existing capacity needs a varying degree and level of revamping/BMR. Prior and immediate attention may be given to those projects including privatization of such units along with their gas allocations. GOP/MoWP are reportedly seized of this matter, along with USAID support in this respect.

2) Single cycle gas turbines (mostly out-dated) should be put much later in the economic dispatch order, than is the current should not have a capacity factor/utilization of more than 20-30%.

3) NEPRA monitoring code of generation capacity should be implemented with strictness and monthly website publishing be made mandatory. Electricity generation data by generation facility must be published daily by CPPA/NTDC.

13. Reduction of T&D losses including theft in Electricity and Gas sector.

1) Ironically T&D losses in electricity sector in Punjab are minimal (12%), while elsewhere these exceed 25-30%. In industrialized countries T&D losses to the exclusion of non-existing theft are a mere 5 %. However in the same very Punjab, gaT&D losses ,which mostly are shear theft, are phenomenally high ,much higher than in Southern sector (SSGC network) .This indicates that company culture and history ,its organization, work-force and management has a lot to do with theft than the possible sociological factors. Regulatory authorities ought to delve deeper into this phenomenon.

2) USAID assistance ala DRUM project India must be procured where such programs are showing good results. India, to consolation of many among us

14. Renewable Energy

14.1. Solar Energy

It appears that the earlier US target of achieving grid-parity in 2015, meaning that solar power becomes competitive with fossil power on the electric grid, would be achieved. The indicators are several; last month, the quoted capital cost rates in the U.S. markets came down to 3.5 USD per KW, it used to be more than twice this figure only some years back. Solar cells of high thermal efficiency (mono-crystalline Si- 17.5% efficiency) are costing less than 2.5 USD per KW, and thin- film lesser efficiency ones are being sold at 1.0 USD per kW or less. In China, several government contracts have been made at the rate of 1.5 USD per kW for domestic power, although Chinese rates, especially in the domestic market do not quite reflect true costs and prices. Still, it gives some trend.

However, even if grid parity in solar power is achieved as early as 2015, it would not mean overnight conversion in the US, Europe and Japan. It would take a long time to develop production and supplies infrastructure. Solar and other renewable market share in the developed world may not exceed 10-15 % by 2030, although new fossil plants construction rate may come down very significantly by that time (2030).

14.2. Towards a Solar Policy

Solar future may be far off for us, if we do not equip ourselves with the right technology at the right time. Easier said than done, but it can be done. This should not, however, mean recruiting non-productive scientists bureaucracy in our R&D institutions and elsewhere, marveling at show case projects. Throwing money at it, does not bring in technology, neither doing nothing and waiting to be supplied packaged technology, in the rich oil producing Arab countries' style, suits us. Private sector would have to be integrated, which is a separate discussion and would be taken up at some other time. It would remain a difficult question as to when to enter into this and how. Although a few things can be done immediately, like introducing solar energy in schools and universities curricula, and augmented by R&D activities in PhD programs should receive immediate priority. That a trained work-force brings down technology induction costs and speeds up the process, would not be lost to anyone.

14.3. The Lessons from Wind?

We may miss the boat for early solar power, if we do not plan for it.. Look at the Wind Power. Despite a forward looking policy, we have only a few MW of wind power installation, although a few projects are at an advance stage of processing, which may mean 100-150 MW of wind power in a few years time. Due to heavy demand of Wind Turbines in the Western markets, no wind power equipment vendor was ready to supply wind turbines to our projects. Long lead times were quoted and not honored. In this atmosphere, obviously prices quoted are high also. Of late things seem to be changing; enthusiasm has shifted to solar energy, and considerable resistance developed against wind power due to noise, birds' safety and aesthetic issues. Consequently vendors are talking to project sponsors in Pakistan, and hopefully would be offering reduced prices that may not necessarily translate into lower NEPRA tariff for reasons we have been discussing elsewhere. Prices in Pakistan do not come down so easy and automatically!!

14.4 When should we jump in?

When should we jump in? We are already in it in limited ways , largely on the basis of foreign funded projects , which are also serving as demonstration models for manufacturers as well , and hence the rationale for foreign aid , apart from its philanthropy and ? Solar PV costs are coming down very fast. Sometimes, in the next five years, solar power may be competitive in off-grid markets, of small and far off villages. For specialized applications such as power supply to communications tower, monitoring stations, pipelines instrumentations, health and education facilities in far off villages, it is already competitive and in demand. In Bangladesh, reportedly, a PV-LED combination has become very popular and successful in villages, where a 20 watts PV –LED power is lighting the lives in rural homes. The rent/tariff, it is said, has been kept as low as their kerosene budget for lighting. Not a bad deal, if that can be replicated here in this country.

14.5. Institutional issues

Even if the real days of Solar Power may be ahead in time, there is to be some home work and an enabling policy in place, to guide investors, businessmen, R&D institutions, vendors etc. For example in what areas and villages government is to priorities solar power. What kind of institutional arrangements are required and may be permitted and supported. In this case company model may not work as well as it does

for grid power. Cooperative bodies may have to be promoted and the role and functions of such co-operatives may have to be defined. Electricity Co-operatives have worked successfully in The US in the initial days, and have survived till this day. Electricity Coops are going to be in fashion again through out the world and more so in the developing countries. May be for development purposes a few one-MW solar power plants may be permitted every year, which may require auctioning such opportunities. Local content may have to be mandated.

14.6. In Concrete Terms

Following steps are recommended.

- 1) a limited number of small commercial-demonstration projects may be approved and installed as IPPs, such as in the following;
 - one or two solar PV projects of 5 MW each.
 - 10 -20 MW Solar Thermal(Parabolic trough) as ISCC with an existing Steam Turbine or Gas Turbine Combined Cycle Plants in Kot Addu/Muzaffar Garh.
 - One or two Solar dish 1 MW projects.

These projects may be auctioned to get lowest offers as solicited projects. The preferential feed-in-tariff would not pose a heavy burden on consumer tariff.

2) In the area of Wind Power, there is already a demonstration project in the form of Zorlu. Several projects are at an advanced stage. Now that we seem to have missed the boat on early wind power, we can afford to wait till a reasonably priced Wind Power regime based on some indigenization can be brought in. Work on this must be initiated sooner than later.

15. Full disclosure and transparency

15.1) Electrical sector

1. Freedom of information act 2003 must be implemented in letter and spirit in the regulated sector of electricity and industry. A visit to websites of Indian utility and government energy agencies may be useful in learning as to how this aspect can be improved in energy sector in Pakistan.

2. implementation of the following two NEPRA notifications must be expected;

Instead of annual reporting, monthly publishing on the websites of individual entities/companies may be instrumental in resolving many problems. A case in point is the NEPRA determination on KESC's fuel adjustment charge (FAC) where in two and of four member have distanced themselves from siding with and signing NEPRA determination and have written "notes of dissent". There is a petition in Sindh High court in this respect as well. Had requisite data, mandated in the two of NEPRA gazette notifications (on generation and distribution performance) been implemented and requisite data made available on monthly basis, the scope of confrontation and confusion could have been lessened if not eliminated altogether.

NEPRA has done well by publishing details of "fuel (adjustment) charges (FAC)", for the first time in May 2010. Earlier it used to simply announce a figure in a few lines statement. We would encourage NEPRA to continue with this practice and even broaden the scope of such detailed publications in this respect. NEPRA should also publish data or/and require agencies such as PEPCO/CPPA to publish data on "Annual Fixed Cost payments". Although "reference data" is already published by NEPRA in its determinations, there is a significant discretion and detail in this respect. Scope of such disclosure is required to be broadened and extended to include IPPs.

15.2) Oil and Gas sector

Oil and gas sector is worth more than twenty billion US dollar in terms of sales and output. Except for Gas T&D tariff and mere posting of petroleum retail prices and gas wellhead prices, there isn't much to show by OGRA. The sector is almost totally regulated, theoretically, except LPG where there is confusion as to the regulatory domain. Admittedly OGRA works within the framework of the role assigned to it by Ministry of Petroleum (MPNR) and the GOP. It cannot arrogate powers to itself, although it can build pressure towards higher domain and role for itself. The due process is lacking in the following areas: Surely there are and must be rules in the following areas which in itself is not enough. The actual application and adjudication of those rules is to be the subject of due public process, where price is not determined by the market forces. International transparency moves and initiatives these days even go beyond public tariff and pricing determinations. They are demanding *Publish what you pay(PWYP)* policies and regime, for it has been found

that the actual payments vis-à-vis publically determine tariff may be deviating for legitimate and not so legitimate reasons. Following areas should come under some process of public input and scrutiny through the regulatory process of OGRA and the latter should not restrict to posting of results but invoke the whole regulatory input and process into these.

- 1) Well-head prices of oil and gas.
- 2) Ex-refinery prices of petroleum products such as gasoline and diesel, including crude oil imports
- 3) Oil pipeline tariff
- 4) PSO imports of petroleum products (50% of the total demand is met through imports valued at around 8 billion dollars)
- 5) Furnace oil pricing despite claims of being in the open sector; and most importantly
- 6) High Speed Diesel (HSD) pricing.

On the other hand, what little powers have been granted to OGRA, successive leadership of that organization have not chosen to make use of those. For example who stops OGRA in holding public hearing for discussions on the other constituents of petroleum prices, if the ex-refinery (wholesale or producer price) is made an untouchable tree for it?

16. Energy Development Fund

Pakistan is suffering from an Energy crisis, causing social, political and economic difficulties. The region is a victim of terrorism furthering and pronouncing the aforementioned problems. Lack of timely investments in the immediate past in the sector has been diagnosed as one of the key issue. It is more than a simple government failure. There are structural problems. Current Electrical Power installed capacity is around 23000MW. The demand is expected to double itself every ten years, which means an additional capacity requirement of 75000 MW in the forthcoming two decades. Besides generation capacity, this would entail investments in Transmission, and Distribution. Also investments in primary energy production and transportation utilities.

This may require an investment of 200 billion USD. This can be both a problem as well as an opportunity. This is one area where Pakistan would need support from friendly countries in terms of foreign equity and project loan investments. A commercially viable capacity building project is being proposed to facilitate domestic and foreign investment in the energy sector. An Energy Development Fund is proposed, which would not be a recipe of free lunch. The basic idea, as explained in the

forthcoming, is that the proposed fund acts as an intermediating and facilitating instrument and institution.

16.1) Energy technology indigenization

Indigenization often suffers from chicken egg syndrome; indigenization does not occur because lack of an adequate market, while market does not develop due to lack of indigenous resources. A lot of energy and power equipment is labor intensive, bulky and transport cost sensitive, paving way for local cost efficiency. Except for turbine-generator, the rest of power plant (about 50% of the total) can be locally manufactured with lower costs and higher efficiencies. There is abundant evidence from India and China, where coal power plant and wind power plant are produced at 50% of the price level presenting in OECD countries. Western companies do not even compete when Chinese/Indian suppliers are expected to bid. In automotive sector, vendor industry has been developed largely under tariff protection, which cannot be done in the case of energy sector, where near zero tariffs regime exists due to the need of keeping energy prices competitive, if not low enough. In the case of power (equipment) industry, Energy Fund may go a long way towards development of local indigenous industry creating jobs, self-reliance, saving foreign exchange and reducing costs. Apart from cost reasons, local availability is expected to facilitate speedy project completion and lesser cost escalation risks.

16.2) Risk intermediation

There are wide variations of risks including country political risk, project location etc. The proposed Fund may offer various mechanisms to mitigate risk or offer to share or fully take up risk premium as a subordinate loan or outright grant etc.

16.3) Green Projects

The Fund may also market credit lines, concessionary or otherwise, dedicated to green projects such as alternate energy, energy conservation, energy efficiency, related BMR, CDM etc.

16.4) Commercial Credit lines and Equity Finance

EDF can also source market, manage or intermediate ordinary debt and equity instruments.

16.5) Project Development

To shorten lead times, project identification studies, preliminary and feasibility studies and other investigations may be financed on grant or concessionary loans basis.

17. Towards Zero Energy taxation

Petroleum taxation is a major cause of inflation in Pakistan, especially in sensitive prices index. All daily consumption items have to be transported from long distances to retail outlets and daily workers travel to suburbs which are at the city limits requiring major transportation expense. Petroleum taxation and in general all indirect taxation has been guided more by practical reasons of collectability at source or purchase and rather than much economic rationale. A marginal petroleum tax may still be maintained to cover the user charge and financing needs of the transportation sector.

What is zero-energy taxation regime? Simply put this means integrating the energy sector and its taxation; pooling the taxes and subsidies to balance and cancel each other. This would allow withdrawal of electrical subsidies and reduction in petroleum taxation resulting in falling petroleum prices with the rise in Electrical tariff. This may be acceptable and affordable to all parties; lower prices to consumer, no budgetary loss. Above all, it would be sellable to lenders and donors which pose a major constraint in independent economic policy making.

18. Co-operation with India

Trade with India is permitted in many products. Pakistan would tremendously benefit from trade in Power Technology sector. Indian coal and wind power is probably cheapest in the world and it is next door. Tremendous savings of time and cost can be made through overland transfer and shipment of often very heavy and bulky power equipment. India has installed 11000 MW of Wind Power .The wind turbine price in India is almost half of what it is in Europe and else where. Pakistan-specific power plants can be built by Indian companies within Indian borders under a power purchase agreement with Pakistan companies under PPIB rules and tariff .Very interesting and economical propositions can be built. A consensus needs to be created in Pakistan among the stake-holders in this respect .This consensus seeking initiative should be launched by the political leadership. There is a bipartisan support to the improvement of trade relationship with India. Former

government of President Musharraf also sought rapprochement with India.

Although one would like and prefer to have China in this role. But China is over-committed on many projects including the hydel ones, and the latter is expanding into Africa. And India is next door. Several companies like HMC, HEC and KSEW may be revitalized under such arrangements. Otherwise many private sector companies may also benefit from such trade and Joint venture besides cheaper inputs to the power sector.

2 Energy Policy

Somebody said it well: our policy is to have no policy .Policy can be a drag and a liability , if it tries to be too ambitious , attempts to lay down ground rules for every micro issue ,does not have openness and flexibility (too much of which can be counter productive to a policy, nullifying the very purpose of issuing a policy) , is prepared without consultation of stake-holders (without being a hostage and victim of powerful vested interest) etc. Policy can be annoying to all as it tries to optimize and balance the interests, and consequently every body may not get its desired want and objective fulfilled. If it tries to be hunky-dory, it may be an exercise in useless journalism as many policies really are.

Energy Policy can be a thankless job, as it may try to reconcile producer and consumer interests; producer wanting to have more profits and returns for share-holders which may maximize investments and supply; and consumers with their limited means and general poverty in this country, would want to have it dead cheap. Expensive energy may otherwise lead to widespread stealing bordering looting, as is the case with Electricity in most parts of the country except Punjab. Ironically in Punjab, natural gas theft is the highest than in any other province, perpetrated, not by the poor house-hold but by industrial sector. Then there are supply chain dependency and linkages. If the policy satisfies primary energy sector, it may leave little margin for electricity producer, sending a chill wave to them. All problems are for a sensitive and conscientious policy maker and government functionary. For those who don't care, there is no issue. People don't expect much from them, lose hope and look forward or pray for their exit or ouster.

Policy has to have a heart, and not mind only. It has to consider the weak and the poor, who cannot often defend it, and is not adequately represented and lobbied of. It should provide for pay-off and compensation of sorts to the intended and unintended policy victim. A dam may be a public good, but may displace a lot of people and deprive them of their livelihood. Alternative accommodation and resettlement, sharing of the output (free or near free electricity), sharing of royalties, preferential employment etc are the usual ways and means to broaden the acceptability of projects and policies. Opposition to Kalabagh dam in

Sindh could be ameliorated, if the claimed loss of land and livelihood can be internalized in project costs.

A policy makers and a functionary must integrate himself with stakeholders intellectually, but insulate from stakeholders/vested interests socially. In our set up, secretaries and officials routinely wine and dine, attend marriage ceremonies, travel on the expenses of the company with family and entourage, have their son's tuition of foreign universities picked up and to harmlessly stay in London apartments of the business friends. There are apparently no rules regulating the social conduct of officials except ISI regulating foreign mission's contacts. These kinds of officials are usually very popular among all kind of people, bosses, juniors, clients, public, friends and family. The one who has some qualms about propriety and has some principles, is often disliked and abhorred by almost every one and even suffers from the contempt of his family, particularly of the spouse. Often he may not be that suave and welcoming and receptive open-door type, as his life is often difficult. He cannot and does not invite and entertain. Such a person is awarded various names and pejorative like *Khushka* ,*Be-faiz* ,*non-practical* etc..

In Pakistan, we have special and additional sets of problems. The department secretaries may be coming from totally irrelevant departments like Hajj and Auqaf depending on their lobby and clout with the government in power and other landed interests and connections. On the other hand experts from line departments such as WAPDA etc may be too narrowly focused, specializing in only wire and cable and transformer. Consequently, except for Hajj policy, all policies are usually made with a heavy dependence and input from international agencies. Some times, local bureaucracy cannot even write the TORs for such studies and input. Often this dependence also stems from the loan conditionalities. Quite a few of these consultants often are strong disciples of John Adams who try to implement all economic principles of user charge ,pricing ,resource allocation, and efficiency etc. ,trying to specify treatment without much regard and sensitivity to the condition of the patient. A patient can die of the right medicine due its side effects.

So should we have policy for policies? We certainly need to train our bureaucracy well, introduce some sensitivity to specialization and expertise in recruitment and placement policies. We need to involve and develop think-tanks, NGOs, foundations etc. The political parties should get deeper into policy making while being out of power, by instituting the shadow cabinets, not for being an alternative for military dictators but for developing expertise and capability. We see that finance ministers

invariably come from outside having a lobby in the World Bank or IMF. One can be acceptable to these veritable international institutions and yet be honed in the domestic political process. Unfortunately, in today's circumstances, these are mutually exclusive attributes.

Competition, competitive pricing, decontrol of prices, market development are the usual catch phrases and prescriptions of foreign consultants and their parent institutions. Competition, except among the poor and the labor, has seldom worked in countries like ours. Often it is collusion and conspiracy among the producers and of the controller which may hold sway, which kind of behavior may attract severe penalties including prison sentencing. We have noticed the difficulties of Competition Commission of Pakistan. Penalties are resisted tooth and nails and not paid; if at all some officials are stupid enough to risk their jobs and even safety. Policy makers have to be watchful of such often external advice. Conspiracy theorists may go as far as blaming the donor agencies for conspiring against our national interest and for having an agenda to keep us begging and underdeveloped.

The purpose here is to discuss Energy Policy, although in Pakistan there is no Energy Policy issued as a single document, but is spread subject wise into separate sub-policies. There is Petroleum Policy, Power Policy, renewable Energy Policy etc. It may not be a bad idea to issue an Energy Policy document, that integrates the residual , remaining and interfacial issues and defines vision ,goals and objectives , while introduces the sub-policies. There are multi-ministerial issues connected with ministries of Petroleum and Water & Power and even of Environment where in joint determinations are required and are lacking at this moment, some of which have required prime-minister's interest and intervention in the recent past, although the latter may have been done for stressing and emphasizing the need to fast-track processes and solutions.

There are specific issues that may have to be answered by such policy such as the following: 1) Although energy or electricity for all may be a good slogan or vision, Some quantitative target and schedule should be included not of the rural electrification, but also for thermal/cooking energy need, in which context LPG policy and its pricing becomes a major issue. Also of concern is gas distribution network's expansion. Bio gas is also an important component of rural energy policy. Electricity and gas distribution to Katchi Abadis is to be an aspect worthy of attention in policies. 2) There is today confusion as to the role of regulatory bodies. IN this respect OGRA's performance and conduct has received external criticism. Where do the Ministries' role end and regulatory bodies begin?

There are extreme cases of liberty and control at the same time. For example, NEPRA is at almost unlimited liberty at approving capital costs without defining limitations or guiding principles and criteria. In fixing rate of return, NEPRA has arrogated authority to itself, while it should be given in an energy policy announced by GOP. On the other hand, NEPRA has been constrained to waste its time and energy in Quarterly Tariff determination of DISCOs, in addition to the monthly announcements of Energy prices. NEPRA cannot do anything about it. People are crying hoarse that excessive profiteering is being resorted to by the LPG companies and that LPG prices are unreasonably jacked up.

Ministry of Petroleum criticizes OGRA for inaction and inefficiency, while OGRA argues that it lacks jurisdiction.³) although there is a renewable energy policy, there are serious issues of capital costs. Infact, jacking up of capital costs are a perennial issue; NEPRA does not seem to have guidance in this respect. They are resorting to common sense or/and looking the other way, in place of a policy guidance. 4) There used to be a uniform tariff, irrespective of costs, subsidies filled the gap. As subsidies go, what is to be the policy and criteria or the principles forwarding the costs to the regions? Some rules of Tariff differentiation among user groups and the cross-tariff subsidy; 5) some policy on T&D losses and their reduction, schemes and incentives; 6) Royalties issues on hydro/Tarbela, gas royalties and well-head prices, resolving the grievances of producer provinces like Balochistan.⁷) The policies of appointing Regulatory bodies' management such as members and chairmen of NEPRA and OGRA remain either unimplemented or seem to suffer from gaps and aberration. One has never come across the advertisement for recruitment of chairman or members of NEPRA, although one would have noticed advertisements for OGRA members.

Chairman NEPRA's appointment is under litigation, with claims that he does not have the right qualifications, although I do not really believe in rigid qualifications parameters. For such positions, selection committee's determinations should get priority. Similarly members keep lobbying chief ministers nominations of provincial quota. These senior appointments should be done on merit. Any way now with the 18th amendment, all regulatory bodies being federal subjects, should mean that such provincial requirements would no longer apply.

Surely there may be some rules and procedures, but these are a patch-work requiring integration and consolidation and removing gaps and writing out un-written arbitrary practices. Users and stake-holders should know about it, removing monopoly and undue discretion and thus

obviating the abuse of power and its associated manifestations. Lastly, announcing a Policy is a good way for politicians and ministers to take charge of their portfolios and greater say in affairs than the day-to-day determinations of the bureaucracy. It is a good way of getting known and publicizes their work and acquire respect and credibility among the public.

3 Energy Scenario

HDIP Yearbook is one of three or four main sources of data and statistics on Energy. We have relied on it for most of our work on Energy on HDIP. There is data of six years, enabling us to assess changes in the last five years period (2004-5 to 2009-10). Let us review, what the yearbook reveals;

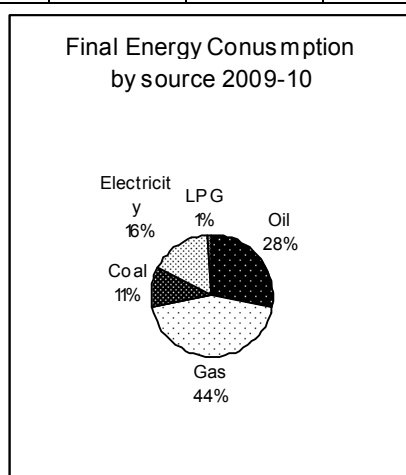
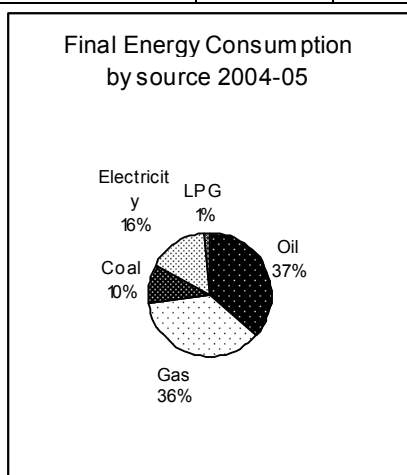
- 1) Over the last five years, total energy consumption has grown at an ACGR (annual compound growth rate) of 3.8 %. The fastest growth rate was in the energy consumption of the commercial sector with an ACGR of 7.2%, perhaps an indicator of the shift of the economy towards trade and the service sector. Industrial sector continues to be the largest energy consumer, having a share of 40.3 %, followed by the transport sector with a share of 30%. The domestic sector is the third largest consumer with a share of 21.4 %.
- 2) As usual the largest share in Energy supply is of gas at 48.8 %, which has grown although at much slower rates of 2% over the past five years due to the supply constraints. Oil consumption has grown at double the rate of gas at 3.9 % and has enhanced its share at 31.4 % of the total. Reliance on oil in power generation sector is growing at an alarming rate of 20.6 % per year ACGR. Over the past five years, the oil consumption in power sector has grown to almost thrice its level in the year 2004-5, while gas consumption in the sector has gone down by 30 %. Consequently, oil has a share of 54 % as opposed to gas with a share of 45 %. The trend needs to be reversed, perhaps with the launching of Thar coal and hydro projects.
- 3) Interestingly, in the Domestic sector, Gas consumption has the largest share of 61.4 % and the largest growth rate as well of 5.0 % per year, as opposed to the share of electricity at 52 %.
- 4) In the industrial sector, Gas again has a dominant share of 58 %, followed by Coal with a share of 27.6 %, while electricity has a share of 10.2 %. However, this may not mislead the reader. A much larger share goes towards industrial sector, if one takes into account the conversion and T&D losses. The share of electricity is 15.6% in the final consumption. Also, the consumption of the otherwise invisible coal is concentrated in

the Cement sector. The dominance of primary energy consumption in the industrial sector indicates the dominance of primary producing activities in our industries.

- 5) In the Transport sector, Petroleum has a share of 76 %, while Gas (CNG) has an appreciable share of about 20 %. CNG conversion has increased at a phenomenal rate of 32.3 % ACGR per year.
- 6) A good 30 % of natural gas consumption goes towards a highly subsidized fertilizer sector, which could be converted to coal (Thar). Fortunately, most Fertilizer plants are located in the vicinity of Thar resources.

Table 3.1: Final energy consumption by source

Source	2004-05	2006-07	2008-09	Unit: TOE	
				2009-10	ACGR
Oil 1/	11,710,920	10,575,330	10,842,614	10,829,455	-1.6%
Gas 2/	11,637,566	14,701,024	16,307,898	17,024,933	7.9%
Coal 2/	3,310,512	4,149,041	3,893,001	4,282,061	5.3%
Electricity 3/	4,994,560	5,921,635	5,731,032	6,054,921	3.9%
LPG	450,379	658,225	569,995	576,631	5.1%
TOTAL:	32,103,936	36,005,255	37,344,540	38,768,001	3.8%
Annual growth rate	10.78%	6.07%	-5.25%	3.81%	



- 7) LPG sector has grown at a rate of 9.5 % p.a. It has a further potential growth in the Transport and as well as domestic sector. LPG is a cheaper source of supply and much less capital intensive in terms of transportation. In the view of high prices of LNG and pipeline gas from Iran, attractiveness of LPG has enhanced. However, the LPG supply potential from the regional markets is much less as opposed to natural gas, which two largest deposits of the world lie in Iran and Qatar.
- 8) In the transport sector, share of HSD (High Speed Diesel) has gone down to 58.33 % in 2009-10, from a share of 74.47 % in the year 2004-5. Similarly, the reverse has happened to the Gasoline, which share has gone up from 13.4 % to 17.2 % in the same period. About 700,000 tons of HSD has been replaced by Gasoline. So much for the environment or matching and balancing the refineries output. What has been compromised in the process is a good vehicle to support public transport. This will not work. Recent political controversy on petroleum prices has indicated that the tilt against HSD is not acceptable. More on this, in chapter on oil pricing.

Table 3.2: Energy Consumption by Sector

Sector	2004-05	2006-07	2008-09	Unit: TOE	
				2009-10	ACGR
Domestic	6,812,535	7,605,145	8,092,132	8,360,016	4.20%
Commercial	1,080,235	1,377,247	1,459,817	1,530,154	7.20%
Industrial	12,759,957	15,792,049	14,845,670	15,604,871	4.10%
Agriculture	717,151	767,266	789,008	849,595	3.40%
Transport	10,071,427	9,721,183	11,371,869	11,654,834	3.00%
Other Govt.	662,631	742,364	786,045	768,531	3.00%
Total	32,103,936	36,005,255	37,344,540	38,768,001	3.80%

Table 3.3: Energy Demand-Supplies (2008- 2025)

	Share %	Growth % p.a.	Level MTOE 2008		Level 2025 MTOE	
			Demand	Supply	Demand	Supply
Oil	30.5	1.3	19.20	3.4	53	2
Gas	47.5	7.7	29.87	29	99	19
Coal	9.2	18.1	5.78	2	17	13
Hydro + Nuclear	1.2	12.1	0.73	0.73	13	12
Total	100	4.42	62.9	42	211	75
Deficit			20.9		136	
Deficit share % of total energy demand			29		64	

Note: Pakistan Energy Yearbook 2006, Medium-term development framework: 2005- 10 planning commission, government of Pakistan adjusted to GDP growth rate of 7%; Compiled by the author; HDIP data; Mukhtar Ahmad, presentation (2005) *ibid* (projections).

Source: Mukhtar Ahmad (Energy Adviser to PM of Pakistan) presentation to South Asian energy conference 2007.

Energy demand projections.

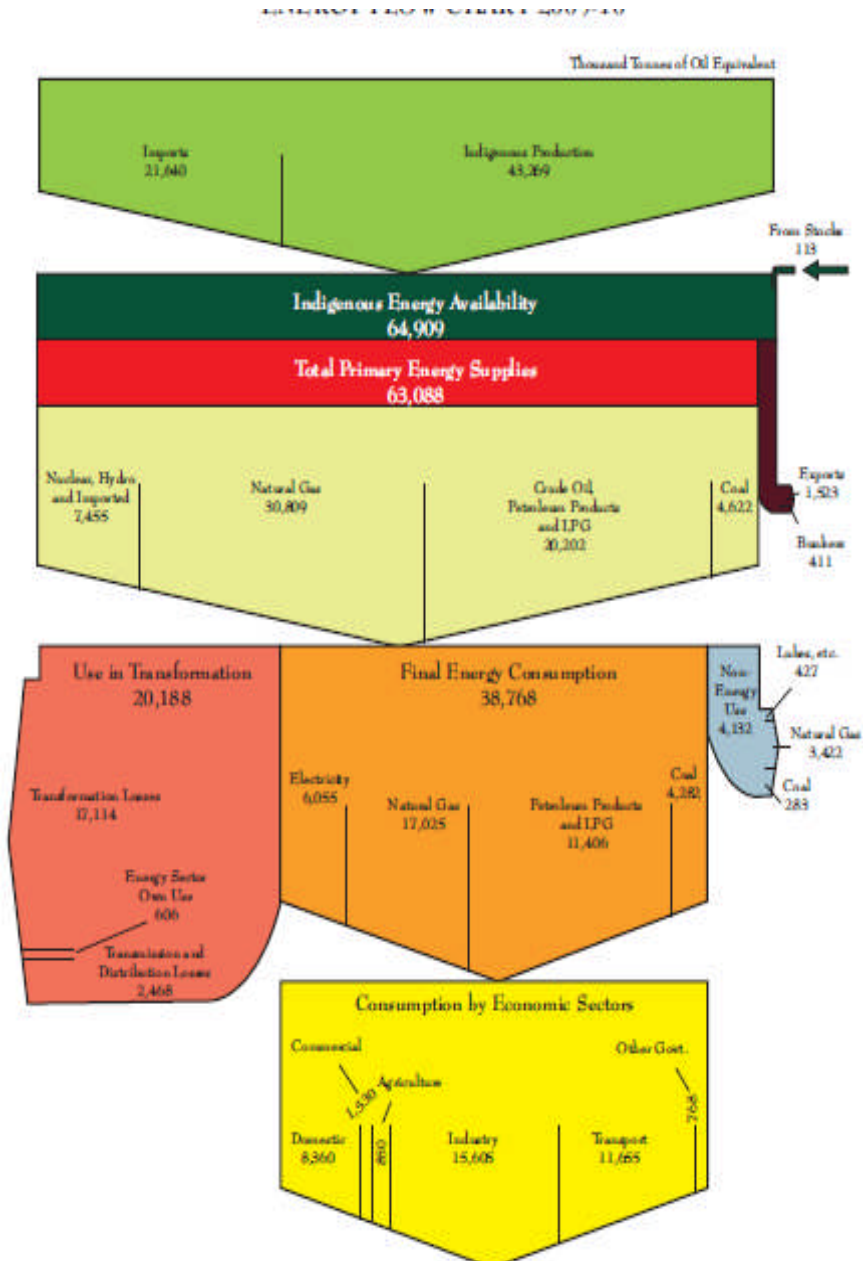
There is a lot of controversy and uncertainty regarding future energy consumption and growth. There are all kinds of forecast; from ambitious to pessimist. There is generally a pessimism regarding the institutional capacity for inducting huge demands over the course of next two decades. Adding to the uncertainty is the dramatic emergence of the renewable energy as a viable and cost effective option. Already wind power is competing with conventional energy, and that may begin to happen in Pakistan as well, although in Pakistan at the moment NEPRA is awarding higher and higher tariffs to wind projects without considering the new trend. There are convincing programs and forecasts for renewables, wind and solar, to cost around 5-6 cents per kWh within a decade. Price is going to affect the demand. Then there are conservation issues as well. Largely under price pressure, energy conservation has started to become effective. One has to look at the wide scale adoption of the energy saver bulbs. Users have become more sensitive to the energy waste generally. This is going to have an impact on demand growth rates as well.

Historical growth rates of total energy demands have hovered around 4-5% p.a. In Pakistan's boom-bust economy, rates have varied greatly over the years. At a minimum, the demand would at -least, catch up with the population growth of 2.5% p.a., assuming a pessimist scenario assuming no increase in per capita income and consumption. On the other hand, there are demand projections that assume a 10% growth rates per annum, continuously for the two decades. This has resulted in some grotesque forecasts of demand. A classical example of which are the projections of Planning Commission in 2005, under Energy Security Plan(2005-2030), predicting electrical demand of 162,590 MW, half of which to come from Natural Gas . The plan is not taken seriously now and has been probably abandoned. This, however, indicates some grave inadequacies in our institutional system. Energy Security Plan was not a routine one done at a low level of hierarchy for annual economic surveys. It was presented at the highest level of PM-President and support of all the relevant departments.

There is justified pessimism regarding institutional capacity in Pakistan for inducting a large capacity induction. Recently, a seminar was held, where a respectable author predicted that no more than 30,000 MW would be added in the next two decades. My own projections based on demand side are for 61000 MW of new capacity. However, keeping in view the supply side constraints, one does not see more than 10,000 MW on stream in this decade, assuming implementation of major hydro and coal projects, and another 20,000 Mw in the next decade of 2020-30. That would mean an installed capacity of hardly 55000 MW.

Pakistan's existing gas resources are nearly exhausted, but there is a widely believed potential to discover more gas resources, once political break-through is achieved in Balochistan. The nearby middle-eastern region is rich in gas resources. Gas resources of Iran and Qatar are going to enter into the South-Asian regional gas market. There are projects like IPI pipe-line and LNG imports in the pipeline. Thar Coal itself can generate a lot of combustible gas as well. Thus Gas is expected to be on the energy menu for quite a while, despite temporary supply constraints. Keeping in view such potential and uncertainties, there is a need to undertake a serious assessment of demand and supply growth and constraints and come out with a reliable energy plan.

ENERGY FLOW CHART 2009-10



Courtesy HDIP

4 Energy Resource Development

Energy sector has a potential to drown Pakistan

Last oil price hike was among one of the major factors of devastating Pakistan's economy. What will another hike do is any body's guess? Great risk lies in there. Our dependence on oil is increasing despite such impending and known risk. Almost all power plants that have come on stream recently run on oil; more are to come. Domestic oil production is not increasing, despite some potential. Gas production is going down and in the process of being used up. New exploration and discoveries are hampered due to political and law and order problems in Balochistan and elsewhere. Despite Balochistan package and other palliatives and offers, political situation in Balochistan has only worsened.

One notes a trend of more attention being given to the imported energy projects, perhaps being despondent of resolving the problems of local resources. There are a number of domestic resources that could be developed and put to use. In this chapter, we would highlight some of the major resources in this respect.

Table 4.1: Pakistan Energy Potential and Resources

Resource	Potential	Known Reserves	Installed/ Consumed already	Net available
Oil (million Barrels)	22,000	936	609	327
Gas (TCF)	282	53	23	30
Hydro	40,000	20,000	6,447	Renewable
Coal (billion tons)	200	185	Nil	200
Wind (MW)	110,000	20,000	Nil	Renewable
Solar	Unlimited	20,000	Nil	Renewable
Coal base methane (TCF)	25-50	-	-	-

Source: Pakistan's Energy Development: the road ahead; Akhtar Ali; Royal Book Company-Karachi; 2010; table 2.12

The Thar Coal

I will bring in the oft-repeated Thar coal issue, which is on the table for at least a decade. Almost all major experts and consultancies have prepared reports on it and have found it feasible. Thar coal is almost equal to the combined total of oil and gas resources of Iran and Saudi Arabia put together, in terms of its energy content. Worldwide coal based electricity is less than fifty percent cheaper. Imported energy will continue to be expensive than local resources, despite the role of all the rentiers classes. No serious move seems to be in the offing. If the ten point agenda deliberations only manage to find out a way for breakthrough on Thar, it would in itself be a major achievement.

The bureaucratic circles tend to show that there is progress on Thar coal. But the fact remains, that there is almost none. Allocation of blocks, MOUs and even feasibility studies do not mean much, as many such things have been done in the past. Under-ground coal gasification project has raised false hopes among the public. Without casting doubts on the scientific credentials of its eminent promoters and on the technological potential of the route adopted, the problem of scaling up would remain for which there is no capability in the country of a level that would be acceptable to the lending banks. While the existing gasification would yield useful data, we would be back to the square one, which is of requisite financing.

The bad news is that under criticism and pressure from international Green lobbies, World Bank has discontinued its technical assistance program on Thar coal, amidst news that government of Sindh has persuaded them to renew it. Even if they do renew, it sends us ample signals on difficulties that we are going to face towards financing Thar coal. With time, the opposition to coal would increase. Our problem is immediate and the renewables are still to be perfected and improved to be cost effective and competitive. In any case, renewables are projected to have a share of 20% even by the year 2050. What are we to do in the meantime. The threat is that by the time we put our act together, although fossil based power age may not be over, the financing regime may become too difficult and hostile against coal.

Towards a Thar Coal Infrastructure Company

The residual issue as it stands today is not the financing issue of the mining and power parts of the projects, however difficult it may itself be, it is the financing of infrastructure part which is proving to be a

stumbling block. Various estimates put these requirements to between 1 to 2 billion US dollars. More money is required for infrastructure, than the first coal mine and power plant itself. Government of Sindh, obviously would not have such resources, nor would the federal government. And in these days of emphasis on provincial autonomy, where is the appetite for common projects. There are also issues as to the technical and management capability of the provincial bureaucracy, as the project continues to be run from the narrow confines of the Sindh secretariat. Apparently, there is no shaft of light at the end of this tunnel, although it is not the only one.

In all humbleness, this scribe makes the following proposals. There are two options. One is to tender for a large project of 5000 MW or so, which may be able to assume the infrastructural development costs. The cake becomes big enough to absorb all kinds of interests. This is not new. In India, this size of coal projects are being planned already. The feasibility of this proposal in Pakistan context can only be tested once it is actually tendered. The second option would be to float tenders for establishing a mining development company that undertakes to develop and finance the infrastructure and manages the Thar coal operations on behalf of Sindh government, within the framework of the relevant rules and regulations. The company recoups its investments by granting mining leases and charging a fee on coal production by individual companies. Obviously such a company would be a multinational which may have a joint venture with local private sector and government of Sindh's share in it. Such a company would offer many advantages. First of all to bring in finances, which appear to be well-nigh impossible for Sindh government to finance? Secondly, the operations would be more commercial like and would be on fast track. Ironically, I have made a case of yet another feasibility study? Not necessarily.

Oil and Gas Potential

Many reliable sources have indicated that there is much more gas potential, as much as six times greater, than has been discovered already. Exploration activities have been hampered by the poor law and order situation and lethargy and inefficiency of our companies like OGDC and PPL etc. Gas exploration and development is no secret or rocket science. If we put our house in order, activate and energize these companies and apportion some investment (almost the same as we would be spending on subsidies and higher oil prices).

One should not become complacent with the profitability of these companies, which is natural in high oil price environment. Their original mandate is Exploration and Development. Technology is changing. Those oil and gas resources that were marginal and were abandoned are suddenly becoming productive. In the US gas prices have plummeted recently due to the advent of new technology. The technology is available and can be further facilitated through the US AID programme.

There are many options even with the old technology. Thus with more gas and more CNG, the required insulation from higher oil prices for the transport sector is very much on the card. More gas can also go into power sector. But there are other more appropriate options as we shall see in the following. Some crash action is required.

I am not the only maverick privy to all this information. In 2005, a presentation was given by the then chairman of the Planning Commission, to the then President and the P.M. in the presence of all the Who-is-who of the scientific and petroleum bureaucracy. The presentation is available on internet. One of the major conclusions of the study/presentation was the Gas potential. It was projected then that there was enough Gas potential to generate 80,000 MW of electricity by 2030, as opposed to 5-6000 MW of gas based electricity generation today. Even if the projection is dubbed as an over-shot, there is consensus that much more gas potential is there. Instead of developing local potential we are running after imported options, for which neither the government nor the people will have the resources to pay for. Be it LNG from Qatar or pipeline gas from Iran, the sellers are linking the gas price to 75-85 % of oil price and are in no mood to entertain floors and slabs, limiting the damaging peaks in prices. The imported gas will be more than twice as expensive as locally produced gas, and as much expensive as oil. Let us have a serious look at our domestic options.

Exploring non conventional gas (shale) resources

I would like to draw the attention of the readers and policy-makers on yet another vast potential, called Shale Gas. There are two types of Gas resources; conventional or core resources, the ones we are consuming now; b) non-conventional gas resources. The non-conventional resources have three further classifications; a) Coal-based methane found in coal deposits; b) Tight gas resources, are the ones which have been abandoned earlier due to special problems and were not explored .On Tight gas resource GOP has issued a draft policy, which process is moving at a snail pace, and needs to be expedited; c) Shale Gas is a

relatively new resource and technology that has not been discussed or evaluated much in Pakistan. My focus in this article is on Shale gas.

But before, I dilate on the Shale gas issue, I would like to say a few words about Coal-based Methane (CBM) gas resources potential and its exploration and exploitation in Thar Cola field. Currently Under ground Coal Gasification project is at an advanced stage of implementation. I would propose that the scope and domain of the project be extended to explore CBM gases as well. It is not a very difficult task, and drilling of only 100-200 meters is required as opposed to thousands of meters in case of conventional oil and gases. Foreign companies have earlier been awarded exploration licenses earlier, but were cancelled for unknown reasons. Sindh government would be doing a lot of good to the province, if it starts taking interest in this matter as well, by initiating policy processes and practical steps including the ones proposed earlier.

American Petroleum Institute (API) defines Shale gas as,” natural gas from shale formations. The shale acts as both the source and the reservoir for the natural gas. Older shale gas wells were vertical while more recent wells are primarily horizontal and need artificial stimulation, like hydraulic fracturing, to produce. Only shale formations with certain characteristics will produce gas. The most significant trend in US natural gas production is the rapid rise in production from shale formations. In large measure this is attributable to significant advances in the use of horizontal drilling and well stimulation technologies and refinement in the cost-effectiveness of these technologies. Hydraulic fracturing is the most significant of these. Tight gas, coal-bed methane, and shale gas will make a major contribution to future North American gas production. Unconventional gas production is forecast to increase from 42 percent of total US gas production in 2007 to 64 percent in 2020. Despite the current economic conditions, the long-term need for US natural gas should be strong enough to support these anticipated future production levels. “

Today, due to the emergence of these new resources, there is a glut of gas in the US. Instead of importing gas from Canada and LNG from the Middle East, there are talks of exporting gas. Gas prices in the US have plummeted to less than 4 USD per 1000 Cft. This is despite, rising oil prices. The US resources of gas are now forecast to extend beyond 100 years, at current rate of consumption and including these resources. We can have like of the same. We are also one of the significant gas producing countries of the world. Lethargy and despondency that seems to have taken over us must go.

Yet, there is another gas resource that has a significant potential. Stranded gas resource are those which could not be utilized for a variety of reasons; being of low heating value, of not pipe line quality; away from network; or not being in sufficient quantities. UCH gas resources were once considered stranded and were not utilized due to low heating value. It was used later by an IPP, which project is now being expanded after a very successful first installation. There are reportedly many stranded resources which could be put to use by creative policies. For example, rental or mobile power plants could be installed around such resources. GOP has reportedly announced its intentions to move in this direction.

Oil and gas sector in Pakistan is a victim of neglect for a long time now. There have been controversies in appointment of management and chief executive of such vital organizations like OGDC. Ministers have been changed, one after the other, and none of them had familiarity with the sector. Provincial autonomy issues have also caused uncertainty. Whatever be the political dispensation or the approach to slice the pie, the need for an organized core establishment in this sector cannot be over-emphasized. Issuing policies alone, although necessary, is not enough. Policies have to be implemented. Both foreign exploration investment and as well as national one are required. As the former finance minister Shoukat Tarin, once said, we are following soft paths of launching energy import projects instead of developing our own.

The US government has expressed its willingness to share this technology with other nations and has taken certain practical steps in this direction. Global Shale Gas Initiative (GSGI) has been launched, and many nations including India and China have been taken as members of this initiative. Unfortunately, Pakistan despite being dubbed as most allied ally or lackey or care-taker of US interest is found nowhere in the list. Partly or mostly, the fault probably lies with us, of not showing interest and lobbying enough in this respect. Part of the problem lies in the under-development of our oil sector, and partly the law and order situation in our gas prone areas, which discourages involvement of external parties, agencies and companies.

We have to do something about these issues and work towards a political break-through and settlement with the disgruntled forces, and pave the way for initiating much needed efforts both to exploit conventional and new resources in the Oil and Gas sector. On diplomatic front, instead of almost a sole focus on acquiring arms from the US, or cash resources,

technical and technological acquisitions such as in Shale gas development should be pursued.

I would also appeal to our US benefactors to be more willing and forthright in this respect, as we do not find much of the physical evidence of the promised US assistance and support to Pakistan in the Energy sector. Instead of forecasting or planning on how to deal with a potentially divided and anarchic Pakistan, (as one of my old friends Prof. Stephen Cohen of Brookings Institution and a well-known expert on Pakistan has recently written), it would be a good investment to take care of some of Pakistan's critical problems.

Wind Power

There is a 20,000 MW resource lying unutilized close to Karachi near Gharo. Wind Turbine prices are coming down for the last two years. There apparently is no move in this direction. If at all, it is quite likely that NEPRA would be approving projects at previously held high rates, as has been the case with a few other projects. India has been able to install 11000 MW of wind power capacity, at 50% cost of the international prices utilizing its low labor costs and other advantages. The same could have been done here, utilizing the underutilized capacities in the countries major projects like HMC and Karachi Shipyard, and the private sector as well.

Global Shale Gas Initiative: US Government

Overview

The Department of State (DOS) launched the Global Shale Gas Initiative (GSGI) in April 2010 in order to help countries seeking to utilize their unconventional natural gas resources to identify and develop them safely and economically. Shale gas is one of the most rapidly expanding trends in onshore U.S. oil and gas exploration and production. According to the U.S. Energy Information Administration (EIA), during the last decade, U.S. shale gas production has increased fourteen-fold; it now accounts for 22% of U.S. gas production and 32% of total remaining recoverable gas resources in the United States. By 2030, EIA projects that shale gas will represent 14% of total global gas supplies, providing the reserve base necessary for expanded consumption in a business as usual scenario. Future climate policies could increase demand for shale gas

since it is a lower-carbon “bridge fuel” to reduce CO₂ emissions. Although the U.S. shale gas experience cannot be precisely duplicated, its application through GSGI can be instrumental in helping governments understand the complexities of shale gas development. Governments often have limited capability to assess their own country’s shale resource potential or are unclear about how to develop shale gas in a safe and environmentally sustainable manner through establishing the right regulatory policy and fiscal structures. The ultimate goals of GSGI are to achieve greater energy security, meet environmental objectives and further U.S. economic and commercial interests.

Country Participation

Countries have been selected to participate in GSGI based in part on the known presence of natural gas-bearing shale within their borders, market potential, business climates, geopolitical synergies, and host government interest. Within GSGI, priority countries have the greatest potential for benefiting from GSGI opportunities. Other, non-priority, GSGI participants include those countries that have expressed interest and meet GSGI criteria. To date, partnerships under GSGI have been announced with China, India, Jordan and Poland, with bilateral agreements possible with several other additional countries.

Government-to-Government

The GSGI uses government-to-government policy engagement to bring the U.S. federal and state governments’ technical expertise, regulatory experience and diplomatic capabilities to help selected countries understand their shale gas potential. U.S. government agencies that partner with the Department of State under GSGI include: the U.S. Agency for International Development (USAID); the Department of Interior’s U.S. Geological Survey (USGS); Department of Interior’s Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE); the Department of Commerce’s Commercial Law Development Program (CLDP); the Environmental Protection Agency (EPA), and the Department of Energy’s Office of Fossil Energy (DOE/FE). A benefit of this government-to-government cooperation is the potential for establishing and strengthening long-term working relationships at the technical and ministerial levels.

Sample Activities

GSGI activities are tailored to each country’s specific needs and availability of funding. Examples of GSGI activities in priority countries

include: shale gas resource assessments; technical guidance to evaluate the production capability, economics and investment potential of shale gas resources; and workshops and seminars on technical, environmental, business and regulatory challenges related to shale gas development. Engagement with non-priority countries focuses on regulatory policies and fiscal structures challenges. At the request of these countries, DOS organizes conferences, meetings, training and public-private sector events in the United States. They are also invited to participate in select multilateral GSGI events.

Source: www.state.gov/gsgi

As it is electricity is expensive and kind of unaffordable for most of the people and even businesses, a Pandora box will open up. The issue may not end up in terms of the aforementioned cool and cold logic. The issue is far more complicated. KP will argue that you take away our (it is not theirs' solely) cheap hydro electricity at one Rupee a unit and sell it back to us at 6-7 Rupees. In Balochistan cost of gas fired electricity is Rupees 4 per unit and similarly Sindh produces a lot of gas for electricity production. What is the way out? Balochistan's consumption is quite low and could be handled in a variety of ways. In Sindh, problems would be further compounded due to KESC vs rest of Sindh. More thinking is required on this.

And as for the pricing, GOP has been subsidizing electricity amounting to Rs 150 billion per year. It has not been able to pay it, however, along with the non-payment of electricity bills by the provincial governments. This has given rise to circular debt of Rs 200 billion. It does not get paid off, as more amounts are added to it successively. And IMF is also requiring do away with these subsidies. If these subsidies are withdrawn, along with the uniform subsidized tariff, electricity rates in Sindh, KP and Balochistan would increase. In Punjab electricity rates are expected to go down? Why? Is it another so called "machination from Punjab" as many nationalists would be akin to term it? Not really the story is as follows. About 25 % of electricity is lost in T&D losses; a large part of it is theft. This T&D loss (theft mostly) is not uniform through out Pakistan. In Punjab, it is the lowest around 12% in northern and central Punjab and 15% in southern Punjab. Everywhere else, these losses are in the range of 35-45%. Currently these excessive losses are hidden and averaged out in uniform tariff. Without electricity subsidy borne out by the GOP, every province and user would pay for its losses. Thus Punjab having lesser losses would end up in lower tariff and the opposite will happen to the users elsewhere.

However KP issue can be at least partly resolved by resolving the Hydel Profit/Royalty of Tarbela Dam produced electricity. No permanent solution has been implemented. Despite practical suggestions proposed by this scribe some 18 months back. My suggestion is simple. Give 12% of Tarbela generated electricity to KP free as royalty or alternatively pay 12% royalty at CPPA whole sale price. Both are more or less equivalent, transparent and simple to understand and not mired by the complicated calculations of AGN Kazi. It is being done in India, a country not disliked by Sarhadi Gandhi to say the least? Elsewhere the royalties are lesser. This maximum should be acceptable to the government of KP and even the other distracters. An early decision should be made in this respect in consultation with the stakeholders. These royalties should go towards adjustments of tariff increases. I would tend to support 12% free electricity which has a larger public appeal and would be politically attractive.

5 Energy Prices

Are Energy prices high in Pakistan and are the current and projected increase in energy prices especially electricity are justified? The proposed increase of 2% per month in electricity tariff to effect a raise of 24% in one year over and above the increases already made may become a political bomb shell. There may be genuine economic dislocation of people and may result in non-payments and increased theft and pilferage, nullifying the purpose for which these increases are being made or proposed to be made. There are difficult questions involved. If compared with the purchasing power and generally low incomes of the people, energy prices are generally high.

In South Asia including Pakistan, there is a unique and welcome aspect of energy tariff that small and poor consumer is charged much less than others, in some cases the rates are just a pittance, if compared with international rates. However, now business community is protesting loudly, as while they may be rich personally but their businesses are poor and operate in low margin regime, whether exports or domestic market, except for the monopolists and cartel members who may be able to extract or pass on rather undue profits and prices.

In Pakistan, South Asia and other poor developing countries are charged less than industry and commerce, making the tariff of latter even higher than they would have paid in a neutral regime. In most developed countries, the reverse is true. Large customers are charged lower rates on account of lower overhead and processing costs. In some cases Industrial tariff is kept artificially low to boost competitiveness or regain it. Chinese prices are a case in point but that may have more to do with the exchange rate issue. A more indicative policy pricing would be France, where one of the lowest or perhaps the cheapest energy tariff is maintained partially artificially, although cheaper nuclear and hydro energy has more to do with it. The most expensive energy rates are found in most of Europe and Japan, except those countries like France, Sweden and Norway where there are cheaper nuclear and hydro resources. Elsewhere in Europe Energy is severely taxed on one account or the other? Gasoline and Diesel are taxed at 100% and even more, while electricity is being indirectly taxed due to rather excessive feed-in tariff for renewables.

The cheapest energy is found in most of the Middle Eastern countries where oil and petroleum products are usually priced below crude oil prices. The other country is USA, where energy is minimally taxed. There is hardly 15% tax in the US on diesel and gasoline, resulting in the cheapest motor fuel among the advanced countries. In Pakistan both retail and wholesale prices of energy have been traditionally low. Hydro and gas based electricity are the examples. Also gas itself, which has been priced less than half of energy cheap and abundant America. Over the last many years, GOP has been subsidizing electricity: the last year's subsidy was of more than 1 Rupee per unit resulting in budgetary deficits and circular debt.

We used to have relatively cheaper electricity due to cheap gas and hydro power. Over the years, the incidence of gas and hydro has been decreasing in the total package, and the share of expensive and imported oil has been continuously increasing, generating pressures for tariff increase. Unfortunately due to non-implementation of any hydro scheme and lack of any major discovery of natural gas due to lack of adequate level of Exploration activities, the traditionally cheaper energy resources are getting eclipsed. Imported gas, whether LNG from Qatar or Pipeline gas from Iran is no cheaper. It is being increasingly linked with oil and that at very high rate of 75-80 %.

If reliance is increasingly on imported fuel, there is no economic case for cheaper energy than elsewhere because almost every input including power equipment is imported (except manpower), costing more due to extra transportation and logistics. There is a strong moral and welfare case, however, to try to minimize the energy prices as much as we can and search for solution that may bring the prices down by whatever margin that may be possible and feasible. Bulk of our population is poor save a small percentage of the well to do or those who are insulated from inflation. Energy is a necessity, used in transportation, cooking and living. Let us examine what are the options and potential available to us in this respect.

There are no quick fixes other than finding the money from somewhere and meet the shortfall. Money comes from taxes which most of us evade; consequently we are one of the least taxed countries of the world. It can come from royalties of oil which we do not have and can only dream or pray about. It can also come from savings which we cannot due to a variety of political reasons. Quite a few among us want a tall foreign policy agenda, continuous rift with neighbors, big armies, welfare state

and no aid or trade, all in one. And we have anchors as well? It is not easy to govern Pakistan.

In the mean time Government should take the business leaders in confidence and explain its difficulties and constraints and invite their proposals. They may come out with ideas on reducing tax evasion by their community, enhancing government revenues and its ability to continue to provide subsidies to the energy sector. However, they are more likely to come with a demand to levy income tax on wealthy landlords. Secondly, the real incomes of the average person in Pakistan are going down. There is an urgent need to promote income generating employment opportunities. At present level of general unemployment and under-unemployment, almost nothing is affordable. Genuine land reforms and income tax on agriculture may be the need of the hour.

Finally, there may be some scope of negotiating with the IMF for doubling the adjustment time to two years, reducing the increase to 12% per annum than the present 24% in one go in one year. Another immediate option available to the government is to negotiate with IMF a zero tax-subsidy regime for the whole energy sector, whereby taxes on petrol and diesel and other energy inputs, balance out subsidies on electricity. Alternatively government may examine the possibility of substantial tax cut on petrol and diesel which would go a long way towards controlling the run-away inflation and would make the increases in electrical tariff more acceptable to people. In the medium term, there is a lot that can be done towards bringing down energy prices in the country and would be a subject of our next section in this series. In short these are;

1.improving thermal efficiency by retiring and replacing the old plants with new more energy efficient ones; 2)fast track implementation of Hydro and Thar coal projects; 3)exploration of gas resources including non-conventional tight and shale gas resources; 4)reduction of T&D losses; 4) more rigorous regulatory processes to bring capital costs down; 6)promoting conservation and efficiency at consumer end including large commercial buildings and industrial sector; 7)energy labeling programs for energy consuming domestic appliances .

**Table 5.1: Energy prices in various countries in US dollars
(dated 5/2010)**

Countries	US Dollars					
	Gasoline	Diesel	Residential Electricity	Industrial Electricity	Industrial Gas	Residential Gas
	Per liter	Per liter	Per kwh	Per kwh	Per 1000 Cft	Per 1000 Cft
France	1.7816	1.4688	0.1794	0.0897 - 1.0404	12.2320	26.4572
Germany	1.8088	1.5504	0.2890	0.1731 - 0.1889	15.8274	33.2180
Spain	1.4960	0	0.1817	0.1033 - 0.1196	11.6068	24.3859
Italy	1.7816	1.5504	0.3473	0.1904 - 0.2312	13.4044	28.5284
UK	1.7680	1.8088	0.1871	0.1360 - 0.1700	15.4366	16.3354
Netherlands	2.0128	1.5232	0.3233	0.1224 - 0.1822	18.3285	18.4458
Denmark	1.8768	1.5096	0.3633	0.17 - 0.17	19.7745	45.8408
Sweden	1.6864	1.5368	0.2547	0.0816 - 0.0938	15.0067	46.9742
USA	0.77		9.2 - 17.27	5.30 - 8.65	9.58	13.68
Japan	1.164	0.866				
Korea			0.0886	0.06		
Malaysia						4.25
Singapore			0.0165			4.05
India	1.06	0.7978	0.06 - 0.13	0.075 - 0.126		
Pakistan	0.8378	0.7185	0.0206 - 0.1590	0.0880	4.4050	1.0957 - 5.7439

* USD per 1000 cft (2008 prices) 1 USD = 85 PkRs = 46 IRs = 0.7352 Euro

Source: Compiled by the Author from various sources, EIA, IEA, EU, IOC, SSGC, OGRA, NEPRA, and CEA

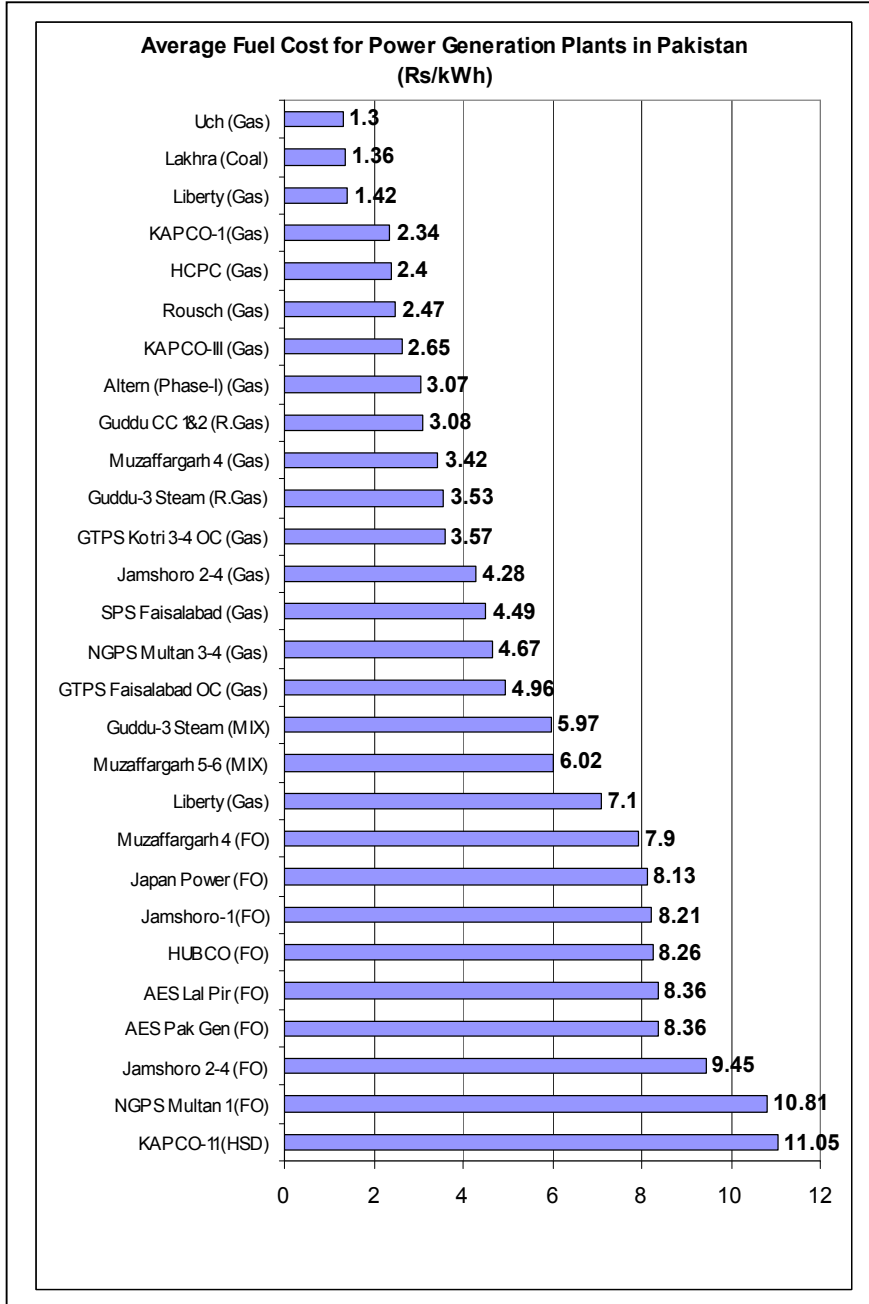
Coming back to the energy sector, following suggestions are being made by this scribe;

1. There are a number of stranded or low btu gas deposits which can be utilized in bringing cheaper electricity on line in two or three years time. A special case in point is of Uch gas which remains unutilized due to the unreasonable demands of the project sponsors with respect to capital costs.
2. NEPRA and other regulatory agencies be encouraged to diligently and carefully process the tariff cases and bring the tariffs down to the extent it is feasible. It is widely known that there is significant padding in capital costs proposed by the project sponsors resulting in higher tariff.
3. Hydro power projects and Thar coal should be implemented on fast track basis to avail of cheaper aspect of these resources.

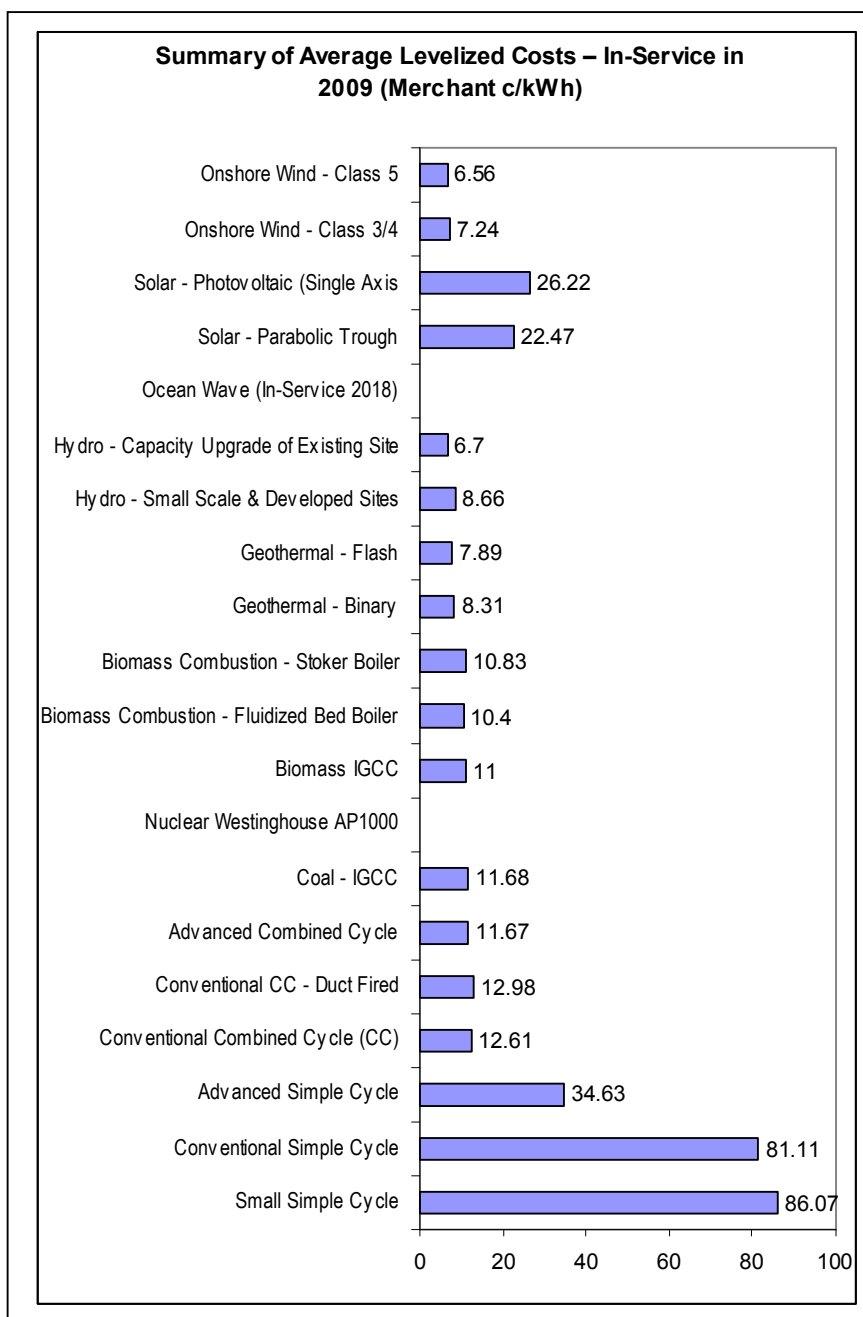
4. Thermally inefficient plants be either retired or used sparingly for peak load. Investment be made in thermally efficient plants. Fortunately some action has been taken in this respect by KESC and another public sector plant.
5. Conversion from oil to coal and to gas (in case of availability of LNG or Iran Pipeline) may result in reduction of cost of generation. Reportedly Planning Commission has already initiated studies in this direction.
6. Reduction of T&D losses including theft and pilferage. The current incidence of 25-30% of T&D losses is very high. It can be brought down to 10-15%. Already, DISCOs in Punjab are having T&D losses in the proposed range. The culprits are Sindh, Balochistan and KP including KESC. While there may be socio-political issues involved in T&D losses, at least technical losses could be reduced through technical improvements.
7. There is a potential of discovering more natural gas in Balochistan. Present government has taken many initiatives to resolve political problems and difficulties in that province. More should be done in this respect, once there is respite from other challenges.
8. Conservation and energy efficiency at consumer end should be facilitated. This has a lot of potential in reducing the monthly energy bills of the consumers, if not the energy prices and tariff. Most electric fans and electric motors in Pakistan are energy deficient wasting a lot of energy. Similar is the case with Air-conditioners. Energy efficient motors are unaffordably expensive. There are no checks on producers or any technical assistance programme for SMEs which manufacture most of the electrical equipment. Standardization or labeling programme could create market incentives to improve electrical efficiency of their products. It has been done successfully elsewhere including the neighboring India. There is no reason, it cannot be effective here. Energy savers have already made a sizeable impact on people's energy bill, even of factories. More initiatives are required in this respect.
9. Similarly there is hardly any building with insulation in residential or commercial sector. No window glass has ever been found insulated, resulting in heavy heating/cooling losses. Relevant government agency should launch awareness campaign and prepare legislations to bring about controls in this area. This has been one of the most neglected areas.
10. Our industrial sector except some notable exceptions has not been traditionally much interested in conservation and

efficiency issue , although that may be changing due to rising energy bills and lesser opportunities for energy theft. The textile sector, one which is the most vocal against raises in energy prices has been found to be particularly wasteful and least interested in improvements. Some magic should be found to reform them.

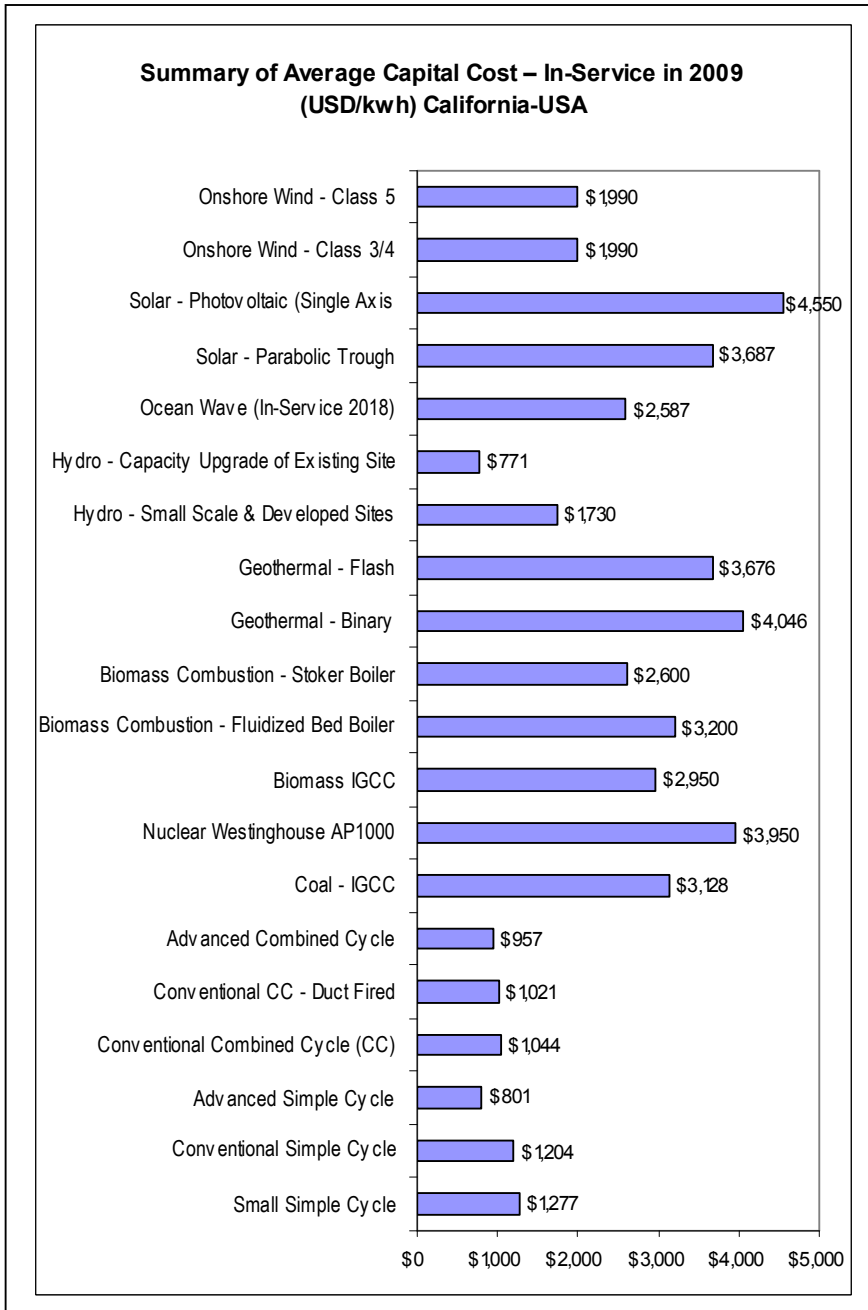
Appendix:



Source: NEPRA



Source: California Energy Commission (CEC)



Source: California Energy Commission (CEC)

6 Oil Pricing

The recent petroleum price increases in the first part of 2011 announced by the government has been basically motivated by the phenomenal increase in Crude Oil prices exceeding over a period of a few months beyond USD 125 per barrel, as opposed to 87 USD per barrel only in the last months of 2010. While it may be legitimate to pass on the increase of crude oil prices, the charging of Petroleum Levy, as usual, when the basic prices are so high is unwarranted and inadvisable. If high petroleum levy was unacceptable and was withdrawn last month at relatively lower crude oil prices, where is the magic which would placate the general public and make them accept the tax now? There are only two possible explanations; a) it is a negotiating instance; b) the advisors of the government are not sincere with it and want it to pack up sooner than later. Perhaps former is more likely, as the news is coming in for some compromise and downwards revision.

Petroleum is a major revenue earner for GOP, an estimated Rs. 120 Billion per year, over and above the GST revenue. Apart from its absolute value, it is reliable and efficiently collectable. Also, the subsidies in allied areas such as Electricity require some source of finance. Petroleum taxation has also been justified and made use of in financing road building and its maintenance; all of this make a strong case for some level of Petroleum Levy (taxation) in the long run.

On the other hand, transport and the fuel are essential items, having a direct and indirect bearing on inflation and the cost of living; indirect effect being of equal magnitude than the direct price increase. At higher crude oil prices, the affordability of Petroleum levy is reduced very significantly.

It is rather difficult, however, to understand the mind that has been working on the application of Petroleum Levy. As common sense would tell, Petroleum Levy and prices should move in the opposite direction for the purpose of price stabilization; when crude oil prices are high, PL should come down and vice versa. As they say common sense is not common. The reverse seems to be the case. During the peaks of 2006, PL was higher, as prices were, and then PL went low in 2007, when the crude prices came down. Then at the peak in 2008, when Petroleum

prices crossed the 100 Rs (for Gasoline), PL went at its highest, crossing Rs 25 per Liter, triggering (although unwarranted) Supreme Court involvement and its committee. Had opposite being the case, prices would have been affordable, relatively speaking. For most part of 2009, GOP could have levied a little more PL, than it did. While 2010 went almost all right with manageable crude oil prices and a constant PL, the continuation of the same became unaffordable and unacceptable among the high crude oil prices; and hence the continuing acrimony since the advent of the year 2011. An almost withdrawal of PL on Diesel and a much reduced PL of 3.16 Rs per Liter, seems to have settled the issue. Unfortunately, the reader would not be able to view the accompanying graph, which would have so graphically described, what can almost be called the, "Petroleum Levy saga".

Also, there appears to be some hidden padding in HSD prices, as LDO (light diesel) had been priced at Rs.73.21 per liter, as opposed to Rs.86.09 for HSD; both are essentially the same products (In international market one does not find such terminology. One wonders, if it was defined, what it is). Bringing HSD prices to LDO level can have quite salutary effects on the economy by pushing down the mounting inflation and as well as the peoples welfare. With the total withdrawal of Petroleum levy, GOP loses Rs. 37.50 Billion (10 Billion Liter HSD consumption at Rs 3.75 per Lit PLD), from Diesel and Rs. 12.50 Billion (2 Billion Liter Gasoline consumption at Rs.6.25 per Lit PLD), which totals to a rather staggering sum of Rs.50 Billion per year or Rs. Rs.4.2 Billion per month. The latter figure is more valid as, the price decision is for one month; and the same problem to emerge next month again. To avoid such frequent politicization and controversy, we have made a proposal in the following.

But before that, it may be useful to have some comparison with international Gasoline and HSD prices. There are two bench mark prices; one of the USA which traditionally maintains the lowest prices among OECD countries and the other of Luxemburg, which maintains, the lowest in Europe. In the USA, the average Gasoline price is Rs.76.62 per Liter and HSD price in the USA is Rs. 84.17. By comparison the prices in Luxemburg are Rs.145 per Liter for Gasoline and Rs 140 for HSD. In France and Germany, these prices are in the range of Rs.170-190 per Liter. Traditionally, Europeans charge heavy taxation on Petroleum products. The low prices of Petroleum products in the US are due to low taxation, lower crude oil prices and more competitive and efficient oil industry.

In our region, in India, Gasoline price, as last revised on 1st March, 2011 stood at IRs.63.08 (PkRs. 119) per Liter in Mumbai and around roughly the same figure in other major Metropolitan regions, except Delhi, where the prices are kept at 5 IRs lower, interestingly. Similarly Diesel prices were set on September 8, 2010 and remain unchanged till today (March, 4, 2011). In Mumbai; it is IRs 42.06 (PkRs. 79.33) per Liter. Petrol is 50% more expensive than Diesel or alternatively Diesel 33% cheaper than Petrol. The rationale is obvious; Diesel is used by the public transport of goods and passengers. This point is amazingly lost on our policy makers. Diesel prices in India are cheaper than Pakistan, albeit by a small margin. The Gasoline price in India (PkRs 119) is 55 % higher than that in Pakistan (Pk.Rs76.58).Due to higher share of Diesel in overall fuel consumption, 4-5 times than Gasoline in both the countries, a small subsidy in Diesel results in 4-5 times higher price premium in Gasoline. Pakistanis seem to be doing the opposite; premium on Diesel subsidizing Gasoline. Result; there is mayhem on the street.

In Pakistan also for a long time, as the data available since 2001 indicates that HSD prices used to be kept significantly lower(46-27%) than Gasoline .It is only since 2009,that the trend has been diametrically reversed , causing and contributing to high inflation. There has been no parallel development in the international market. It was an autonomous and domestic change. It needs to be reversed back, to result in lower diesel prices than gasoline. There are apparently two justifications for this unjustified reversal. Diesel causes more pollution than Petrol and secondly there is a surplus of petrol in the refineries output, which is exported with difficulty. The merit of both the arguments is much weaker than the public transport costs issues.

Some non-traditional ways may have to be explored as well. Firstly, it is widely known that Saudis offer some concessionary prices to Pakistan that is not perhaps passed on to the consumer. The whole issue of oil pricing has to come into open with no holds barred, keeping in view the gravity of the situation. Secondly, it may be advisable that government reviews the month-to-month price adjustment policy to replace it with a yearly or half-yearly price adjustment. The International oil price increase can be temporary at times due to seasonal or transitional issues such as the trouble in Libya. Passing on price increases immediately, causes hardship to general public, undue profiteering of the petroleum dealers at the time of frequent changes, and generates public discontentment among many other side effects as well. Temporary and fluctuating oil price increase creates permanent inflation, as the indirect inflation does not come down instantly with oil price decreases. It is

possible, as it used to be a practice before and is still done in many countries including India and Bangladesh. As the government is short of cash, a price stabilization fund can be created through agreement with international suppliers and friendly countries with zero net cost at the end of the year.

Some improvements in the situation can be made by reversing the current policy of maintaining higher prices for Diesel, and lower for Petrol. In old days many developing countries even subsidized Diesel due to its use by public and goods transport. Even now, in most countries except USA, Diesel is kept cheaper. The space for discussing the pros and cons of the existing policy is not there. The public purpose is huge enough to warrant a review and reversal in this respect. It has to be done gradually; otherwise the motorcyclists would be enraged. Some creative solution should also be explored to separate the motor fuel from that of Motor cycle that may broaden targeted subsidy option of the government. By now, some working rules on Petroleum pricing and management must be developed under a bi-partisan understanding. Following suggestions may be considered;

- a) Import quantum restriction to a maximum of 10 Billion USD, beyond which some rationing scheme should be triggered.
- b) A maximum PLD (e.g.,) of Rs. 10 per Liter on floor price of (e.g.,), of USD 75 per barrel.
- c) A zero PLD at crude prices of 100 USD per barrel, and pro-rata for 76-99 USD per barrel.
- d) GST cuts to be triggered at crude oil prices of USD 125 per barrel, in addition to zero PLD.
- e) Use of price stabilization fund (internal and external) to avoid frequent changes in oil price.

The Rationing

However, old-fashioned it may sound; Pakistan may have to go in for rationing both in Energy and Food sectors; in the case of Petroleum for demand management and in Food for targeting prices and subsidies. Prices do not always act as rationing instruments for a variety of reasons, especially when a large number of people and sectors are able to pass down the load to others and ultimately to the weak and impoverished consumer. The proposed rationing may be used for directing subsidies to the intended recipients. The whole of Europe went into rationing of petrol in 1973. In the proposed rationing, to be introduced at an

unbearable stage in oil pricing, the defence sector may have to be involved as well.

Infact some of the institutional rationing has already begun. Oil has not been supplied or not used voluntarily by the power plants, as it became too expensive. Gas substitution has been made, despite gas shortage. First KESC did it and was taken to task, but later every body else saw the merit. More formal and inclusive steps may be required and should at least be planned for. The last step in this chain would be of ordinary consumers and individuals. The cost and disturbance in planned rationing would be much less than that of de-facto shortfalls and emergencies.

Towards a Zero- Tax/subsidy energy regime

Over the last two years, 2008-09 and 2009-10, there was an average income of Rs 120 billion Rupees from Petroleum Taxation (PL). PL tax rate has been varying over the years. When the oil prices have been low, PL taxation rates were higher and vice versa. PL tax rates have gone as high as 25 Rs per Liter, amounting to 40 % of the selling price of the petroleum product. One could assume a long term average of Rs. 10 per liter for Gasoline and HSD separately. For 12 billion Liter of Petroleum product, the revenue comes out to be Rs 120 billion Rupees, neatly matching with the budgetary figure of the last two budgets. On the other hand for the last several years, GOP has been subsidizing the power sector to the tune of Rs. 120 billion per annum. Under an agreement with IMF, and even otherwise, these subsidies have to go. Already electric Tariff is on the way to the full cost recovery. Thus over the last several years, either by design or default, a zero-energy taxation or subsidy regime was in existence. From January this year, PL rates have come down under public and political pressure, while Crude oil prices have been rising from 85 USD per barrel to the current rate of 105-110 USD. It appears that crude oil prices may not come down in the near future, as is indicated by forward contracts and future trading. GOP should have collected a PL of RS 60 Billion by the close of the December last (2010), it may be able to earn another 10-20 Billion Rupees on this account. Thus there is going to be a shortfall of Rs 30-40 Billion. GOP subsidy to the power sector may also be reduced by the same amount, making the total to be a zero. Thus it appears to be a robust equilibrium, and may be adopted as a policy than a mere coincidence.

There may be irritants or spoiler to this rather unique and tentative equilibrium. A 10 USD per barrel reduction in crude price brings in an impact of Rs5-7 per Liter, and vice versa. GOP may be able to share in

such reduction, by the way of earning a portion of this reduction. It may not be able to offer much assistance beyond withdrawing whatever marginal PL taxation remains today in the wake of 5th March reductions. People are talking about reduction in GST, if the prices go beyond 125-135 USD per barrel. Such extra-ordinary prices may be short lived, and hence there would be a role for a **price stabilization fund**, balancing the peak and troughs in prices, as has been discussed elsewhere.

Transparency & Regulatory oversight resisted.

There is an issue of lacking transparency and persistent attitude of the ministry of petroleum against regulation and transparency. We will discuss this issue in detail a little later. In the beginning let me share with the reader, the classical case of LDO and HSD. Light Diesel Oil(LDO) is a local product, the like of which is not visible in international market. On a monthly basis, OGRA issues its circular with considerable augustness about it, announcing the regulated prices of Petroleum products. Its price list includes all kinds of products like Kerosene, Jet fuel, Hi-octane etc including Petrol. The price list includes LDO, which is hardly consumed or sold(less than 1%), and excludes HSD which has a share of 80%, in the total consumption. The HSD price announced almost surreptitiously, and appears on the PSO web-site, apparently with no sign of any regulatory process. So whatever lame and inadequate regulatory function of OGRA is there, HSD is out of limits for OGRA. Can any body explain the rationale?

Ideally all prices should be determined through unhindered market forces and their competition. It requires a large number of buyers and sellers. In Pakistan and other similar developing countries, sellers are usually not in high numbers and usually collude in price fixing and hoarding and manipulation of all kind. Sugar is a good testimony to the aforementioned. In the case of utilities such as electric power and oil and gas, there is a strong case of due regulatory process due to the monopolistic character of this sector. NEPRA and OGRA have been formed in this perspective.

Transparency in regulated sectors is measured by the following factors;

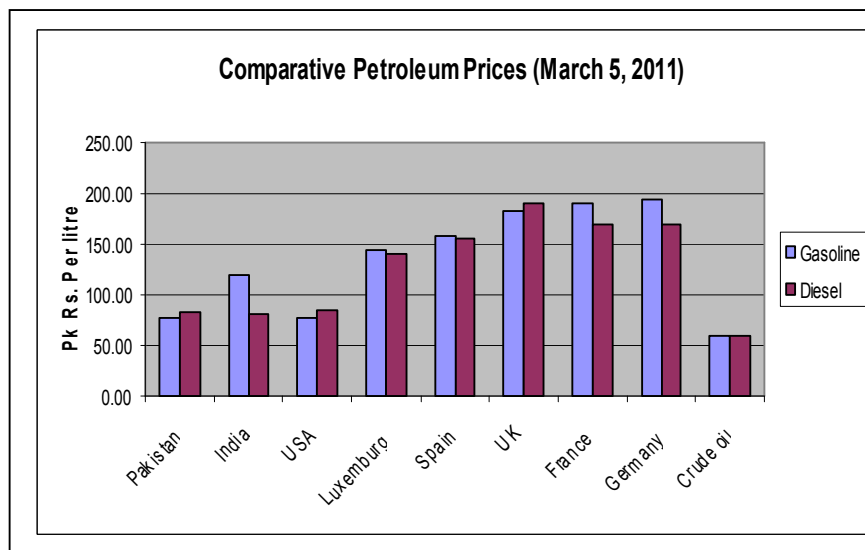
- 1) Independence and reasonable domain of the regulatory agencies.
- 1) Written and publicly available policies, rules and regulations.
- 2) Public participation in Tariff and pricing.
- 3) Un- restricted publishing of data

Measured on the above yardsticks, Oil and Gas sector in Pakistan appears to be quite lacking. On the other hand, Pakistan's electricity sector and NEPRA's performance in this respect appear to be far better. An examination of the websites of NEPRA and OGRA would amply demonstrate this. While NEPRA website is full of petitions and determinations, public hearings and data, OGRA website publishes tariff without any pretension of public process. We will examine transparency issues in Oil and Gas sector and OGRA's role and performance in some detail in this article.

OGRA's regulatory process seems to be only concerned with the determination of Tariff for the Transmission and Distribution of natural gas that is supplied by the two companies, SSGC and SNGPL. Measured on the above transparency criteria, the performance in this limited respect appears to be relatively much more acceptable. On the technical side (standards) also, there appears to be a reasonable OGRA activity and performance.

Oil and Gas sector is worth more than twenty billion US dollar in terms of sales and output. Except for the aforementioned exception of Gas T&D and mere posting of petroleum retail prices and gas wellhead prices, there isn't much to show by OGRA. The sector is almost totally regulated, except LPG where there is confusion as to the regulatory domain. Admittedly OGRA works within the framework of the role assigned to it by Ministry of Petroleum (MPNR) and the GOP. It cannot arrogate powers to itself, although it can build pressure towards higher domain and role for itself. The due process is lacking in the following areas: Surely there are and must be rules in the following areas which in itself is not enough. The actual application and adjudication of those rules is to be the subject of due public process, where price is not determined by the market forces. International transparency moves and initiatives these days even go beyond public tariff and pricing determinations. They are demanding *Publish what you pay (PWYP)* policies and regime, for it has been found that the actual payments vis-à-vis publically determine tariff may be deviating for legitimate and not so legitimate reasons. Following areas should come under some process of public input and scrutiny through the regulatory process of OGRA and the latter should not restrict to posting of results but invoke the whole regulatory input and process into these.

Exhibit 1:



Source: Compiled by the Author, data from OGRA, Indian National Oil Company, PSO.

- 1) Well-head prices of oil and gas.
- 2) Ex-refinery prices of petroleum products such as gasoline and diesel, including crude oil imports
- 3) Oil pipeline tariff
- 4) PSO imports of petroleum products (50% of the total demand is met through imports valued at around 8 billion dollars)
- 5) Furnace oil pricing despite claims of being in the open sector; and most importantly
- 6) High Speed Diesel (HSD) pricing.

On the other hand, what little powers have been granted to OGRA, successive leadership of that organization have not chosen to make use of those. For example who stops OGRA in holding public hearing for discussions on the other constituents of petroleum prices, if the ex-refinery (wholesale or producer price) is made an untouchable tree for it?

MPNR has traditionally being reluctant to cede powers to OGRA. In all the above areas, the closed offices of oil bureaucracy have the sway. There has been much controversy regarding the self pricing role of OCAC (Oil Companies Advisory Committee) which has since been disbanded or depowered. It is ironic that OGRA is not considered adequate enough for the role of OCAC. Who does not like power and

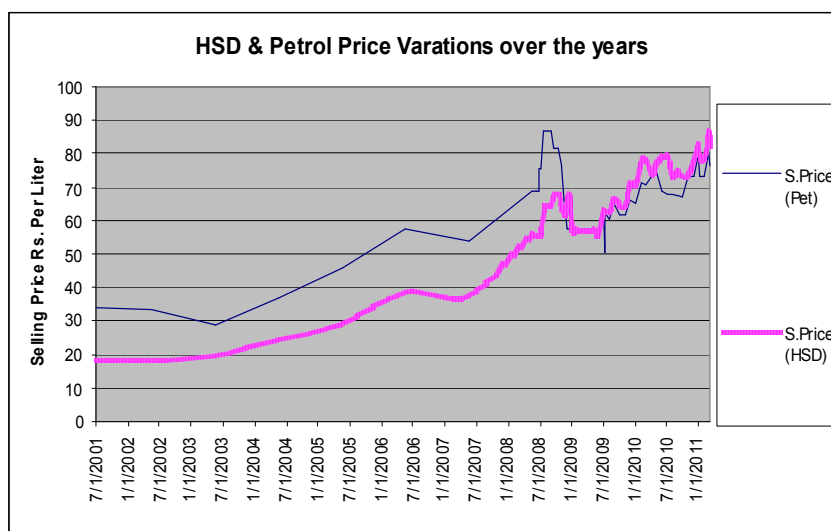
authority? Public process absolves responsibility and implication of public servants in scams and others in a highly skeptic Pakistani society today. They should support the expansion of public process. Transparency would also encourage and promoted much needed direct foreign investment in this vital sector. And finally, it is the responsibility of legislature and public representatives to intervene and write laws and require regulation in this respect.

Table 6.1: Comparative Petroleum Prices Countries (5/3/2011)

Countries	Gasoline		Diesel		Currency Conversion	
	Euro/L	Pk Rs/L	Euro/L	Pk Rs/L		
Pakistan	0.67	76.58		82.22		
India	63.08	120.02	42.06	80.03		
USA	3.38	76.63	3.72	84.17		
Luxemburg	1.21	145.07	1.17	139.93	USD	85.62
Spain	1.32	157.38	1.30	154.99	Euro	119.50
UK	1.52	181.88	1.59	189.65	Irs	45.00
France	1.59	190.01	1.42	169.69		
Germany	1.62	193.59	1.42	169.57		
Crude oil	0.69	59.32	0.69	59.32		110.00
						USD/bbl

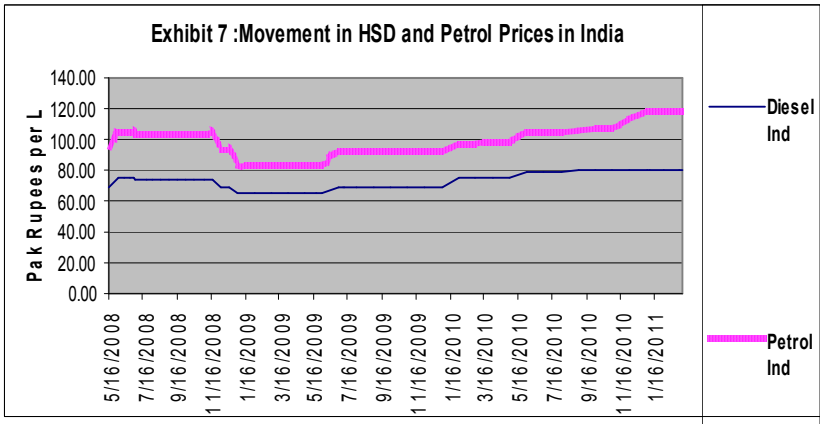
Source: US EIA & EU Energy Portal

Exhibit 2:



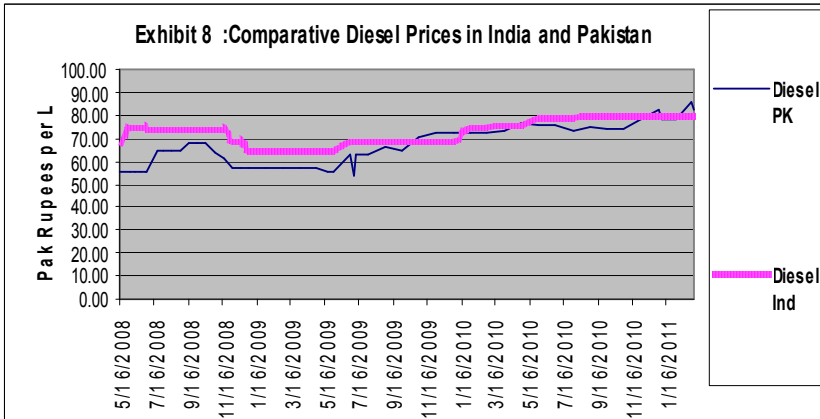
Source: Compiled by the Author, data from OGRA, Indian National Oil Company, PSO.

Exhibit 3:



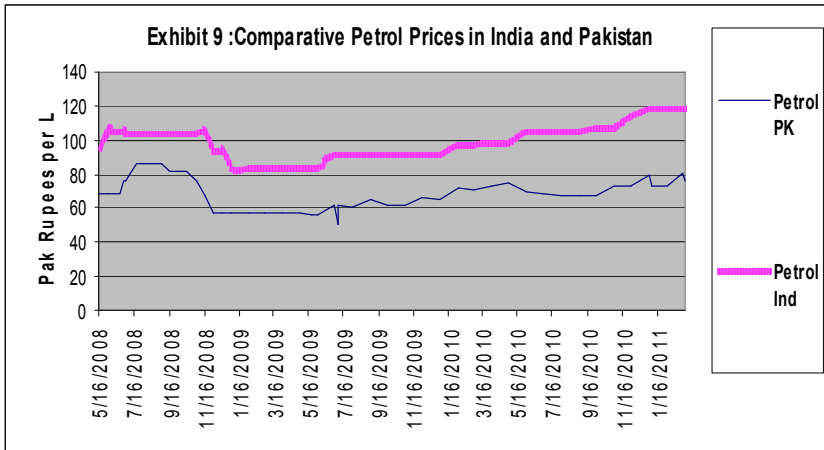
Source: Compiled by the Author, data from OGRA, Indian National Oil Company, PSO.

Exhibit 4:



Source: Compiled by the Author, data from OGRA, Indian National Oil Company, PSO.

Exhibit 5:



Source: Compiled by the Author, data from OGRA, Indian National Oil Company, PSO.

Table 6.2: Funds flow in Energy Sector 2009-10, 2010-11

Mn Rs			
Classification	Budget 2009-10	Revised 2009-10	Budget 2010-11
Non Tax Income			
Gas Development Surcharge	29,937	29,995	29,995
Discount Retained on Local Crude Oil	15,045	6,000	12,000
Royalty on Oil	7,973	14,246	15,500
Royalty on Gas	27,057	28,000	32,000
Total	80,012	78,241	89,495
Tax Income			
Petroleum Levy	112,000	101,546	110,000
Subsidies			
WAPDA(Total)	62,903	147,005	84,000
GST WAPDA	6000	5527	4000
WAPDA Tubewell (Balochistan)	4746	5318	
WAPDA GOP share (12.5%) for Agri. Tubewells	2157	2460	
Inter-Disco Tariff differential	10000	77000	30000
FATA	10000	16700	10000
Interest on TFCs	30000	40000	40000
KESC (Total)	3800	32521	3317
KESC GST	1285	306	1000
KESC Tubewell (Balochistan)	198	198	0
KESC on account of Tariff Differential	2000	31700	200
KESC payable to PSO	317	317	317
Power Sector (total)	66703	179526	87317
Oil Refineries	15000	11224	10807
Total			
PSDP			
MPNR	2374	1000	623
Water and Power	47031	28500	28424
Total	49405	29500	29047

Source: GOP Budget Documents

Table 6.3: Bloomberg Prices (March 3, 2011)

OIL (\$/bbl)				
	PRICE*	CHANGE	% CHANGE	TIME
Nymex Crude Future	104.42	2.51	2.46%	03/04
Dated Brent Spot	115.72	1.26	1.10%	03/04
WTI Cushing Spot	104.42	2.51	2.46%	03/04
OIL (¢/gal)				
	PRICE*	CHANGE	% CHANGE	TIME
Nymex Heating Oil Future	308.93	4.00	1.31%	03/04
Nymex RBOB Gasoline Future	304.64	2.02	0.67%	03/04
NATURAL GAS (\$/MMBtu)				
	PRICE*	CHANGE	% CHANGE	TIME
Nymex Henry Hub Future	3.81	0.03	0.82%	03/04
Henry Hub Spot	3.70	-0.05	-1.33%	03/04
New York City Gate Spot	3.99	-0.13	-3.16%	03/04
ELECTRICITY (\$/megawatt hour)				
	PRICE*	CHANGE	% CHANGE	TIME
Mid-Columbia, firm on-peak, spot	24.06	6.38	36.09%	03/04
Palo Verde, firm on-peak, spot	28.62	4.24	17.39%	03/04
BLOOMBERG, FIRM ON-PEAK, DAY AHEAD SPOT/ERCOT HOUSTON	32.85	1.04	3.27%	03/04

Notes: Bloomberg Oil Buyers Guide subscriber? Log in *Commodity futures and energy prices are in U.S. dollars. Unless indicated otherwise: intraday data is at least 15 minutes delayed; mutual fund NAVs are updated at the close of every market day; all prices are in the local currency; Time is ET. Sponsored Links

7 Natural Gas

Natural Gas pricing

It has been reported recently that natural gas prices would be rationalized. We have a differential tariff for various sectors and for various classes of customers, in furtherance of the economic goals and priorities such as subsidizing the poor and the agricultural sector. Infact, it is a cross subsidy, and government does not end up paying anything in this respect. Some ADB wise man seems to have suggested doing away with it, as a precondition to some loan agreement. It is through these lending arrangements that little thought through ideas and policies are imposed on us. I am not sure weather government would accept much of it.

Admittedly gas prices in Pakistan, especially for the residential and fertilizer sector are low, but so are the production cost and the incomes of the people. In a utopian world of these economists, all prices every where would converge to be the same. This kind of adjustment is certainly not acceptable. One has to only look at the subsidies to agriculture sector and other protective policies for the generally inefficient and uncompetitive manufacturing sectors in the West, and gauge the level of commitment behind these theories and utopia. They would suggest every other type of adjustment, sacrifice and even cruelty on us and the vast number of poor living among us.

The ostensible logic may be that the gas is under priced and thus sends wrong signals resulting in sub-optimal consumption and waste and that price should represent scarcity value leading to allocative efficiency ultimately. And those higher prices would enhance producer profits and would thus attract investment in Exploration and Production, increasing supply and stabilize prices but at a higher level. We have seen how capitalism and competition has been thwarted by the powerful monopolists and the vested interest. Take the case of Sugar, but that is a separate subject, which we would not enter into here due to space constraints. In short all economic theory is made to fail in this country in the implementation process.

Let us test this logic against the real world data. Today, in the US gas prices are one of the lowest in history, having hovered around 6-8 USD per MMBtu (call it unit for simplicity) for most part of the last ten years. This is a yearly average; otherwise, there is significant seasonal variation. In gas producer countries, gas prices have never been linked to Oil prices; reason very simple and oft-practiced. Natural gas is not tradable, except for LNG, which represents an insignificant proportion in trade and production. Oil is tradable and hence priced as per international trade prices plus some tariff and taxes. It is only in non-producer countries of Europe, Japan and South Korea that gas prices are linked to Oil. In these countries, natural gas prices have hovered around 75 % of the oil prices. In the case of Japan and South Korea, it is the LNG factor that operates in pricing. Throughout gas producing countries of Asia e.g. China, Malaysia, Indonesia, natural gas is priced low even as compared to the low prices of US; the rationale affordability of people and competitiveness of industry. Chinese economy and exports would nearly collapse if higher energy prices and higher exchange rate is forced on them.

Currently, there is no major rationale to this kind of linkage in Pakistan, as gas trade in the form of either LNG or expensive natural gas from Iran, are still a few years away and even then its contribution in overall consumption is projected to be low. As the costly imports increase there would be an automatic reflection of it and no such policies would be necessary. We have already increased gas prices over the recent years, especially the gas prices coming from Balochistan. The recent currency devaluation and its expected slide downwards would keep the prices high and increasing. No special tools should be moved in to achieve this.

Power sector is the major consumer of gas with a share of 33.7 %, followed by general industries 28%, domestic 16% and fertilizers another 15-16%. CNG/Transport consumption has been increasing at a very fast pace until recently, and is expected to stabilize around 10 % of the total consumption. Higher gas prices for power sector would enhance electricity tariff which is slated to increase under various pressures and sources including rental power. Something, however, may have to be done with respect to the gas prices in Fertilizer sector, where gas goes literally free, at one-tenth of the average tariff. But increasing those would increase crop prices. This is the kind of hidden subsidy that we provide to agriculture. This is indeed a very difficult situation.

There is nothing wrong overall in the present policy of cross subsidies and differential tariff. It should continue. The government would be well

advised not to consider these unwanted proposals of policy reversal (of gas price hike and the so-called rationalization) at all. Such proposals enter into the national policy apparatus through lending requirements of the often unfeasible projects, which the vested interest keeps pushing on government functionaries. By the way has any public hearing been organized on LNG project as yet and their cost? What would be the use when it is a fait- accompli? The funny situation is that consumer and trade bodies start shouting at only the very end at the level of distribution companies' tariff, be it gas or electricity and enter into useless and destructive litigations, when the die has already been cast. Expensive projects are approved with considerable padding by some of their brother project promoters and investors.

The Gas allocation controversy; Sindh vs Punjab

There is a general gas shortage in the country for the past few years. Known reserves and deposits are on the way to exhaustion, while the exploration activity has been at a low level. Most of the gas these days is being produced in Sindh these days. Gone are the days when most gas used to come from Sui in Balochistan. Thanks to exploration activities in Sindh, many new deposits have been discovered in Sindh and production started from those wells. More exploration activity is expected to yield new gas resources in Sindh. Due to the political and law and order problems in Balochistan ,no new deposits are being discovered as no exploration activity could be sustained there for the past many years. This is a very unfortunate situation, in which no body is benefitting, people or province of Balochistan who are deprived of income and employment and the other parts of the country and people as they are facing gas shortages.

Shortages create many economic and political problems. A number of controversies have developed. Industries have protested and some of which closed down in protest or due to gas shortage. Earlier Sindh assembly passed a resolution demanding priority in gas allocation and a number of prominent politicians issued statements in this respect. They have complained that Sindh's gas is being taken elsewhere in the central system and that Sindh's demands should be met first, and then the residual should go elsewhere. The issue of distribution priorities! They have argued that there is a constitutional provision in support of this stance. Now KESC has joined the debate. In a message to the public and consumers in Karachi printed in newspapers, CEO of KESC demanded more gas allocation and implied that the gas supplies were available and

adequate gas supplies are unfairly denied to his company. And in a related case, LPG distributors threatened to go on strike because of what they think is an arbitrary increase in prices by the LPG producers' cartel. Let us examine the merits of the issue. To top it all, some multilateral agencies are proposing to enhance gas prices to the level which in their view would solve many problems including the ones in gas allocation. GOP is already under severe public pressure regarding the proposed increase in electricity tariff.

There is a general shortage of gas throughout the country. This year in Punjab, people could not even cook their food in winter season due to the heavy gas shortage, while industries remained closed for long periods of time for the same reason. Power plants in Sindh are not getting enough gas and thus load shedding of electricity. Gas and electricity are distributed to user sectors and customers who pay for the service. It is not supplied to an abstract concept or entity as a province. Then gas is distributed and allocated as per priorities. For example, fertilizer sector is a priority and supposing all of the capacity is located in Sindh, allocating and distributing gas to Fertilizer sector does not mean that gas is allocated to Sindh.

If this logic of prior right of producing province is accepted, then many problems would have been created for Sindh itself. Gas exploration and abundance in Sindh is only a recent phenomenon. Previously all gas consumed by Sindh came from Balochistan and most hydro electricity came from Sarhad/KP. Very little was consumed or allocated in the producer provinces, as there was no demand or distribution investment was not justified for widely scattered insufficient demand. Similar demands and protestations were made by some circles in Balochistan, when natural gas was brought to Karachi and Sindh first leaving Balochistan towns unsupplied.

The issue is that production, transmission and distribution facilities have to be invested in. Often the investment comes from private and foreign entities that have to be paid back. The revenue is generated through consumers and customers and not from provincial or federal government. Principles of economic efficiency, markets, sustainability and rate of return to investors are involved. If we do not learn to respect these principles, we are going to end up in more shortages due to lack of investment in supplies sector and higher production costs of utilities and services. The capacity of people to pay has already reached or even crossed their limits.

If there is a shortfall both equity and efficiency considerations are there in allocating priorities. Where there is no efficiency or criticality issue, equity principles of distribution to be applied and not a province based formula based on the ownership of resource.

As to the ownership issue of the resource , except for political ownership which does not mean much in practical sense ,bulk of the resource(88%) that has been extracted belongs to the producer who has spent money, effort, resources and know-how in bringing out the resource from the earth and processing it and making it use-worthy. So the ownership of the extracted resource belongs to the producer, save the royalty portion of say 12%, and not to the province where the resource is located. What is in ground belongs to a people and provincial or federal government as per laws and constitution of the country, but when it comes out of ground it is a different issue.

Energy sector in Pakistan has been developed as one undivided market. It is still the case even after 18th amendment. Electricity has become a federal only subject, while it used to be a concurrent subject earlier. In the past almost all investments in energy have come from federal or foreign equity or debt sources. All WAPDA investments and the ones in Oil and Gas have come from federal kitty. And even in future all investments in nuclear and hydro resources is to come from federal resources. After all these investments, would KP politicians be in their right to make similar demands of electricity ownership. Certainly, they can demand their royalties which issue should be resolved on a permanent basis. They cannot possibly demand that Tarbela should meet their demand first and then the electricity should flow to the rest of the country.

KP has been suffering severe load-shedding despite Tarbela being right there. In future also when hydro power would come from Bhasha and Bunji etc dams, there would be no fundamental right of priority allocation to KP. In fact if Sindh's argument and demand of priority allocation based on producer provinces right is accepted and established, it would be a sufferer in the long run .Temporary advantages and ups and downs do develop in various parts of the country at different times and these should not lead us to bring in constitutional issues unnecessarily.

Constitutional provisions are often desires and ideals. These have to be creatively and constructively interpreted and understood. It is well-nigh impossible for the framers of the constitution to understand the implication of every sentence they write into the constitution. American

constitution explicitly allows only currency, defence and foreign policy in federal domain. American courts have interpreted the constitution so broadly and in totality, that there are sixteen federal ministries dealing with 16 or more subjects. Constitution may have to be amended if too literal interpretation of the quoted constitutional clause is attempted.

As for KESC, its issue is a bit complicated due to the tariff issue, which may not be intelligible to the non-specialist. KESC runs on what is called a constant tariff, with periodic adjustments for the fuel price inflation and general inflation as well. Gas is more thermally efficient fuel than oil in the sense that in combined cycle plants, an efficiency of 50% or more is possible today than the traditional efficiency of steam turbine plants run on oil. KESC is expected to earn through increase in thermal efficiency and reduce other losses and leakages.

There are many other issues with KESC tariff formula as it exists today. Normally such formulae are agreed to for relatively short periods. It has no answers or solutions for the long run. It may cause much more serious problems in future, details of which cannot be explained in this space. A review of this formula is required, along with a number of reforms and pro-active actions. For the time being GOP has allowed Oil sales and supply in lieu of non-supplied gas, at the price of gas. Perhaps this solves KESC's working capital problem. A longer run solution would require the following steps; KESC should be a part of the central pool and eligible to draw from the central pool as per an agreed formula; KESC to be treated as an IPP, and allowed to make investments in generation outside Karachi, for example utilizing cheaper gas resources elsewhere. KESC's generation assets and activities be separated and treated at par with other IPPs. A new tariff formula based on cost-plus approach and central whole-sale pricing is introduced as it is there in other parts of Pakistan.

8 Liquid Petroleum Gas (LPG)

There is usually a lot of protestation against the increase in LPG prices which are termed unjustified by the consumers and other stakeholders, rate of Rs 135 per liter, against its normal. There appears to be a lot of confusion in LPG policies. Apparently, the sector is unregulated, yet OGRA is prescribing LPG producer prices of local and imported production. Perhaps these are recommended prices and do not carry the weight and support of law. The air is full of controversy. Minister of petroleum and others in government have spoken against LPG price increases and profiteering of the LPG sector. A parliamentary Committee is investigating some questionable deals in LPG sector while OGRA keeps threatening the marketing companies with action and dire consequences. Let us examine in these passages the issue and the nature of the problem in some detail and the possible options and approaches that may be available to resolve these. Some perspective is essential.

LPG access and consumption

Only 20% of households in Pakistan have access to natural gas. Gas supply to consumers is dictated by the availability and expansion of the gas distribution network. Some 68-83% of households rely on wood and biomass. Bulk of the natural gas goes to the non-domestic sector; 33% to power, 28% to industries and 16% to the fertilizer production. Only 16% of gas goes to the domestic sector. For small residential consumer, the gas tariff has been kept really low, at 1.5 USD per unit as compared to the average rate of 6 USD per unit. By contrast average tariff in the US is 12 USD per unit, while in most of Europe it is twice the US gas tariff. I am recounting this data for giving the reader a perspective, and am not building an argument for increasing domestic gas tariff.

Most of the cheap domestic fuel (natural gas) is available to the urban areas. Most people in rural areas either burn woody biomass and some consume LPG. Half (50%) of LPG consumption goes to the transport sector, mostly in Taxis which cannot afford the initial cost of CNG installation or operate in non CNG areas. 30% of LPG goes to residential and commercial sector. Also roadside cafes and tea-stalls and tharas use LPG for a variety of reasons of supplies related issues.

The remaining 20% is consumed by other commercial and industrial users.

LPG has unique characteristics, some of which make it a preferred fuel, especially its relatively easy transportation as compared to the natural gas which has to be distributed through pipeline and also cannot be stored conveniently. Despite this LPG consumption in Pakistan is very low; 2.6 kg per capita, as opposed to 7.3 kg in India, 12 kg in Philippines. LPG consumption peaked in the year 2006-7 at a level of 649,000 tons, and came down in the last few years to 500,000 tons, perhaps due to the price increases and unstable pricing regime that we would discuss in the following. This amounts to some 25 Billion Cft as opposed to 204 billion cft (12%) of natural gas consumption in domestic sector, and 1275 Bcft (2%) of total yearly gas consumption of the country. LPG market should be able to be quadrupled to 2 million tons in a matter of a few years.

Supply Issues

We live in the gas surplus region or adjacent to it. Iran and Qatar together house 33% of world natural gas resources. In LPG sector also, there is a surplus which is being exported. Middle East has a surplus of more than 3.0 million tons, half of which is in Iran. Iran is facing problems in its exports due to the frequent trade embargoes of all kind. Also there is exportable surplus in Turkmenistan, which goes as far as Indonesia. Pakistan has not been able to fully exploit the potential of LPG imports from the region. Only 8% of the demand is met through imports, which is really negligible.

There is a scope for expanding LPG imports and supplies by establishing a stable and dynamic LPG market based on imports, while there are obvious limitations on domestic production. LPG imports from Iran can provide for a very significant domestic demand, if adequate transportation infrastructure is brought about and facilitated. All of this can be provided by the private sector. Ideally, rail transportation is the most economical, but is subject to many issues. For all practical purposes, road transport may have to be employed. GOP lifted price controls in a hope that it would expand supplies and attract investments in imports, storage, transportation and distribution. Nothing appreciable seems to have happened. This is despite, that there is no restriction on imports. Any body can import. Infact the sector suffers from monopolistic conduct and structure. Competition Commission of Pakistan (CCP) has levied fines and penalties on two major LPG companies, which is reportedly subjudice.

Competition does not seem to work in Pakistan. We have witnessed this in case of sugar and cement and other areas where there are a far more number of suppliers than they are in LPG. In LPG sector, there are only 10 producers. Neither has price gone down, nor have supplies and investments increased despite significant scope and opportunities of imports from Iran. Only some smuggling takes place, and undertaken possibly by small parties who do not have the wherewithal of dealing with the practical barriers that may be involved in official imports despite an ostensibly open import regime.

As mentioned earlier, LPG can play a significant role in filling the demand supply gap, especially in cooking fuel sector, domestic and commercial. Pressure on gas supplies is increasing. Due to the lack of availability of a suitable alternative, rural population is resorting to felling of trees, reducing the much needed forestry cover. Recent floods have been aggravated due to massive deforestation in the northern areas. For the 80% uncovered population, LPG seems to be the only short-term option, especially when the domestic natural gas resources are running out.

LPG pricing options

LPG has economic characteristics in between oil, a traded commodity deserving international market price regime, and gas which is often priced at local production cost. Currently, Saudi contract prices are taken as a bench mark for prescribing upper limits for the producer prices. Following are some other pricing options that could be examined;

- a) Imported LPG be priced at landed cost plus taxes and duty, taking Saudi contract price as a bench mark.
- b) Fixing LPG well-head prices according to the natural gas price formula, with some possible enrichment; where LPG is extracted from Petroleum, it could be paid as a fraction, say 75% of the ex-refinery price of Gasoline; an average whole-sale/producer price to be worked out depending on the sources of gas, such as natural gas fields, oil refineries or imported. Forward prices in the value chain to be fixed by allowing gross margins/mark-ups for marketing companies and distributor. If such margins are fixed in case of gasoline and diesel, why can't it be done in case of LPG?
- c) The retail price basket of selected stations in the U.S. or EIA retail average price could be taken as a bench mark. Other prices in the value chain are worked out as per fixed margin allowed to every stage. Current retail price of LPG in the US averages around 1.25

USD per kg. In Europe, it is about 1 euro per liter before tax. In the U.S., however, the marketing and distribution margin appears to be quite high, almost 100 %, as one would readily see from the table provided. LPG is marginally taxed in Europe, while petrol attracts heavy taxation of 100%. It can be safely concluded that the classically, LPG/LNG are priced at 75% of oil/gasoline prices per unit of calorific value.

LPG expansion and subsidies issue

One is intrigued by the kind of controversy that prevails around LPG sector. It is alleged that the powerful local producers are inhibiting competition by keeping the prices low and discouraging competition. On the other hand there are charges of excessive monopoly profiteering and that the actual profits are made at retail level, as most producers have profit linkages down the line. One would require undertaking a detailed cost of production and marketing study, to get to the bottom. It appears rather strange that some quarters demand higher producer prices, so that they can import LPG and make profits. This would naturally make the prices still higher, while people are protesting against high LPG prices already. Imports are normally allowed to keep the local prices in check and not otherwise. In fact a case could be made the other way round for decreasing the producer prices. As we have discussed earlier, LPG has trade and pricing characteristics midway between oil and gas. LPG is also extracted from gas, while gas prices in Pakistan have been lower comparatively.

The idea of providing subsidies to LPG to targeted sectors such as domestic consumers in FATA and NWFP deserves serious attention as well. These subsidies could be shared under a trilateral programme wherein GOP, GoKP and U.S aid could share the cost. The programme should be administered under some kind of a fuel ration card system to restrict the subsidies to the intended target group. Apart from welfare and political consequences, the subsidized cooking fuel rationing would help reducing deforestation. There is a public demand of doing away with the GST on LPG; one would be inclined to support it for residential use of poor customers, especially in KP and FATA.

Also the proposal of mandatory imports by the local producer to the tune of 25% of their annual production is worthy of consideration. LPG supplies are often found restricted, especially in winters when the demand in the northern region is high. It has been alleged that imports of

LPG is discouraged by the dominant local producers and some key players. Mandatory quotas of imports are expected to improve supplies

GOP and the Ministry of Petroleum (MPNR) would be advised to come out with an explicit policy for the LPG sector. If unregulated sector has not given the desired dividend, regulation and controls may be tried. Regulated sector often provides the stability, confidence and reassurance our business sector needs. It is perhaps not strong and confident enough to benefit from an open sector that works without assurances of return. Regulatory status has not prevented power sector to attract IPPs. Infact it is doubtful that IPPs investment would have come about without a regulated policy frame-work. Same may be true for LPG.

Table 8.1: Comparative Fuel Prices in the European Union (Euro per Liter)

Country	Gasoline unleaded	Gasoline Super	Diesel	LPG
Belgium	€ 1.46 (€ 0.60)	€ 1.54 (€ 0.64)	€ 1.19 (€ 0.61)	€ 0.57 (€ 0.47)
France	€ 1.37 (€ 0.54)	€ 1.45 (€ 0.60)	€ 1.17 (€ 0.55)	€ 0.72 (€ 0.54)
Germany	€ 1.42 (€ 0.54)	€ 1.50 (€ 0.58)	€ 1.22 (€ 0.56)	€ 0.62 (€ 0.43)
Greece	€ 1.52 (€ 0.58)	€ 1.56 (€ 0.63)	€ 1.31 (€ 0.66)	
Italy	€ 1.39 (€ 0.60)	€ 1.43 (€ 0.66)	€ 1.25 (€ 0.62)	€ 0.66 (€ 0.43)
Luxembourg	€ 1.19 (€ 0.58)	€ 1.23 (€ 0.62)	€ 1.00 (€ 0.56)	€ 0.53 (€ 0.45)
Netherlands	€ 1.53 (€ 0.56)	€ 1.62 (€ 0.61)	€ 1.22 (€ 0.55)	€ 0.70 (€ 0.49)
Spain	€ 1.18 (€ 0.58)	€ 1.22 (€ 0.66)	€ 1.10 (€ 0.60)	€ 0.62 (€ 0.50)
UK	€ 1.41 (€ 0.53)	€ 1.49 (€ 0.60)	€ 1.44 (€ 0.55)	€ 0.75 (€ 0.55)

Source: EU Energy Portal; prices in parentheses are before tax.

Strengthening and Expanding LPG supply chain LPG (Pipeline) from Iran

Keeping in view ,the afore-mentioned logistics study of the LPG sector, it appears that quite some changes and infrastructural facilities may have to be brought about to increase the role and scope of LPG supplies in the country. By opening up the sector, GOP meant that such arrangements would develop in an open market regime. It not has happened. Our problems are of the short and medium term, and probably there is no long term in oil and gas business. So if something is to happen, it has to happen soon, so that there is enough period left in the remaining lifecycle to recoup the investments. Oil and gas story may not last beyond 2030.

Table 8.2: LPG prices in the U.S.: Whole-sale vs retail

Prices					
Retail	10/4/2010	10/11/2010	10/18/2010	10/25/2010	Retail Margin
Average	2.359	2.393	2.412	2.422	90
East Coast (PADD 1)	2.824	2.846	2.866	2.876	112
New England (PADD 1A)	2.824	2.842	2.852	2.878	
Central Atlantic (PADD 1B)	2.919	2.945	2.962	2.956	118
Lower Atlantic (PADD 1C)	2.588	2.611	2.668	2.676	97
Midwest (PADD 2)	1.817	1.857	1.876	1.886	52

Whole Propane Price				
	10/4/2010	10/11/2010	10/18/2010	10/25/2010
Average	1.31	1.327	1.288	1.274
East Coast (PADD 1)	1.361	1.393	1.37	1.356
Central Atlantic (PADD 1B)	1.374	1.392	1.37	1.356
Lower Atlantic (PADD 1C)	1.342	1.395	1.368	1.355
Midwest (PADD 2)	1.29	1.3	1.256	1.241

Note: (i) Retail margin is calculated as a ratio of retail & whole sale prices
(ii) 2.046 kg/gal

Source: U.S. EIA

Already, it has been reported that depending on the season, 200-300 tons of LPG per day is imported from Iran, through informal sector. There are many other products from Iran that are smuggled. The question is why it can't be brought under regular channel. GST evasion by the small sector appears to be the incentive and saving in the informal sector. Often there is a cost associated in all illegal businesses. Half of the 17.5% should only be the savings and then there are issues of other inefficiencies and diseconomies of small scale. So it appears to be much more than a GST evasion issue and appears to have larger socio-economic dimensions. It is perhaps the only channel through which small enterprises can operate. Running regular businesses has been made a bit too difficult. The obstacles of small businesses in running regular businesses in LPG sector should be looked into.

The smuggling cluster can be transformed and expanded into regular and legal business, supplying much needed energy. Possibilities of establishing a LPG/petroleum market on the border of Iran, somewhere near on the coast, say, in Gawadar may be investigated. Iran has become a hub of LPG business. Not only it has its own surplus of 2 million tons per year, it falls on the transit route of LPG exports from Turkmenistan

and other central Asian Countries. Iran has a large supply of LPG bowsters which are utilized in transporting LPG to the adjoining countries. The same infrastructure can be shared by Pakistan as well. In fact, there appears to be a case for installing a LPG pipeline from Iran to Pakistan. This may not be a billion dollars affair, but can possibly be done under 250 million US dollars. Recent LPG pipeline project in India of 1014 kms length and a transmission capacity of 1.7 million tons per year (5000 tons per day) cost only 248 MUSD , and was completed in 2003. The project consisted of a 1014 kms (10-16 inch dia) pipeline, 5 dispatch terminals, 9 tap-off points and 3 intermediate booster stations. Another project recently commissioned by National Oil Company India, has a capacity to transmit 700,000 tons of LPG through a pipeline of 273 kms, linking Panipat with Jullandar.

If a similar project is installed at Gawadar to take surface deliveries from Iran and ocean freight deliveries from other middle-eastern sources, competitive pricing would be obtained and there would be diversity of supply sources reducing supply risk. IPI project is costing 6.7 Billion USD for 1164 Bcf of natural gas. Pakistan's share in this project is to be 50% as per previous configuration (about 500 billion cft), with a share in investment of 2.006 billion USD. Pakistan's annual consumption of natural gas is 1275 Bcf. If a 5000 tpd (1.7 mtpa) LPG pipeline is installed between Gawadar-Nawabshah, it would cater to 80 Bcf equivalent of natural gas, which is 6.27 % of the total demand. For comparison, this would be 4 times current consumption of LPG.

LPG Hub at Pak-Afghan Border

There is a scope and rationale to establish a LPG hub somewhere on and around Pak-Afghan border to cater for the requirements of northern areas, KP and FATA. There is severe problem of modern cooking fuel in these areas. LPG prices here are found to be 25-35% higher than elsewhere in Pakistan. Piped gas has reached less than 13% of the population of this region, which is lower than the country average of 20%. LPG from Turkmenistan and other Central Asian countries comes down to Afghanistan through an established trade network. The same sources can be tapped for meeting the requirements of the northern region. A LPG hub can be established there with storage and distribution infrastructure. As mentioned earlier, subsidized or GST-less LPG can be distributed under private supply network, under a fuel Ration Card system. Alternatively, the proposed LPG hub can be created around Chanda gas field in Kohat, integrated with LPG imports from or via Afghanistan.

LPG Paradox

There are paradoxical controversies in the LPG sector. To consumers prices are too high and to importers and traders too low to enable imports. Low prices increase consumption and demand and are good for public, but low prices also discourage supplies and cause difficulties in the required access and availability of LPG at all the places. GOP and OGRA's role is confusing and mixed one. LPG sector is deregulated, yet OGRA under public pressure takes interests, in vain, to control LPG prices. We would examine the underlying issues to explain the paradoxical situation and develop a few proposals to promote public welfare and sectors expansion. Let us review some facts and data first.

There are 10,000 vehicles and 40,000 homes which use LPG currently. Mostly those who do not have gas connections or are located in non-gas areas, especially, the semi-urban areas and small towns use LPG. Also those who do not have the capital to install expensive CNG kits install cheaper LPG kits and use LPG. Normally, poor owners of very old taxis use LPG. However, with the natural gas shortages, the prospects and usefulness of LPG is assuming new dimensions.

Most LPG consumed in the country comes from domestic sources. It is extracted from oil and gas wells as an associated gas and is also produced by the oil refineries as a by-product in their process. Imported LPG is limited to small imports in the form of smuggling. Formal imports are too little or non-existent due to low prices of domestic LPG which make imported products uncompetitive. On the other hand, there is quite some latent demand that should be able to afford higher prices and thus encourage imports and expand supplies. This is not happening. Market is not filling the gap and hence the need for policy and regulation. Unfreezing prices is often considered as a panacea. It does not work always. Regulation sometimes is better than free market as we shall see.

Let us review the prices, domestic regional and international. Domestic LPG prices normally hover around Rs 100 per kg these days. LPG prices are the same for auto and as well as for house-holds, contrary to the usual case, where the LPG for auto use is normally dearer than for residential uses due to varying taxation levels. In India, these days LPG prices for the auto sector are IRs.37.85 per kg (Pak Rs. 75.70), and for home use the LPG price is much lower at IRs.24.54 (Pak Rs.50) per kg. Gasoline prices in India these days are Pak Rs 116 per Liter. Thus LPG in auto sector is 50 % more expensive than the rates for home use; and

allowing for energy content differences, about 25% cheaper than Gasoline. In Spain, a relatively low petroleum price country, LPG price for the auto sector is around Pak Rs.140 per kg(0.62 Euro per Liter).In the US the LPG prices for residential use average at Pak Rs 120.0 per kg(2.88 USD per gallon).Although the retail LPG prices in US for residential use may vary from under USD 2.0 per gallon (Pak Rs 85 per kg)to a median value of 3.44 USD per gallon(PkRs 140.0 per kg).In and around Texas and elsewhere , LPG prices at gas stations are in the range of around 2.8 USD per gallon and goes as high as 3.4 USD in some locations. It appears that in the US, taxation policies do not differentiate or discriminate among the end use. In Texas, spot prices of LPG last week was Pak Rs.56.6 per kg (USD 1.363 per gallon), which compares with the usual producer prices of Rs.50-55 per kg in the local market.

Table 8.3: LPG Price in various countries and regions

Country		USD/gall	Euro/Litre	Pk Rs/Kg
USA Spot		1.363		0.66 USD/kg = Rs 56.625
USA (whole sale) 25-10-1010	Avg	1.274		
USA Retail (Residential)	Minimum			0.94 USD/kg
	Avg	2.88		1.408 USD/kg =Rs.120
	Medium	3.44		Rs 143
USA Retail (Auto)	Range	2.5-3.5		
CP Saudi (FOB)				
Europe Retail (Auto) Spain (incl. VAT)			0.62	1.17 Euro/kg =Rs 140
Pakistan	Producer			Rs 50-55/kg
	Retail			Rs 100
	Import Price (2-11-2010)			1.1 USD/kg
India IRS/kg	Residential			IRS 24.54 = Pk Rs 49
	Auto			IRS 37.85 = Pk Rs 75.70

Note: Sp. Gravity (40% propane + 60% butane) = 4.582 lbs/gal = 2.046 kg/gal = 0.53 kgs/l IRS = PkRs. 1USD=Rs85; 1Euro=Rs120

Source: Compiled by the Author (US EIA, EU Energy Potal, Indian National Oil)

What to do then? Decrease the prices ala India or slightly higher? This would further discourage the imported supplies and hinder market

expansion. The solution lies in regulation and differential tariff. It is common knowledge that electricity is produced at varying prices, from as low as Rs. 1.0 per unit for hydro to as high as Rs.12-15 per unit for oil based electricity and in between many other rates. Similarly electricity is retailed at as low as Rs. 3.0 per unit to Rs.15.0, with a lot of other categories in between. Similar is the case with natural gas pricing. Why this can't be done for LPG. Producers' prices can be linked or determined under a cost-plus system. Admittedly, it is different in some respect. Differential tariff may be abused and difficult to implement. But so are Electricity and natural gas tariff, to quite some extent. Often residential tariffs are paid for commercial uses. There can be various approaches; for example, taxing and allowing imported LPG for Auto use and available from only LPG (Petrol) pumps. This would release considerable LPG for household sector. LPG's wider availability would fill the gap left by increasingly unavailable CNG. Of-course, this has to be accompanied by price regulation and control.

As said earlier, freeing prices is no panacea, and neither price controls a catastrophe or a sin. Free prices are never free. These are manipulated and set by vested interest. The theory or philosophy behind free prices and competition seldom work. We have seen it in case of sugar and cement and in many other cases. Let OGRA work out details for the proposed regulated regime.

Case Study of LPG sector in the U.S., India and Central Asia (Iran) the US

In the U.S., almost all of LPG demand is met through domestic production and none is imported. LPG consumption in the transport sector appears to be much less than in residential sector. Apartment complexes have LPG tanks of 1000-5000 gallons, which are filled by LPG trucks run by the distributors. However, most houses I have seen use electricity for cooking. LPG is used mostly for heating purposes. Occasional barbecue requirements are catered by nearby hardware stores, which fill the LPG cylinders of the consumers from their own tanks and cylinders (This makes me wonder why there is a commotion against LPG shops in Pakistan who do the same).

LPG in the U.S. as elsewhere is produced both in the petroleum refineries and gas processing plants and is stored in under ground tanks. LPG is transported to UG storage and marketing companies through LPG pipelines, from where it is mostly transported through 10,000 gallon trucks-bowsers, to the distribution network and facilities. Distributors

have their own storages (usually around 30,000 gallons), from where it is transported through smaller LPG trucks of 1-2000 gallons.

India

In India, most LPG is imported, although local LPG production is there from traditional petroleum refineries and gas processing plants. In India, LPG pipelines are more common than elsewhere, transporting 30% of the annual consumption through pipelines which often extend beyond a thousand kms. Current pipeline network is of 2500 kms, and more are being added under an ambitious expansion plan. In India, LPG pipelines have become popular due to the logistics requirements of imported LPG. However, now they are considering connecting some 200-50 cities to LPG pipeline network.

LPG pipelines are much simpler to install. These are pressurized to 300 psi, almost twice as much as tyre pressure, can be as small as 6 inch in dia and may go up to 2 ft usually. However, there is a considerable pressure drop and re-pressurization is to be applied every few hundred kms. Pipeline transport is convenient, cheaper and reduces traffic congestion. However, for inner city transport, there is no option but to use roads. It can be made more cost effective and easy if LPG shops are provided with tanks from which they could fill the automobiles as well as fill LPG cylinders. In many countries, especially, in Italy one sees roadside convenient fillers occupying very small area of 8x15 ft, and even less.

Central Asia

Since independence, LPG production capacities have increased almost 20 times thanks to installation of new technological units at the Turkmenbashi complex and gas fields in the east of Turkmenistan. In particular, gas from the abundant reserves of Zaunguz Karakum fields is processed at the Nayyp gas processing plant. Three industrial units fitted with modern equipment and with the total capacity of 112,500 tons/year of LPG were built there by Canadian and Italian companies. By 2020, Turkmenistan intends to increase the LPG production to more than 2.2 million tons/year.

A number of large investment projects will be implemented to this effect. They include a new gas processing plant being built by Canadian firms at the eastern field of Bagaja. Another modern gas processing plant will be commissioned on the right side bank of the Amu Darya River.

Turkmenistan exports LPG to Iran, Armenia, Afghanistan and Iraq. Butane Int'l, Iran's largest private LPG distributor and exporter, in May 2006 said rising demand for LPG in Armenia, Afghanistan and Iraq put Iran at the centre of the supply chain because of its extensive rail infrastructure and common border with Turkmenistan.

Butane Int'l imports 420,000 t/y of Turkmen LPG, of which 250,000 t/y are handled on behalf of PCCI, the export arm of Iran's state-owned National Petrochemical Co. (NPC). Turkmen LPG is mostly sourced from Krasnovodsk before being shipped to an import terminal in Mashhad, eastern Iran.

Iran has over the last year developed its rail infrastructure to enable delivery of LPG by rail from Mashhad to Bandar Abbas, Iran's largest commercial port in the Persian Gulf.

Butane Int'l has a fleet of 120 LPG railcars, with more than 300 LPG trucks used for transport by road. Butane Int'l has had a contract with TurkmenNafteGaz since 2003 for the import of over 120,000 t/y of LPG which the Iranian firm exports to neighboring countries. Afghanistan absorbs as much as 60,000 t/y of LPG from Turkmenistan. The product is mostly shipped from Iran to the western Afghan city of Herat. Supplies from Afghanistan of Turkmen LPG compete with imports of the product from Uzbekistan. Butane Afghanistan is the LPG importing company. Pakgas of Armenia imports a further 24,000 t/y of Turkmen LPG, transiting through northern Iran, while Pakistan buys much smaller volumes of around 2,000 t/y. (Butane Int'l is part of Butane Co. The firm controls about 25% of Iran's LPG market. Iran consumes 2m t/y of LPG while national production is around 3.504m t/y).

9 Coal

Our energy crisis is so huge and worsening that one finds it only appropriate to belabor the known facts and bring forward new thoughts and solutions that come to ones mind. By this time, it should have become obvious that there is no escape from fast tracking the Thar coal project. Hydro power is also an equally viable option which solves water storage problem also, but suffers from seasonal factors. The two resources together offer optimal opportunities to meet Pakistan's Energy demands. Here we are focusing on Thar coal.

Thar coal is larger than the oil resources of our rich brothers of the Middle East. Many people may cast a doubt on such an assertion. This scribe has collected facts and data and has made some calculations and is happy to report that these claims are by far correct with the following details and provisos. Total Middle East Oil and gas resources add up to equivalent of 385 billion tons of Brown coal, out of which Iran and Saudi Arabia own 110 billion tons of coal equivalent each. Pakistan's Thar coal is 185 billion tons. More data is available in the adjoining Table 1. We should, however, remember that Saudis would have been quite poor had they had 189 million people to support, instead of their current population of 25 million only.

The bureaucratic circles tend to show that there is progress on Thar coal. But the fact remains, that there is almost none. Allocation of blocks, MOUs and even feasibility studies do not mean much, as many such things have been done in the past. Under-ground coal gasification project has raised false hopes among the public. Without casting doubts on the scientific credentials of its eminent promoters and on the technological potential of the route adopted, the problem of scaling up would remain for which there is no capability in the country of a level that would be acceptable to the lending banks. While the existing gasification would yield useful data, we would be back to the square one, which is of requisite financing.

Projects in Pipeline

1) Sindh Engro, 1200-2400 MW; 1.5-3.5 Billion USD investment, Feasibility studies completed.

- 2) Oracle Coal mining, 300 MW, 450 Million USD investment, Feasibility being done.
- 3) Cougar Energy, 400 MW, 600 Million USD investment, Feasibility being done.
- 4) Under Ground Coal Gasification, 100 MW, 150 Million USD (Pilot plant under implementation).
- 5) Al-Abbas Group, 300 MW, 500 Million Euro, investment, under study.
- 6) Some Chinese companies are reportedly coming back, which had left after a tariff dispute with WAPDA

Source: Sindh Assembly Proceedings, March 4, 2011, DAWN.

Table 9.1: Thar Coal vs Middle Eastern Oil & Gas

Countries	Oil Reserves Billion Barrels	Gas Reserves TCF	Total Oil & Gas Billion Barrels	Total Oil & Gas Billion Tons Coal
Egypt	3.7	58.5	13.762	4.93
Libya	44.3	54.5	53.674	19.24
Nigeria	37.2	188	69.536	24.92
Sudan	5	3	5.516	1.98
Iran	137.6	1045	317.34	113.74
Saudi Arabia	264	258	308.376	110.53
Iraq	115	112	134.264	48.12
Qatar	15.2	890	168.28	60.32
Yemen	3	16.9	5.9068	2.12
Middle-east	625	2625.9	1076.6548	385.9
Malaysia	4	8.3	5.4276	1.95
Indonesia	4.3	98.8	21.2936	7.63
USA	21	1836	336.792	120.71
Russia	60	1680	348.96	125.08
Pakistan	0.936	30	6.096	200

Source: Compiled by the Author, Data from US-EIA

The bad news is that under criticism and pressure from international Green lobbies, World Bank has discontinued its technical assistance program on Thar coal, amidst news that government of Sindh has persuaded them to renew it. Even if they do renew, it sends us ample signals on difficulties that we are going to face towards financing Thar coal. With time, the opposition to coal would increase. Our problem is immediate and the renewables are still to be perfected and improved to

be cost effective and competitive. In any case, renewables are projected to have a share of 20% even by the year 2050 .What are we to do in the meantime. The threat is that by the time we put our act together, although fossil based power age may not be over, the financing regime may become too difficult and hostile against coal.

The residual issue as it stands today is not the financing issue of the mining and power parts of the projects, however difficult it may itself be, it is the financing of infrastructure part which is proving to be a stumbling block. Various estimates put these requirements to between 1 to 2 billion US dollars. More money is required for infrastructure, than the first coal mine and power plant itself .Government of Sindh, obviously would not have such resources, nor would the federal government. And in these days of emphasis on provincial autonomy, where is the appetite for common projects. There are also issues as to the technical and management capability of the provincial bureaucracy, as the project continues to be run from the narrow confines of the Sindh secretariat. Apparently, there is no shaft of light at the end of this tunnel, although it is not the only one.

In all humbleness, this scribe makes the following proposals. There are two options. One is to tender for a large project of 5000 MW or so, which may be able to assume the infrastructural development costs. The cake becomes big enough to absorb all kinds of interests. This is not new. In India, this size of coal projects are being planned already. The feasibility of this proposal in Pakistan context can only be tested once it is actually tendered. The second option would be to float tenders for establishing a mining development company that undertakes to develop and finance the infrastructure and manages the Thar coal operations on behalf of Sindh government, within the framework of the relevant rules and regulations. The company recoups its investments by granting mining leases and charging a fee on coal production by individual companies. Obviously such a company would be a multinational which may have a joint venture with local private sector and government of Sindh's share in it. Such a company would offer many advantages. First of all to bring in finances, which appear to be well-nigh impossible for Sindh government to finance? Secondly, the operations would be more commercial like and would be on fast track. Ironically, I have made a case of yet another feasibility study? Not necessarily.

Certain issues related to the 18th Amendment need to be sorted out. After the amendment, Electricity sector becomes a federal only subject, as there is no concurrent list any more. Earlier Electricity was in concurrent

list. Coal was and is a provincial subject. If I understand correctly, federal responsibility and role in Electrical power sector should be larger than it was prior to the amendment. Thar coal power development, therefore, ought to occupy higher priority in Federal budgeting system. It may not be a bad idea considering some kind of linkage between investments in Hydro and Thar coal power; one project in hydel, and one in Thar coal. There is a technical requirement to balance hydel power as well. Gas being no more and oil unaffordably expensive and imported, thermal energy in future should mean Thar coal energy. Politicians from Sindh can suitably make a convincing case, provided they are also prepared to readily agree to federal involvement.

Converting Oil-fired Power Plants to Coal and Combined Cycle Gas

There is some merit in this proposition. Oil has become quite a risky fuel, as the recent oil price hike has amply demonstrated. While apparently, there is no substitute to oil in transportation sector, the recent trend of installing oil based power plants (IC Engines mainly) has been rather unfortunate. Pakistan now has a dubious distinction of being 10th largest importer of Oil and also the 10th largest user of Oil in Power sector in the world. This may prove to be a very costly and tragic distinction indeed, if indigenization of fuel is not pursued seriously.

It is almost certain that oil would be extinct in the next fifty years and as its extinction phase starts, as it already has; its price behavior is projected to be quite volatile. Future price hikes ala 2008 cannot be ruled out. These would occur more frequently in future. Recent reliance in oil has perhaps been for no other short term alternative. Earlier oil-fired power plants have been installed in 30 USD per barrel regime.

Even Earlier oil fired power plants have suffered from low capacity utilization, although these were quite capable of running as base load power plants. A classic example is of HUBCO, which capacity utilization has improved very recently due to the power crisis. Otherwise, oil being expensive, HUBCO came in a low merit order and thus the low capacity utilization, which is ironic indeed for capital scarce countries like ours.

For the reasons discussed, oil fired power stations have been converted to Coal in Europe and ASEAN region in the wake of oil crisis of 1973, and the trend continues. Despite general environmental dislike and opposition to coal, for instance, Italy's major power utility ENEL has gone for conversion of 2500 MW oil fired capacity to coal, as reported

by NYT. There are other examples as well; also conversions have been made from oil to high efficiency (55-60%) Combined Cycle gas systems. In the following, we will first discuss conversion from oil to coal. In the subsequent section, we will discuss conversion from oil to CC gas.

In the U.S already, coal based power is abundantly installed to the extent of 50 % of the total installed power generating capacity, providing cheap power (5 cents or lesser per unit) from cheap coal .Apparently, the U.S. has no reason to increase the already high predominance of coal, while other resource options are there like gas and nuclear.

Coal, however, is not immune to unruly price behavior. Recently, its price also hiked in the international market in sympathy with oil, to three times its usual level. Therefore, while imported coal could be a short term option, the longer term option has no escape from utilizing our domestic Thar Coal (lignite). Optimally Lignite is better utilized at mine-moth power plants. However, Lignite can be transported to a few hundred kilometers quite economically, comparatively speaking, as is being done in (hard) coal scarce northern regions of India like Gujarat and Rajasthan. We can therefore look forward to utilizing Thar coal up to southern Punjab like Muzaffargarh.

Transportation is an important and significant component of the total received cost of coal and can add as much as 50% to the at-mine cost. Interestingly for some coastal towns, imported coal and its transport can be cheaper than domestic coal. This is one of the major reasons in India today for resorting to imports of coal. Unfortunately, Pakistan will ultimately be having two major energy resources at two geographical extremes, while most of the market may be around the center; hydro power in the north and coal (imported or domestic Thar) and Wind in the South. There would be no other option, but the universally available solar energy, which may ultimately balance out the situation in due course. Reportedly Afghanistan has significantly large Hard Coal resources. Both Pakistan's and Afghanistan's economies are going to benefit immensely, if these resources are developed also. These ideas should be kept in view, while planning for reconstruction in Afghanistan and returning of normalcy in the region.

For a variety of reasons, Thar coal cannot be adequately utilized with Thar based installations alone. By 2030, our famous Energy Security Plan (2005) envisages 25000 MW to come from Thar Coal; even more, if the unrealistic projections of gas are taken into account. All of this capacity cannot possibly be installed at one location, whatever be the

dictates of transport optimality. There are many issues like security based dispersal, water, ecological limitations, demand location, manpower etc.

For the time being, it is imperative that the proposition of converting Oil-fired power stations to coal be given consideration. It is a long cycle issue, and may take some 3-5 years to materialize. Already, new power plants based on imported coal have been proposed for Balochistan coast, near Hub Power Plant, and regulatory approval obtained in this respect. However, keeping in view the eventual potential conversion to Thar Coal, it is suggested that coal power plants be based on Sindh coast. There was a proposal earlier, mooted earlier in 1988, to install imported coal power plant at Keti-Bandar under the auspices of ADB. Infact, whole of Sindh coast extending from Bin-Qasim to Keti-Bandar is quite opportune for such siting keeping in view the closeness to Thar Coal.

Technically speaking, there are no limitations to the proposal. This is possible in today's technology. In steam turbine based power plants, Oil fired boilers are to be replaced with coal fired boilers, although not a cheap proposition, as 30 % of the power plant investment may be in the boilers itself. Capital cost component in the unit product cost, do not exceed 15-20 %, bulk of it being the fuel cost. In the long run, even Gas fired combined cycle plants could be converted to coal based IGCC, a technology that would be commercially available in next five years. But let us not just delay action today for options of tomorrow.

Converting Oil-fired to Gas-fired Combined Cycle

Oil fired Steam turbines usually have a thermal efficiency of 38%, while today a gas-fired Combined Cycle Plant can have an efficiency of 55-60%. Why not convert from Oil to Gas. In certain situation, coal logistics may not work out. We have also seen that conversion to coal may not reduce the foreign exchange drain appreciably, if the conversion is based on imported coal. It may, in such cases, be worthwhile to explore converting oil-fired steam turbines to Gas fired Combined Cycle Plant. It must be noted that oil-fired steam plants are already dual fired normally, here we are not proposing a simple switch to gas, which in current circumstances would not have any rationale at all, as we are running out of gas. Here we are proposing addition of gas turbines upfront of already installed oil fired boilers/steam turbines. Normally, for every single MW of Steam Turbine, 2 MW of gas Turbines are to be coupled to balance the energy flow. Thus the additional advantage is tripling of the capacity, utilizing the same infrastructure. The proposal is not new or unique. It

has been done in Europe and as well as in Singapore; the common theme being the risk and cost of oil.

A classic case is of HUBCO, which has 4x323 MW steam turbines, giving a total of 1292 MW of installed capacity. This capacity can be tripled to 3876 MW by adding 8x323 MW Gas Turbines. Of-course this is subject to gas availability, say through LNG or Iran-Pakistan Pipeline. While electric supply from this plant may triple, the energy consumption would only double or be slightly more, due to enhanced thermal efficiency. With gas prices, is it LNG or Iran Pipeline as high as 80% of oil, the only profitable use of natural gas today appears to be in the proposed high efficiency combined cycle plants?

Therefore, while conversion from oil to Coal may be desirable and must be investigated, conversion to CC gas may also be investigated in certain cases.

Table 9.2: Advantages of conversion from oil to gas CC

Oil-fired power plant 300 MW		Natural gas-fire combined cycle plant 300 MW	
Efficiency	38%	Efficiency	56%
CO ₂ emissions (g/kWh)	740	CO ₂ emissions (g/kWh)	360
Total CO ₂ emissions	1.30 Mt/y	Total CO ₂ emissions	0.65 Mt/y
CO ₂ emissions (g/kWh)	740	CO ₂ emissions (g/kWh)	360

Table 9.3: Implications of conversion from Oil to Coal

Oil-fired power plant	Clean Coal-fired power plant	
Net efficiency	38%	45%
Fuel	Oil 0.23% S	Coal 0.3to1% S
Desulfurization systems	NO	Yes ($\eta = 97\%$)
Denitrification systems	Yes ($\eta = 80\%$)	Yes ($\eta = 85\%$)
Particulate abatement systems	Electrostatic ($\eta = 90\%$)	Bag filter ($\eta = 99.9\%$)
CO ₂ emissions	740 g/kWh	770 g/kWh

Should Coal be imported, in spite of Thar Coal?

Coal is being imported in Pakistan and the imports are increasing every year. Coal is required and used in industries such as cement, brick kiln,

metallurgical industries etc. Hard coal of good quality is also being mined in Balochistan, KP and Punjab. Production of hard coal is limited by manual and artisanal mining. The known sources are not large enough to attract capital and mechanization. Whatever is produced is consumed, and even imports are made to meet the demand.

In this section, we are concerned with a specific question. Should we import coal for power sector? There is advantage in coal. In Pakistan, there are large deposits of Thar coal, and in the world coal is the most abundant fuel, expected to afford 200 years of world consumption. It is abundant in China, US, Australia, India, Canada, and India and the lesser countries of Indonesia and South Africa. Industrial revolution in Europe took place on the shoulders of the then abundant coal there. Coal served as a backbone to progress and production in almost every industrial society.

Coal is being much despised and opposed these days by the generally environmentally sensitive world of today. Pollution and Green-house gases are the two principal factors responsible for the opposition and resistance against coal. On the other hand, this is also true that most electricity in the world today comes from coal. In the U.S., almost 50% of electricity comes from coal. In China, one Coal Power plant goes up every week. India has an installed base of 75,000 MW of coal power and a sizeable coal resource base. However, it has started importing coal for a variety of reasons; principal among those is excess demand due to production bottlenecks, despite a sizable resource base. In the U.S. all kind of energy is produced, imported and exported.

Why import, when one is exporting; and why export when one is importing. Trade is done for many reasons seasonal factors, location issues, transportation costs, business linkage etc. In the case of coal, imported coal may be cheaper than domestically produced due to sheer logistics reasons. Coastal towns and markets may prefer imported coal for convenience and cost reasons; if domestically produced coal is far off in the inner regions. That is the reason behind energy trade in the U.S., involving imports and exports as well. In Pakistan, despite cotton abundance, it is considered wise to keep imports open to have a check on the local prices, as well as seasonal issues. Excess supply and availability in certain months may induce exports and lesser availability in others may induce imports. India, to-date prefers importing coal for coastal towns, as imports are cheaper in coastal towns due to cheaper transportation than bringing domestic coal from inner regions. At some point in time, India may import Thar coal or electricity produced from it,

for its coal scarce regions of Rajasthan and Gujarat, which is adjoining Pakistan, in place of coal from south. It is sheer economics, if politics permit it to operate. Often it does not. Similarly, Pakistan may import Coal from Afghanistan, in preference to its own coal in the South.

Am I making a case for importing coal for establishing power plants, as some foreign companies have proposed? Why have they done so? For almost the same reasons as we have discussed earlier. However, the primary concern is that people are generally skeptical if Thar coal resource would come on line at all? Our provincial government of Sindh and its relevant departments may not like this kind of skepticism. Every now and then they do announce their actions, projects and approvals. Engro has completed its feasibility study, which gives some credibility and optimism.

However, it is still a low key affair, not befitting of a gigantic project of this nature, being largely operated and handled from a single room in Sindh Secretariat. Visibility and profile gives credibility to vendors, technology suppliers, investors etc. Unfortunately, its absence does not appear to be very reassuring. If projects are progressing, these are to be planned; monitored and co-ordinated .It requires qualified managers and manpower, training activity etc. No credible international party is yet on board. The sole public demonstration of such an association is indicted by a trip to Germany by the project authorities. World Bank is double minded, despite its technical and financial assistance project. Some very fundamental issues which may impede progress ultimately are of coal pricing and royalty. These remain unstudied and unresolved. To federal bureaucracy, the provincial set-up appears to be too tight lipped and secretive, resisting involvement of others which may be a requirement of such a huge projects. Some of them are looking forward to the ultimate failure of the provincial government and its relevant department, which appears to be the sole player trying to take it to the goal all alone. Chinese, the most befitting partners, for Thar coal do not appear to be interested at all in it, while they are interested in every thing else from nuclear power plants to dams etc. There is something missing?

However, I do not think that going for the imported coal option for new power plants would be a good idea at all. First and foremost, such a project would crowd out the investment in domestic coal, after there is a limited supply of foreign capital willing to come to Pakistan especially in the difficult political circumstances. Coal prices also increase in sympathy with oil, as has been amply demonstrated by the recent past. We are suffering from a perennial trade gap and balance of payment

problems obliging us to approach IMF for loans restricting policy options for economic expansion and peoples' welfare. Import of coal would be a luxury we cannot possibly afford. In South, we already have Thar coal. Had there been some possibilities of sourcing the same from hypothetical northern sources, there would have been a logistical rationale for meeting the requirements of the upper and central regions. In these circumstances, there appears to be no rationale for entertaining such projects, except slow progress on Thar, which it is hoped, would be speeded up by a coordinated action of Federal and provincial governments.

Thar Coal: potential for Indo-Pakistan Collaboration

There has been a long held desire in India and Pakistan to exploit the geographical advantage and expand trade and investment among the two countries. Most of such hopes have been sacrificed at the altar of political tensions, which have existed due to the Kashmir issue, which has been further complicated by the alleged terrorism episodes India appears to be more enthusiastic in broadening trade ties, however Pakistan links it to the settlement of the political issues. Many people in both the countries argue that strong trade links may create vested interest and stakes in peace and may create the requires rationale and pressure to solve political problems. The debate can be endless, among the unwilling partners.

Lack of availability of suitable projects has also been one of the reasons inhibiting economic cooperation among the two countries. Efforts have been made, in the past and continue to be so, towards building a project portfolio for possible collaboration, if and when political environment improves. SAARC project fund has been commissioning such studies. Reportedly, there is a SAARC energy initiative as well, headquartered in Islamabad for promoting cooperation in Energy sector. Let us explore what can be done in this direction.

Thar Coal and its vast deposits, apart from meeting Pakistan's energy requirements, may have a potential for building and expanding regional economic cooperation. There are a number of possibilities such as; a) export of Thar coal to coal deficit adjoining states of Rajasthan and Gujarat; b) India assisting Pakistan in developing and exploiting Thar coal resource; c) India installing coal-fired power plants in its border towns, and exporting electricity to Pakistan produced by Pakistan exported Thar coal. Let me explain and analyze these propositions a bit.

First on India assisting Pakistan in developing Thar coal resources; India has one of the largest coal industries of the world. It has a coal fired Power Plant capacity of 72,000 MW. India has one of the most efficient coal power plant construction sectors, building coal plants at a capital cost rate of 1100 USD per KW, perhaps even cheaper than or competing with Chinese prices. It can supply consulting, training and even complete plant construction services and equipment supplies. They have experience and exposure in both types of coal; hard coal and our brown coal lignite, although most of their coal is hard coal with high ash content, considered inferior by many international end-users.

Reluctance of western countries with coal is increasing. International financing agencies are under pressure from environmental lobbies not to fund and assist such projects. Chinese appear to be reluctant as well, as reportedly; numerous attempts to revive their interest in Thar have failed. They still appear to have bitter memories from their past involvement in it and the uncooperative conduct of WAPDA that was manifested by the later. India may not be able to provide the full scope of services and may not be ultimately entrusted with a major role. However, it can be suitably involved and usefully inducted in a number of ways.

Secondly, exports of Thar coal to India's adjoining states of Gujarat, Rajasthan and Punjab. It is a misnomer in Pakistan, that Lignite can be only utilized at mine-mouth. It is true that there is limitation in long-haul and international sea transport. However, in India Lignite is being frequently transferred in large volumes up to a distance of 400 kms. Exports to adjoining states should be very feasible, if the production and transport costs are competitive. One can only be sure of it after having done a feasibility study on the subject. This is an idea worth exploring. India is falling short of coal and has started importing it due to heavy demand. The adjoining states have a deficit of fuel/coal supplies. Exports from Pakistan may reduce traffic congestion caused due to interstate transportation of coal, which is expensive as well in terms of transportation costs.

The third proposition is rather unique, ambitious and extremely profitable, all at the same time. The detail is, that Pakistan exports/barters Thar coal to Indian border towns like Munabao and Bakhsar, the latter may not be more than 50 kms from Thar coal mines. Dedicated coal train can make several trips in a day, carrying 10,000 tons of coal in one trip. India installs Coal power plant(s) in its border town, which would remain a domestic investment in India. India burns Pakistan lignite and transmits the electricity so generated to Pakistan. India is only paid for

the capital cost component, as the fuel would remain Pakistan supplied. It can become a total Barter trade, if more lignite is sent/ exported to cover the capital costs afforded by India in supplying electricity to Pakistan. There is a scope for several thousand MW of such projects.

Similar ideas have been put forward earlier as well. There were proposals for exporting electricity to India due to temporary. Power excess situation created in the immediate aftermath of HUBCO installation. The proposition in this form may be unique that it offers an energy exchange opportunity. Besides, it is not a temporary surplus. Thar coal deposits are of 200 billion tons and are expected to last for centuries ahead.

Easier said than done, but it can be feasible. As for the security concerns, of large volume of goods transport and human traffic, Thar is a far-off town. Indian nationals may be allowed to come to Thar only through land route or a future direct flight from to and fro Thar. It may remain as good as domestic travel for them. Special immigration rules and status can be created for Thar coal projects. There is no major security installation or threat nearby. So security issues can be managed.

So many people and nations in the world want India and Pakistan to collaborate and work together, that the above propositions may receive instant support, if presented properly. Quite some funding could be garnered under this head. The relevant departments in the two countries and the business groups may like to examine these propositions. It pays to be optimistic, however, naïve it may sound in the beginning.

10 Nuclear Power and the safety issues

Three-Mile Island, Chernobyl and now Fukushima in the wake of Tsunami and earthquake? The world is concerned. Even the meticulous Japanese failed, who are reputed to live for working than otherwise. Safety reviews have been ordered almost every where, except India and Pakistan. There is even talk of doing away with nuclear power in many countries, reversing earlier decisions to the contrary in the wake of climate change issues, which gave a new life and legitimacy to nuclear power. We also have a significant nuclear programme, military and civil both. How does this affect us and what should we be doing? What are our options and constraints? Are we doing enough in terms of safety and what more can we do? These are the kind of issues that we would attempt to examine here.

Much has been written on Fukushima. The new nuclear reactor design approaches have become far safer and reliable, which unfortunately do not benefit the existing large number of nuclear reactors. The most important are the passive safety systems. Fukushima's safety systems failed because of the older active approaches.

For nuclear weapon countries (the five plus two of India and Pakistan), there is no choice of retraction. They have assumed and accepted higher risks of nuclear weapons. Besides, the weapon and military sectors have synergy, cost-savings and scale economy issues, putting the nuclear issue in quite a different perspective and context than the non-nuclear weapon countries, some of which may certainly withdraw from nuclear power after this third incident.

As it appears, nuclear power appears to be the only contention free source in Pakistan's domestic politics. Hydro power and dams are opposed by lower Riparian Sindh. Although the opposition seems to be limited to Kalabagh dam, no one knows when the guns would be raised against other projects. The arguments against Kalabagh, also apply on most other Hydro power projects. Similarly the Thar coal continues to suffer from low progress and lingering provincial autonomy syndrome,

which sometimes is stretched beyond reasonableness and abused by the provincial bureaucracy for power monopolization.

The problems of nuclear power are external and by extension of finance. Although, it is one of the cheapest sources, its capital cost is the highest. Four billion USD for a plant of 1000 MW, while in the same investment, more than two of coal power plants can be acquired. Although higher nuclear capital cost is recouped over a life time of 40 years of cheap energy supplies, the upfront costs and financing remains a major bottleneck. That is why Indian nuclear program despite all fanfare to the contrary, has not been able to install much of nuclear power generation capacity due to finance and technology reasons. Perhaps the recent Indo-US nuclear deal may be able to solve these problems for India.

Would Chinese be able to offer all of the 8800 MW of nuclear power projects, as required by us in the next two decades? This would be only 8% or lesser of the total power demand by 2030. Even if Chinese are able to provide the external financing, which may almost be impossible, would others let them have all of it. Many spoilers would be waiting in the wings. Another round of nuclear explosions initiated by India and of necessity reciprocated by Pakistan would provide a large enough of spanner in the hands of our detractors. Or any successful attack on Pakistan's nuclear facilities by the terrorists may be equally damaging scaring the nuclear birds of suppliers and financiers away. Nothing is simple or free in this mortal world?

Coming to the core issue of today, the nuclear safety, apparently all is well in Pakistan. Pakistan is a party to the Convention on Nuclear Safety, from the very beginning and has been following its edicts since 1994, when it came into being. We have Pakistan Nuclear Regulatory Authority (PNRA), of which the readers may not have heard much, except the big advertisements in case of licensing of X-ray machines. PNRA has opted to be a silent worker. Despite its chairman reporting to the prime-minister, it works in the shadow of the PAEC whom it is supposed to regulate. Like elsewhere in the country, operational agencies are usually more powerful and have to deliver the vital services. But nuclear power or weapons are different, for the impact of error or failure, systemic or otherwise, are catastrophic. PNRA has to be less cooperative than its counterparts in other spheres of our national life.

I would invite, rather encourage, the readers and our atomic energy establishment people as well to please visit the web-site of the Nuclear Regulatory Commission of the US, and see for themselves, how a

regulatory agency operates and how is the public informed, involved and reassured. There is an event reporting system, that records every incident relevant to safety, in a formal and structured process, and the same is made available on the internet, for the access of the public, even from terrorism-prone areas like Pakistan and others. And there are many other aspects to the safety regulatory function that seem to be invisible in Pakistan and make an informed person wary of claims and assertions. The whole idea of public involvement in safety issue is to make sure that things are not swept under the carpet, and that controllers and the controlled do not have a cozy and “cooperative” relationship. Fortunately no nuclear accident has ever occurred in Pakistan, and less significant events may not have been reported, although, it is well-nigh impossible that no event having relevance with nuclear safety at any of the installations has ever occurred.

In our case, PNRA website contains operational data only on activities that are related to Hospital X-ray Machines and Industrial applications which have very insignificant amounts but public dealing is involved. It gives them control on the life and businesses of the people. As far as their own activities are concerned, except for the posting of rules and regulations, no detail is available as to how these rules are being applied. An ordinary citizen has no data or reassurance that there is no radiation leak around KANUPP, so that he can peacefully enjoy the Paradise Point beach. The courageous and God-believing people of Pakistan, who are unnecessarily firm believers in fatalism and the inevitability of *Taqdir*, do go to the Paradise Point and do so at their own cost and risk. One would not be comfortable with a puritanical and cocky statement from our nuclear establishment that in the last forty years, never has any radiation leaked into the sea or air, and that no event occurred that qualified for an entry into an open or confidential event register or database.

For the reasons cited above, it is only the public participation and oversight that is going to give the PNRA the required muscle and effectiveness. PNRA maintains quite a good web-site, listing all the regulations, but not much on its actions and performance. It is more open to IAEA submitting reports than its own public, unfortunately quite a number of which have turned into terrorists, adding to the rationale on secrecy and lack of openness. PNRA actions should be motivated more by the genuine realization of the need for its regulatory function, than a simple perfunctory implementation of regulations. A good role model for it in terms of functioning and public participation is of the Nuclear Regulatory Commission of the USA. No country in the world faces more

security and terrorist threats than the US. And look at their openness and public participation. GOP would be well advised to nominate members of civil society and business community on the board of PNRA.

More specifically, there is a strong case for serious consideration that KANNUP which has completed more than its safe design life, should be decommissioned, as soon as the load-shedding period eases. It has been operating under an interim license of questionable validity. Its output has been miniscule and erratic for many years and has been recently refurbished reportedly. In a more aware and informed society such extension and refurbishment would not have been permitted. Even here, had an EIA been allowed, the same would not have been possible. The risk and cost is too high than the benefits. It is right in the middle of the population and the brave and the less knowledgeable go to the Paradise Point to bathe and swim and enjoy. No further nuclear project or expansion should be permitted on this site, contrary to what one keeps hearing of expansion projects. Provincial and local governments and civil society should be watchful and vigilant and must oppose any continuation or expansion there.

Only Nuclear reactors appear to be covered under the domain of PNRA, whatever its shortcomings. Another issue is the domain of other parts of nuclear activities, mining and siting of the military and as well as civilian activities. Many incidences of populations reporting health problems in Uranium mining areas have been reported on and off by this newspaper itself. No EIA of any sort, public or confidential, has been observed. That our public, especially the poor, are used to giving sacrifices for national interests, should not be taken as a license for relaxed practices. That no significant nuclear safety incident has occurred should not be a solace and ground for not having credible safety reviews.

11 Electrical Sector

Overview

Electricity for All remains an elusive goal for the developing world including Pakistan, like many other similar goals that have defied fulfillment. Major failure has been in the rural areas, where bulk of the population still lives, which trend is fast changing. Within the rural areas, even if a village is electrified, the access to electricity may not be to all for a variety of well understood reasons. Therefore, although rural electrification is a step in that direction, it may not in itself result into, "Electricity for all"; more may have to be done to achieve that.

Electricity for All had to be achieved by 2007, by electrifying all the villages in Pakistan. As per WAPDA website, all villages have been electrified, which is obviously not true and is in fact grossly misleading. This may be true that quite some effort was applied by GOP, between 2002 and 2007, to electrify villages. The programme ran out of steam after 2005, perhaps due to financial and power supply shortages. There are conflicting numbers; some data suggests that out of 125,000 villages, only 81,000 have been electrified and 40,000 villages remain to be electrified. If that is correct, then some 31% villages have yet to be electrified, a huge task ahead indeed.

NEPRA Report 2010 released recently provides useful data and insight into the electrical power sector of Pakistan. It confirms and validates the perception and statements of many industry experts who have been making similar statements. Following main points may be noted.

The installed generating capacity reached a level of 21500 MW, with the commissioning of six new power plants last year, with the total capacity of 1165 MW; most of these power plants are oil fired. Another five are to come online adding another 1050 MW to the system. Almost all of these are oil fired. Rental power plants are extra.

Oil-fired plants used to have a share of 33% only five years back, which has gradually but inescapably, increased to 47%, bad news indeed. Who is going to pay for the expensive oil?

Maximum Demand in the PEPCO/NTDC system peaked to 16000 MW plus in summers and 11000 MW in winter. KESC's corresponding figures, respectively, were 2400 MW and 1600 MW. Maximum shortfall in the NTDC system was of 4000 MW. There were four months without heavy load-shedding, from November to February. Shortfall in the other months has varied between 2000-4000 MW. Load-shedding in winters is partly explained by the low hydel output due to lack of snow-melting and consequent low water discharge.

Average availability/peak load sharing has been 67-70%, much lower than the international average of 90% and the best value of 95% nationally for GENCO-II. This indicates that the shortfall is almost equal to the unavailable capacity that is already there and should have been available.

The lack of capacity utilization is not just due to the worn-out plants, which may have contributed part (60 %) of the problem, but a good part (40%) is due to overload, shortage of working capital for maintenance and now even shortage of cash to pay for fuel especially oil. KESC suffers from identical problems. One would have expected more from it, not only because of being in private sector, but also because, all financial benefit of improving efficiency goes towards its profits due to the constant price tariff system it has been granted, as opposed to the cost-plus tariff that is applicable to the PEPCO companies whereby all such efficiency profits are to go to the consumers. KESC, however, is in the process of replacing its worn-out inefficient plants, and some new BMR capacity is expected to come on line by next year. Similarly, one of the GENCOs is undergoing under BMR for a total capacity replacement of some 700 MW at an amazingly low price of 800 USD per KW.

Average Tariff determined by NEPRA in Feb. 2007 ,was Rs 5.14 per unit (kWh), as opposed to Rs 4.25 per unit of average notified tariff (the average rate at which the customers were required to pay), resulting in loss/subsidy of Rs.0.89 per unit. By 1st January 2010, the average NEPRA tariff shot up to Rs 10.09 per unit, while the notified tariff (Consumer average charge rate) remained limited to only Rs. 6.67 per unit, resulting in a subsidy of Rs.3.39 per unit i.e.34 % .GOP in the meantime increased notified tariff in steps; 6 % in Oct 2009, 12% in Jan 2010 and 7.6 % in July 2010, in all 26 % up to July 2010. The plans are to do away with electricity subsidies by the end 2011.It is almost impossible that the distance can be covered in such a short time.

Table 11.1: COGE and Losses of PEPCO

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Avg. Sale Rate (Rs./kWh)	4.1	4.5	5.4	7.3	6.7	
Gas Rs/kWh	2.35	2.68	2.56	3.63		
Furnace Oil (FO)	5.04	5.32	8.12	9.19		13.21
HSD Rs/kWh	12.58	15.08	18.05	13.51		15.55
Coal Rs/kWh	1.33	1.61	2.03	2.12		3.06
Overall Fuel Cost Rs/kWh	2.94	3.66	4.67	5.99		7.20
Average Cost (Rs./kWh)	4.7	5.1	6.5	8.2	10.1	

* Figures for March 2011

Source: NEPRA

In the year 2009-2010, the average fuel cost of GENCOs was Rs 7.49 per kWh and of KESC (with mostly gas fired plants) Rs 4.66 per unit. UCH power plants and other combined cycle plants had a very low fuel cost of only Rs. 1.50 per kWh, almost competing with hydro. Thermally inefficient Single cycle gas plants cost as much as Rs.4.00 per unit as fuel cost. RFO fuel costs were Rs.8.00 per kWh. By Jan. 2011, the RFO based electricity had a unit fuel cost of Rs 11.37 per kWh. By comparison, average household tariff in the US these days stands at 10 cents per unit. Their electricity comes mostly from local cheaper coal, gas and Uranium (nuclear).

GOP could not have paid the entire shortfall as subsidy, and the residual shortfall gave rise to the so-called circular debt. Circular debt by Dec 2010 jumped to. Whatever amount is pumped in by the GOP, new shortfalls suck it, causing no net addition into the liquidity of the energy supplying companies. This shortage of liquidity on the part of the companies has affected their supply capacities, and thus energy supply has significantly reduced over time.

DISCOs also share the blame due to their inefficiencies, at least some of them more than the others. For example PESCO 's T7D losses show a rising trend ,at an already unsustainably high level of 37.4% . HESCO closely follows with T&D loss level of 34.75 %. The technical loss component is hardly 5-7%, bulk of it is theft and receivables. There are other companies, mostly in Punjab, which T&D losses are limited to 10-11 %.

HESCO recovery rate of its bills is merely 59.81%, as opposed to 95% for most other companies. It is said that big landlord in Sindh do not pay their bills. There are big landlords in Southern Punjab as well, where the

recovery rate of MEPCO is 95.82%. It is claimed that in Sindh, the provincial Government and its departments steal and as well as are defaulters, in addition to all and sundry who happen to enjoy some power or nuisance value. More or less same situation prevails in the cosmopolitan Karachi. One would try to condone what happens in FATA, Balochistan or KP which is suffering under terrorism. It is too much. Electricity is too expensive to be doled out in this manner. All these years, the defaulting regions and Discos could have carried on, as the losses and pilferage has been absorbed at the country level.

Tariffs in these regions would be doubled, if provincial autonomy prevails. It is not easy. KP may comeback with its low royalty case, while Sindh has been murmuring about gas not being used where it is produced. They have started troubling OGDC as well. Concluding, if the T&D losses are reduced to fewer than 10%, no subsidies would be required to maintain a reasonably affordable tariff. But, it may remain a big wish. The common man would keep suffering at the hands of powerful and the dishonest. The losses won't go so easily and so early. GOP does not have money. Oil prices are increasing and cheaper local source dwindling, while potential resources remain buried under the earth.

The easiest task for GOP is as follows, in addition to exploiting the dormant resources, I and others have lamented about enough. There is a capacity of 2-4000 MW that can be converted into more efficient new power plants, with lesser investment and shorter time. But the GOP has no money. However, GOP has managed to somehow launched two Combined Cycle projects, one at Nandipur and the other at Chichoki Malian with a total capacity of 950 MW, with a relatively low investment of around 500 Million USD. A new IPP would have cost around 1.2 Billion USD (1200 USD per kW). Similarly, KESC is going for CCPs of its own with a total capacity of 780 MW and an investment of 600 Million USD, giving an average of about 800 USD per kW, higher than public sector project, but still lower for private sector.

The remaining non-performing or inefficient plants can be privatized, if the vested interest and bureaucracy and turf issues permit. A two-envelope proposal could be invited, one for the sale of existing asset and the other for adding new capacity/BMRE. But there are NAB issues and destructive politics that may brake the initiatives in this respect. The safest way out for the bureaucracy and the ministers and the doers is to do nothing.

Rural Electrification

On a global level, 78.2% of the world population has access to electricity of sorts, as against South Asian average of 60.2% .In Pakistan, access rate is 70.4% , 60% in rural and 93% in urban areas. According to the Mouza statistics, 64% of Mouzas have electricity, 19% have no electricity at all, and the rest are in between. It may be of interest to keep in view the comparative, cooking fuel availability. Only 20% of people/households in Pakistan use natural gas; 58% in urban areas and 2.83% in rural areas. Two-third (68.83%) of Pakistan's population uses wood and biomass as fuel, no wonder deforestation is so endemic. Wood use is the highest in KP, up to 83% of households, a major cause of flood aggravation. (There is a considerable confusion as to what is a village in statistical terms. There are some 47482 Mouzas, and some 150,000 villages (deh) in Pakistan. Mouza is a larger agricultural/population cluster; on the average, there are three deh/villages to a Mouza.)

Leaving aside data controversy, it has been studied that about 8000 villages may not be electrified at all ,in foreseeable future , keeping in view the long term grid expansion plan . Rural Electrification project has targeted these villages for electrification, mostly through solar energy. The programme has been estimated to cost 500 Million USD .GOP had committed 18 MUSD, to electrify 400 villages (3200 house-holds) in Sindh and 300 villages in Balochistan.

One Solar Household system (SHS) has been assigned a Solar PV installed capacity of 50-120 Watts. For, 1000,000 house-holds in 10,000 villages would generate a demand of 100 MW of solar PV power. This would also mean, a 100 kW load per village. At a rate of 4 USD per watt for PV capital costs, it adds up to 400 MUSD for generation and a 100 MUSD extra for other costs. Admittedly cost estimates appear to be reasonable.

However, only 18 MUSD has been committed, which would not meet more than 5 % of the target, according to the afore-mentioned numbers? It is also doubtful, that reasonably sufficient funds would be available to implement this programme any sooner, esp. in the scenario of economic and budgetary difficulties in the post-flood situation.

There is one shaft of hope that Solar PV costs are fast coming down. Already, PV costs of under 1 USD are being quoted, although of solar PV Cells only. It is expected that by 2015, solar prices would be competitive with fossil power. Thus one may have to be a little less

ambitious for the time being, run the program at a slow speed, and go in high gear after 2005. There are, however, a few solar applications that may already be competitive and affordable. Solar Pumps with DC motors do not require expensive balance-of-the-system (BOS) ancillaries. For these applications 2 USD per Kw of solar PV costs would be competitive with expensive diesel based power. Similarly, advent of LED bulbs has reduced the power demand due to its high lighting efficiency. Instead of 100 watts per household, even 20-40 Watt per house is being considered adequate enough, as experience in Bangladesh has indicated recently. Another experience from Bangladesh model is that the solar PV-LED system of 20 Watt has been financed through monthly payments that are equal to the fuel/kerosene consumption expenses for lighting the kerosene lamps. My own experience with LED bulbs is reassuring. I use a night reading lamp that mounts on the book that is hardly a few watts, and gives quite adequate lumens for reading. Infact, even my maid uses it in cooking hanging it around her neck. Its replacement cell costs me 20 Rs or less and works for a month.

Reorganization of Electrical Sector

Contradictory reports are coming in regarding the closure of PEPCO, which was created a few years ago in the wake of restructuring of WAPDA. Earlier WAPDA used to be the sole organization, responsible for the power sector, which was a continuation of an early power regime, where hydro power used to be a major component of the electricity supplies. Reorganization was done as under; WAPDA restricted to the dams, irrigation system and the hydro generation facilities like Tarbela etc. WAPDA happened to be the owner of these assets and facilities. PEPCO was given the ownership and management of Power distribution companies (DISCOs) and possibly the thermal generation plants. NTDC (National Transmission and Dispatch Company) was to own and manage the Transmission facilities and act as an integrated system operator (ISO) responsible for power dispatch management. There is a CPPA (Central Power Purchasing Authority) under NTDC with a low profile, which bought electricity from all the IPPs and GENCOs and sold it to the distribution companies (DISCO). The need for this arrangement was felt because of a uniform tariff regime system, under a huge subsidy. The whole system except for KESC and other IPPs was in public sector.

Under a Power Utopia, the entire power sector would be eventually privatized, there would be no subsidies and there would be separate regional or DISCO tariff and thus no WAPDA or PEPCO. Two

developments have taken place recently. CPPA has been upgraded from a section under NTDC to a full-fledged company under GOP guarantee. Perhaps this was a step in the right direction. It had to be a guarantee company because, it would be entering into power purchase agreements, that had to have the benefit of GOP guarantee for the satisfaction of investors and IPPs. It is being wishfully contemplated by the Power theorists of multilateral agencies under which all reform is being engineered that the subsidies would go away along with the uniform electricity tariff in the country.

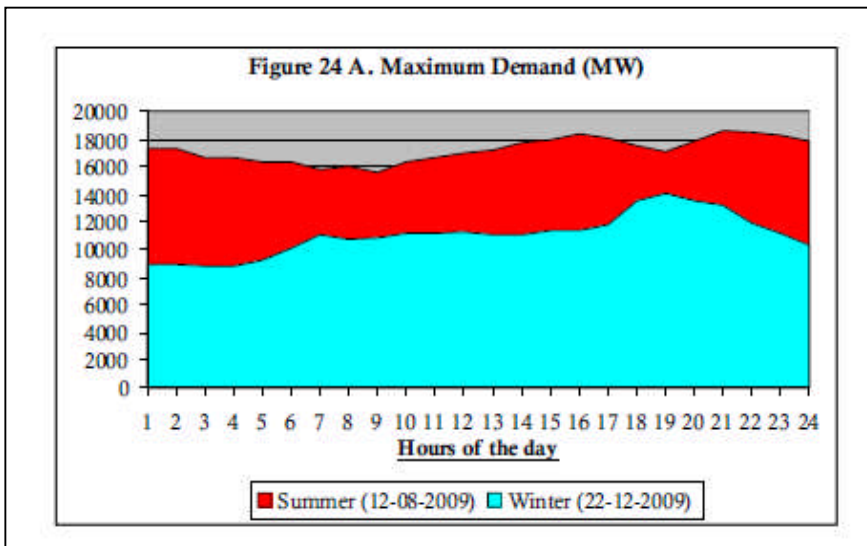
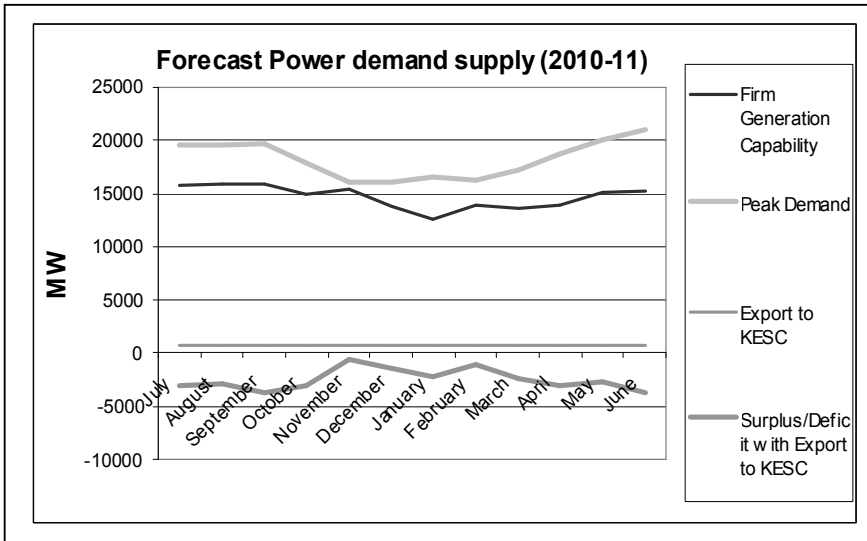
The whole electricity sector has been structured under a unified model of uniform tariff and central investment. All assets and fuel sources have been developed under it. Power sector, under 18th amendment has become a Federal subject, rather than being on the concurrent list as it was earlier. Subsidies may go, but a regional tariff is impossibility due to the baggage of the past. In a decade, the sector configuration may change appreciably due to increased contribution of IPPs. Regional tariff may then be a possibility.

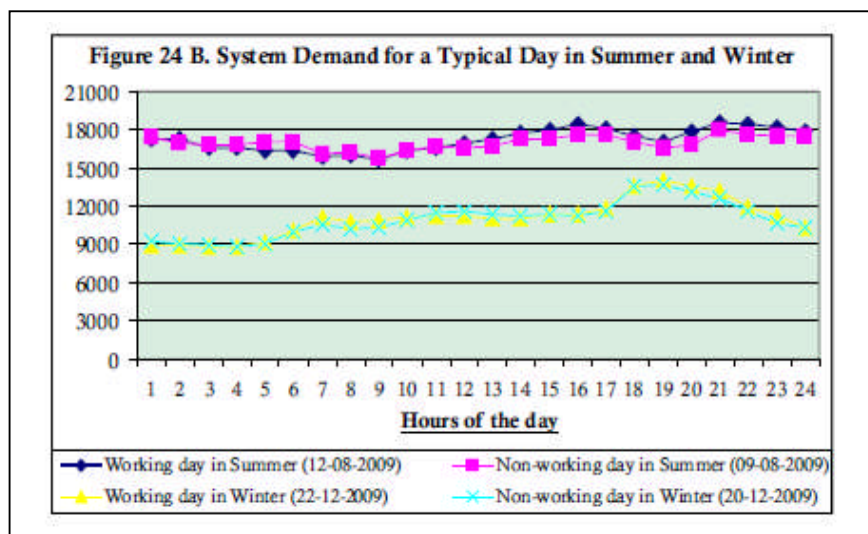
Nationalists of KP, rightly or wrongly, already allege that cheap hydro electricity is bought from Tarbela, and sold back to the province through PEPCO at a rate many times higher. They, however, forget conveniently that, it is the federal investment through which cheaper hydro electricity is produced. KP contribution it is of its location, which is rewarded under a royalty system. Except in Punjab, the electricity losses are 30-40% which is largely taken care of by subsidies. These subsidies are assumed by GOP were never paid off timely resulting in circular debt which leads to shortage of liquidity in the system and low capacity utilization in a situation of power shortages. The theft in Punjab is at its lowest of 15%. If regional tariff is introduced, Punjab as a whole would benefit, which in effect subsidizes the more theft prone regions of the country. Under go alone system, it would probably have a lower tariff. The utopia may, however, have some chance if all resources are priced at their true value or market worth. Natural gas according to this theory is currently underpriced and thus its price /tariff should go up.

All of this can lead to a political disaster, threatening and risking not just the sustainability of democratic system, but the very foundation of a united federal Pakistan. Federalism is popular under which the political actors and the system is ready to get rights and not the responsibility. Let the people get the putative merits and advantages under the new system for a while, and then the requisite burdens and liabilities may be shifted. No wonder some rebalancing may be demanded later.

Coming back to PEPCO, its role and its rationale, in Pakistan an administrative model has worked satisfactorily in the past of sectoral corporation controlling and administering the sectoral companies. As in the manufacturing sector, the privatization took place these corporations went away, as has happened in the case of PACO, Ghee Corporation and others. The Corporation model is of a holding company that serves as a professional intermediary between the public sector companies and the bureaucracy of the ministry, obviating a direct role of the latter in the day to day affairs of the companies. These corporations are also supposed to take care of the sectoral issues and its development, suggested policies and advised government. However, the enterprise/company management has often complained of a rigid control by these corporations, hampering their management independence and flexibility. The notion is sometimes supported conveniently by the ministry bureaucracy who wants direct control without intermediaries of the corporation. Opposition to PEPCO is to be seen in this perspective, although there are genuine issues of reconciling the roles in face of a rejuvenated CPPA. The role of a sectoral corporation and a holding company would be there in the background of the aforementioned issues. There may be no role for it in a Utopia and a totally privatized regime, which time has not arrived yet.

We cannot possibly afford to be reckless theorists unmindful of the consequences of policies and new regimes. The foreign advisor and theorists do not buy the same medicine for themselves as they prescribe for us. Had they done so, there would have not been much of an inefficient manufacturing sector in their countries surviving on trade barriers. Even agriculture survives there on trade barriers and subsidies. Inefficient and labor intensive sectors would have been long shifted to this part of the world promoting mutual welfare and employment in labor surplus economies. This has not happened and would happen very gradually, minimizing dislocation on the part of adjusting people, labor and sector. Same gradualism would be advised here and not the abrupt actions under the knife of IMF and dagger of project loan giving agencies. PEPCO may be allowed to continue or merged with CPPA.





Courtesy Nepra

Energy Security Plan

Planning Commission of Pakistan prepared an Energy Security Plan (ESP) in 2005, and presented it with much fanfare to the then PM and the President. The Plan still remains operative in the books of the government departments, and is quoted and discussed annually in the Economic Survey. In practical terms, ESP was a non-starter. It was not implemented even by the previous government. By 2010, an additional 7880 MW of Electrical Power capacity was to be installed. Only a few hundred MW was installed and consequently we have a deficit of 4000 MW today. Why the “conscientious” Musharraf government was so derelict in meeting its responsibilities in this respect, is a serious question. Equally serious question is what the relevant bureaucracy was doing. Prime Minister Gilani fired the previous Managing Director of Private Power and Infrastructure Board (PPIB) on this account, despite intense lobby in the favor of the latter’s extension of the contract. More heads should have rolled and a serious review of official practices in power sector ordered.

What is known can be visualized by one single example. A veritable Chinese company spent two years in Thar Coal field, prepared a

feasibility study, offered to make the investment and supply electricity at the rate of 5.5 cents per unit. The then military commander holding charge of WAPDA for the reasons best known to him opposed and rejected the offer. We are buying electricity today at twice the Chinese offer and Thar Coal remains unexploited. It so incensed the Chinese that despite many requests the Chinese do not return to Thar.

Returning to the Energy Security Plan (ESP), there is hardly any possibility that it would be implemented as per its projections and estimates. The Plan was so grandiose and unrealistic which could have only pleased a fascist agenda and ruling culture. One gets nervous on our Planning Commission's ability to become so frivolous in its planning practices. I will discuss the details a bit later in these passages, suffice it is to state here to support my contention that the ESP provided 4860 MW of generation capacity based on Natural Gas. Shortage of gas is in the country now for many years. It was known even in 2005, when the Plan was made. One may fail in long term projections, but what to term this kind of outright frivolity.

Long term projections can falter at the altar of reality especially in Pakistan's boom-bust type economy and polity, reversing it in seven years cycles. ESP projected requirements of 72,270 MW by 2020, by the way of installing an additional 50,000 MW in the period 2010-2020, and again half of it to come on Natural Gas. Realistically speaking, only half of that would materialize. We should be thankful and happy, if half of that is achieved. There is no way that the demand could reach a level of 72,270 MW by 2020 in a matter of ten years. ESP predicts an electrical demand of 162,590 MW by 2030, again half of which to come from natural gas: very grotesque and unrealistic projection. Where are they seeing the gas from? Even if both the projects of LNG and the Iran-Pakistan pipeline were implemented and more of the same are added, this kind of gas wouldn't be available.

Electricity demand in Pakistan has grown at a rate of 5% per year, and even at higher assumed rate of 7 % per annum, the demand is to double every ten years, unless we become Chinese by some magic. By that robust formula, the demand would be 50,000 MW by 2020, and 100,000 MW by 2030, most of which should be planned to come from Thar Coal, Hydro, renewables and nuclear and not from gas, as has been proposed in the ESP. There is, however, a potential of gas discoveries in Balochistan, if sufficient exploration effort and investment is directed. The prospects of such effort appear to be minimal in current political and law and order situation prevailing in that province. This may remain a

much desired dream, and robust planning should not be based to depend so heavily on a break-through in that respect.

The problem with frivolous planning is that plans are not respected and a careless atmosphere ensues which results in shortfalls and other problems and inadequacies that we are facing today in energy sector. It is high time that ESP is buried with the kind of condemnation it deserves and a more realistic plan put into place and diligently implemented. Ironically, ESP was one of the rare indigenous planning efforts and failed miserably. Let us involve multi-lateral institutions in this as they do in all the other sectors to the chagrin of many nationalists and conspiracy theorists among us.

**Table 11.2: Energy security plan (Planning Commission) – 2030:
Electrical.**

	Nuclear	Hydel	Coal	Rene wable	Oil	Gas	Total	Cumul ative MW
Existing (2005)	400	6,460	160	180	6,400	5,940	19,540	
Addition								
2010	---	1,260	900	700	160	4,860	7,880	27,420
2015	900	7,570	3,000	800	300	7,550	20,120	47,540
2020	1,500	4,700	4,200	1,470	300	12,560	24,730	72,270
2025	2,000	5,600	5,400	2,700	300	22,490	38,490	110,760
2030	4,00	7,070	6,250	3,850	300	30,360	51,830	162,590
Total	8,800	32,660	19,910	9,700	7,760	83,760	162,590	

Source: Planning Commission of Pakistan / Economic survey of
Pakistan 2008

12 Solar Energy

Solar Power is coming of age?

Fastest growth in technology and business is perhaps in solar energy sector these days. Human beings have been late in discovering and accepting the Sun as a useful source for meeting their daily energy requirements. It is said that Sun shines gives more energy in one hour than the total annual requirement of the world, rich and poor included. It is abundant, it is free and available everywhere. To utilize it profitably has not been easy, although largely due to the chicken egg problem of demand vs technology. However, the oil is now at its end .It will be extinct in less than fifty years and prohibitively expensive much earlier. Although Coal in the world is enough for two centuries, it is creating problems of pollution and green house gases. There was enthusiasm for wind power in the last decade; the availability of wind is still limited. The enthusiasm for wind is still there, however the race is now for solar energy. Solar industry is growing at a rate of more than 40 % per year. Germans are after Solar, more than any body else to be followed by China, Japan and the US.

Solar dream

Solar power has been a dream since Solar Photovoltaic Cells(PV) were first introduced in the space satellites in 1960s.High capital costs and low conversion efficiency have been the major factors making solar power unaffordable. Incremental technological advances have brought these costs down and have improved efficiency many times. Solar cells used to have an efficiency of fewer than 5 %. Today, efficiency of commercially available Solar cells is 17.5 %. There are some with lower efficiency but are also cheaper than the high efficiency (17.5%) solar PV cells.

Chicken-egg syndrome of demand and price?

Demand and prices used to be a chicken egg problem and it still may be; higher costs are due to low demand, while low demand leads to higher costs; no more. Very high supportive feed-in tariffs have spurred the demand. Germany today offers a Feed-in Tariff of 25-30 US cents per kWh, which may be 4-5 times the conventional rate. This makes

Germany today to be the highest electricity cost country. The upside, however, is that 70% of all solar pv installations in the world were in Germany. Germany will recoup the higher costs in the long run eventually in the form of a major solar exporter. German high tariff has created high demand conditions in the world. Pressure has been developed in other countries to offer such supportive rates. High demand initially created short term supply problems and thus led to increases in the prices of solar raw materials, like Silicon.

Grid parity issues

It appears that the earlier US target of achieving grid-parity in 2015, meaning that solar power becomes competitive with fossil power on the electric grid, would be achieved. The indicators are several; last month, the quoted capital cost rates in the U.S. markets came down to 3.5 USD per KW, it used to be more than twice this figure only some years back. Solar cells of high thermal efficiency (mono-crystalline Si- 17.5% efficiency) are costing less than 2.5 USD per KW, and thin- film lesser efficiency ones are being sold at 1.0 USD per kW or less. In China, several government contracts have been made at the rate of 1.5 USD per kW for domestic power, although Chinese rates, especially in the domestic market do not quite reflect true costs and prices. Still, it gives some trend.

However, even if grid parity in solar power is achieved as early as 2015, it would not mean overnight conversion in the US, Europe and Japan. It would take a long time to develop production and supplies infrastructure. Solar and other renewable market share in the developed world may not exceed 10-15 % by 2030, although new fossil plants construction rate may come down very significantly by that time (2030).

The Lessons from Wind?

What does all of this hold for us? Good news, but still not very close-by. Look at the Wind Power. Despite a forward looking policy, we have only a few MW of wind power installation, although a few projects are at an advance stage of processing, which may mean 100-150 MW of wind power in a few years time. Due to heavy demand of Wind Turbines in the Western markets, no wind power equipment vendor was ready to supply wind turbines to our projects. Long lead times were quoted and not honored. In this atmosphere, obviously prices quoted are high also. Of late things seem to be changing; enthusiasm has shifted to solar energy, and considerable resistance developed against wind power due to

noise, birds' safety and aesthetic issues. Consequently vendors are talking to project sponsors in Pakistan, and hopefully would be offering reduced prices that may not necessarily translate into lower NEPRA tariff for reasons I have been discussing elsewhere. Prices in Pakistan do not come down so easy and automatically!!

Cheap Wind Power in India?

In the mean time, India has installed more than 11000 MW of Wind Power, at a modest capital cost of 1100-1200 USD per kW, which is almost half the rate at which similar projects have been approved in Pakistan. Indian case, however, is different. They have a local manufacturing industry which manufactures 100 % of wind turbines and are self-sufficient, thriving upon low costs. Imported western equipment and services are comparatively much more expensive.

Perhaps this is the time for us to pursue Wind Power, even if the interest elsewhere may be waning. Firstly, it has only become available now, in practical terms as has been mentioned earlier. We have long stretches of unpopulated areas, with rich wind resources that remain totally untapped. Various ways and means should be investigated to bring down the capital costs.

Towards a Solar Policy

What is the moral of the story? Solar future may be far off for us, if we do not equip ourselves with the right technology at the right time. Easier said than done, but it can be done. This should not, however, mean recruiting non-productive scientists bureaucracy in our R&D institutions and elsewhere, marveling at show case projects. Throwing money at it, does not bring in technology, neither doing nothing and waiting to be supplied packaged technology, in the rich oil producing Arab countries' style, suits us. Private sector would have to be integrated, which is a separate discussion and would be taken up at some other time. It would remain a difficult question as to when to enter into this and how. Although a few things can be done immediately, like introducing solar energy in schools and universities curricula, and augmented by R&D activities in PhD programs should receive immediate priority. That a trained work-force brings down technology induction costs and speeds up the process, would not be lost to anyone.

The problems with renewable energy

For all the praise of renewable energy, we should also be cognizant of the problems with these sources, apart from the lack of development of commercially reliable and competitive technology.

Sun shines only in the day, and there may be cloudy weather sometimes, though this problem is much lesser with us, but would still influence supply. Although sun shines almost every where, wind of required speeds do not blow every where and all the times. In technical terms, this means low capacity factor. Renewable energies like solar and others may offer a capacity factor (call it utilization) as low as 25 %, as compared to 80 % of conventional power. Thus even, if the per MW cost may be identical; its actual capital cost implication is three time more. Thus if capital costs of solar or other renewables is twice the conventional as the case may be today , its actual capital cost implication would be six times higher. Additional storage costs may be extra. But for industries working in day time , only marginal storage costs may be involved for load balancing purposes only ; Similarly the offices and commercial sectors which today pay highest tariff. Laptops may have built in solar cells eventually, as today calculators work on solar cells, surviving on room lighting as energy source. Today, the solar conversion efficiency is as low as ten percent or slightly more, but is slated to rise to 40 % in a matter of two decades, almost as much as in conventional. But as of today, this seems to be a major disadvantage

When should we jump in?

When should we jump in? We are already in it in limited ways , largely on the basis of foreign funded projects, which are also serving as demonstration models for manufacturers as well , and hence the rationale for foreign aid, apart from its philanthropy and ?. Solar PV costs are coming down very fast. Sometimes, in the next five years, solar power may be competitive in off-grid markets, of small and far off villages. For specialized applications such as power supply to communications tower, monitoring stations, pipelines instrumentations, health and education facilities in far off villages , it is already competitive and in demand. In Bangladesh, reportedly, a PV-LED combination has become very popular and successful in villages, where a 20 watts PV –LED power is lighting the lives in rural homes. The rent/tariff, it is said, has been kept as low as their kerosene budget for lighting. Not a bad deal, if that can be replicated here in this country.

Institutional issues

Even if the real days of Solar Power may be ahead in time, there is to be some home work and an enabling policy in place, to guide investors, businessmen, R&D institutions, vendors etc. For example in what areas and villages government is to priorities solar power. What kind of institutional arrangements are required and may be permitted and supported. In this case company model may not work as well as it does for grid power. Cooperative bodies may have to be promotes and the role and functions of such co-operatives may have to be defined. Electricity Co-operatives have worked successfully in The US in the initial days, and have survived till this day. Electricity Coops are going to be in fashion again through out the world and more so in the developing countries. May be for development purposes a few one-MW solar power plants may be permitted every year, which may require auctioning such opportunities. Local content may have to be mandated.

Towards Indigenization?

Solar PV and Solar Thermal

There are two main technologies; Solar Photo-voltaic (PV) and Solar Thermal. Both are not competing or mutually exclusive. Solar PV converts incident sunlight to electricity directly into a DC current which has to be converted to AC and often there is requirement for storage batteries. A significant portion of cost (up to 40%) can go towards these extras which are called Balance –of-the –System (BoS) costs in the technical jargon. There are to day mainly three technologies in PV; a) Mono-crystalline Silicon b) Poly-crystalline c) thin film. Mono-crystalline Si has been most popular with the highest efficiency that has reached almost 18%.It is also the most expensive but competitive. Poly-crystalline Si is a variant of how Silicon ingots are made.

Mono-Crystalline PV

In Mono Crystalline, one crystal is grown as an ingot, which is fairly expensive and energy intensive task. In Poly-crystalline, larger multi crystalline ingots are cast and then sawn into smaller cylinders. There is no scope here for going into full details and we restrict the detail here to its relevance with the issues we are dealing with. Only about ten companies are reportedly into the highly capital intensive upstream portion of this business. But there is a downstream component, which is labor intensive and where countries like us have a long term potential

comparative advantage. This is of fabricating/assembling the solar panels from imported solar cells. Almost half of the cost (60%) of solar panel is other than solar cells. Other supplier industries like sheet or plexi Glass and backing material like plastic sheets and structural framing components and materials are going to be energized from such local assembly of Solar panels. From the perspective of developing countries mono or multi-crystalline Si technologies are the best bet. This would be one of the ala-garment industries of the future with a potential for very significant employment. It is quite simple to assemble panels. There are many DIY approaches and even in Pakistan, an American professor trained many workers recently on the job in an improvised workshop, product of which were later installed and are working satisfactorily. Yet producing any product, however simple it may be, in reasonably high volume and with consistent and reliable quality, would require investments and participation of private sector. In India, there are several plants making these Solar panels, both for domestic demand as well as exports.

Apart from local employment perspective, there is another imperative for local production. Once Solar Power becomes really competitive, the domestic demand in the producer countries may get so heated up that developing countries like Pakistan may not get the solar supplies and products at all. What has happened in the case of Wind Turbines is quite instructive. There are many Approved and ready projects of Wind Power, but could not be implemented due to lack of availability of willing suppliers even with longer agreed lead times. Only now when there is a thaw in the Wind turbine market, due to the rush and switch to Solar Power that the vendors are now attending to our projects. Similar has been the case of other developing countries except India which has a complete local manufacturing capability in large volumes, the latter has managed to install 11000 MW of Wind Power at prices 50% lower than imported ones.

Let us pray Thin-film technology does not prosper

There are other Solar PV technologies fast coming up where there would be total automation, and no scope for labor surplus countries. Flexible Thin-Film continuous sheets are being produced in a roll-to roll environment; a roll of web material, as in a printing press, is fed in at one end and a role of PV panel taken out at the other end. It has only to be framed as one frames a painting. These are also flexible and can be mounted on curved surfaces.

Solar PV cells mainstay would be in stand alone distributed domestic and commercial lighting system, although many grid connected solar PV farms of exceeding 100 MW are already in operation and more are coming up every day. The jury is still out if PV would be able to supply the volume of utility power that is required. Besides industries require energy in primary form as heating or cooling, where PV is less competitive, although there are split AC systems in the market of 18000 Btu per hour working directly on Dc power produced by solar PV.

Solar Thermal

Solar Thermal is the answer to the sector that may not be adequately catered to by Solar PV. In Solar Thermal, Sunlight is concentrated by reflectors at a point or line, and the circulating medium that can be air, water or salt is heated to relative high temperatures varying between 70deg C to 500degC. Initially only solar water heaters were developed in this sector and remains to be the mainstay of it. However large Power Plants have been built for more than a decade now. Once water or any other liquid is heated at sufficiently high temperatures of 300-500 deg C, the rest is standard steam turbine electricity generation. All one may have to do is to replace the coal or oil or gas fired boiler with a Solar Heating/boiler system. For a variety of reasons, however, integration with combined cycle plants has been found to be more feasible, and implemented under the term ISCC (Integrated Solar Combined Cycle). Cost of a complete system producing electricity is high but competitive generally with Solar PV. There is another advantage to this system. Thermal energy can be stored much more economically and large volumes than electricity produced in PV. Five hours of storage at full load has become a common feature of large scale utility plants of 50-100 MW.

Spain has gone into it with much more commitment and investments. More than a dozen plants of 50 MW are already working there, and more are coming in, although under a highly supportive subsidy system in the form of very high feed-in tariff. This is obvious we cannot afford this kind of feed-in tariff, already there is a lot of social unrest on unaffordable tariff, which otherwise is quite competitive with other countries. GOP has been giving subsidies of Rs 200 billion per year to the electrical sector to sustain the existing tariff level. These subsidies have infact paid for the exceptionally high T&D losses and theft and pilferage. So theoretically, GOP could have afforded some subsidies to encourage Renewables and foster technology development, had these kinds of losses not been there. These subsidies now have to go under

IMF pressure and tariff is to be raised. But some subsidy can be maintained on the account of Feed-in Tariff for renewables, if a reasonable scheme is developed for creation and support of this technology.

Technology differentiation within Solar thermal

There are four technologies within Solar Thermal, largely depending on what kind of concentrating system is employed. That is the reason; it is also called Concentrated Solar Power (CSP), although CSP systems have been used in Solar PV as well. The four technologies are;

- 1) Parabolic troughs
- 2) Heliostats and Solar Towers
- 3) Linear Fresnel reflectors
- 4) Solar dish

Essentially the difference is whether one focuses sunlight on a point like a furnace or a boiler or one does it in on a line or tube carrying a fluid. Parabolic troughs have been more popular, cheaper and are now an established technology. Parabolic troughs are more prone to indigenization, as it is mostly sheet metal work and structures and framing made out of steel. There is some glass work or plastic for reflectors requiring electroplating. Considerable know-how both in formal and informal sector exists in Pakistan and other developing countries like us in this area. It is labor intensive as well. A number of our sick industries in Public sector could be revived by technology arrangements and orders in this field. Also private sector and informal sector can be strengthened.

Building a Solar Thermal (parabolic trough) Power Plant

According to the figures released by US Energy Information Administration, in January 2010, a solar thermal power plant to come on stream in 2012 would cost 4798 USD per kW. It takes three years to implement a 100 MW solar thermal power plant. If one deducts 1798 USD per KW for conventional power component, the solar component cost would be 3000 USD per KW i.e. more than 60% of the total project cost. It requires 25000 tons of steel, 12000 tons of glass and 20,000 cubic meters of concrete among major inputs. It is not round bar construction steel, although some of it is, but mostly it is steel fabrication supporting my argument that we can do it, and we will have comparative advantage in it. Over the years cost s and steel consumption would come down, but

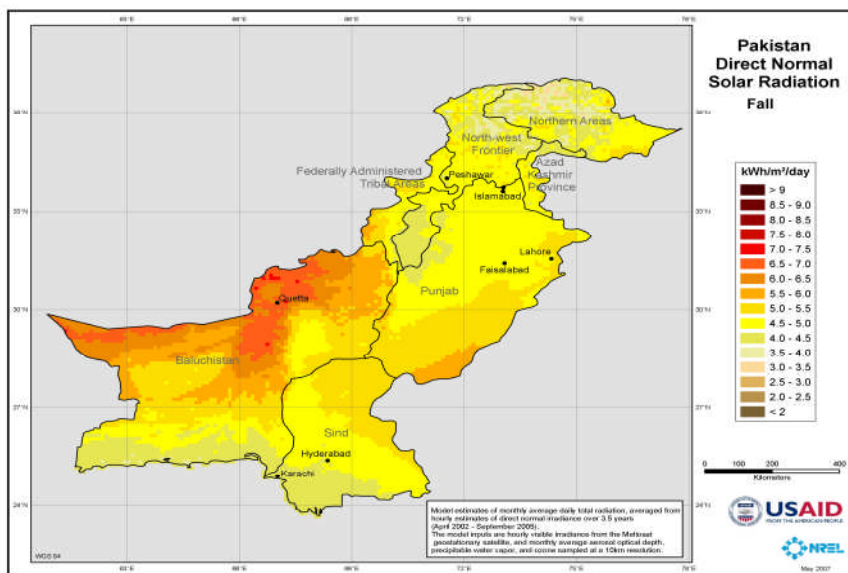
the nature of steel construction may not change. By comparison, a large coal power plant of 600-1000 MW would require steel structures of 5000 tons, which in itself is a large number. Recently an ISCC plant built in Egypt under World Bank/GEF assistance generated a demand of some 4000 tons of steel fabrications for 15 MW only and should have kept the local company busy for one whole year round the clock. Such is a potential of comparative advantage and job creation in ordinary technology of steel fabrication required in Solar thermal. There are associated technologies in glass, and control system which can be bought or partially developed locally.

Solar thermal in the Middle East

Morocco, Egypt, Iran, Algiers and recently UAE have gone into this, but in a very cost effective way. They, except UAE, have launched solar – augmented combined cycle plants running on gas. Parabolic Troughs have been installed to cater to 10-20% of the total fuel requirements of the combined cycle plants. We can do the same in one or more of our existing plants. All these projects, except Iran and UAE, have been financed under GEF. UAE is pursuing two tracks; one for Solar thermal power and the other Solar air-conditioning. A 100 MW Solar thermal has been contracted for, which is to be commissioned by 2012.

Admittedly, there is more solar insolation in countries around Sahara than in South Asia. DESERTEC project has been launched, presently under negotiation, through which electricity produced through Solar Thermal plants installed in Sahara, would be transmitted to Europe through HVDC (a cost effective DC technology as opposed to conventional AC) network, to meet some 20% of the power needs of Europe. Although Terrorism issues may prevent or delay the implementation of DESERTEC, the faith and confidence in Solar Thermal is adequately demonstrated by this EU project. DESERTEC like projects are being encouraged in other countries which have desert. Regional counterpart organizations and arrangements like DESERTEC-India, Asia have been formed. We have Thar, Thal and Cholistan. If Thar Coal gets going finally, there would not much scope there for any thing else. Thus Cholistan can be readied for such ventures.

Geography of Solar Power in Pakistan



Conclusion

1) Concluding Solar Panels Assembly and Solar Thermal new or retrofitting are the areas where initiatives may be taken by the policy makers, public sector industries and private sector as well. Initially demonstration cum commercial approach would have to be adopted for one or more small projects.

2) Solar PV would be a winner in small-scale non-grid power, while Solar thermal may have a niche in large scale grid power. Solar dish may compete with Solar PV in commercial scale power of 20-50 MW. Parabolic Trough would have advantages in Direct Steam Generation (DSG), while Solar Tower may be a winner in HTF energy storage.

3) Almost half or slightly less (40%) of the capital costs of solar PV power system go towards traditional technology of inverters, storage and other electrical installations. Half of that half is of Si-cell, which we may not be able to enter for a long time, due to its technology and capital intensity. However, the rest seems to be straight forward and conventional, some of which may be very simple. For example, making solar panels, which may become a garments industry of the future, due to its labor intensive assembly character? An American professor came to

Pakistan recently through his own private effort and initiative and trained Pakistanis in making Solar panels. Its simplicity has been physically demonstrated to the 30 trainees he trained and the other onlookers and professionals. There are many other institutions that may be able to help.

4) Solar Panel making could be a good employment creating industry, although technology is in flux. Traditional Si- cell based technology which today provides for 90 % of the market and applications belong to the traditional Solar Panel. There is a new technology of continuous laminated flexible film, which may not have high employment opportunities. Background studies must be commissioned to guide into such choices. That day is not far off when a Mohollah electrician would be fitting solar panels of ones roof top and places like Liaqatabad, lawrencepur and Gujranwala and Sheikhpuras SMEs and home industry may be producing solar parts and equipment. Policy can aid in fast-tracking it.

Recommendations

Following steps are recommended.

- 2) a limited number of small commercial-demonstration projects may be approved and installed as IPPs, such as in the following;
 - 1.1) one or two solar PV projects of 5 MW each.
 - 1.2) 10 -20 MW Solar Thermal(Parabolic trough) as ISCC with an existing Steam Turbine or Gas Turbine Combined Cycle Plants in Kot Addu/Muzaffar Garh.
 - 1.3) One or two Solar dish 1 MW projects.

These projects may be auctioned to get lowest offers as solicited projects. The preferential feed-in-tariff would not pose a heavy burden on consumer tariff.

Appendix

DOE Details Initiative to Reduce PV Costs by 75% by 2020

POWER news

The Department of Energy (DOE) last week released additional details of its “SunShot Initiative,” a program that seeks to reduce the total costs of photovoltaic (PV) solar energy systems by about 75% before 2020 so that costs for PV systems can compete with other forms of energy without subsidies.

“With the cost of utility-scale installations reduced to \$1 a watt (or roughly 6 cents per kilowatt-hour), PV systems could be broadly deployed across the United States,” the agency’s Office of Energy Efficiency and Renewable Energy (EERE) said. “The SunShot program evokes the legacy of President Kennedy’s 1960s ‘moon shot’ goal, which laid out a plan to regain the country’s lead. In the space race and land a Man on the moon”.

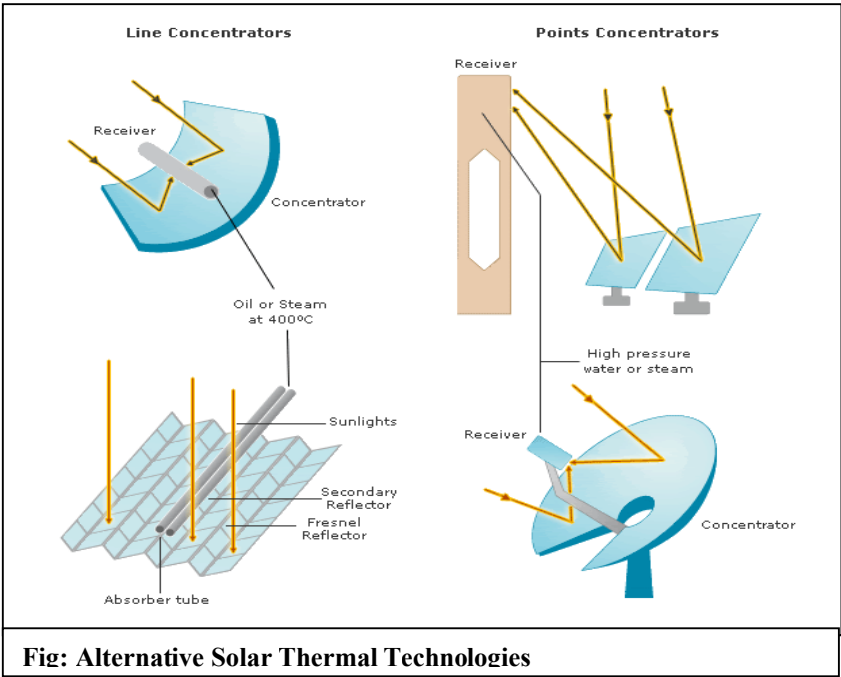
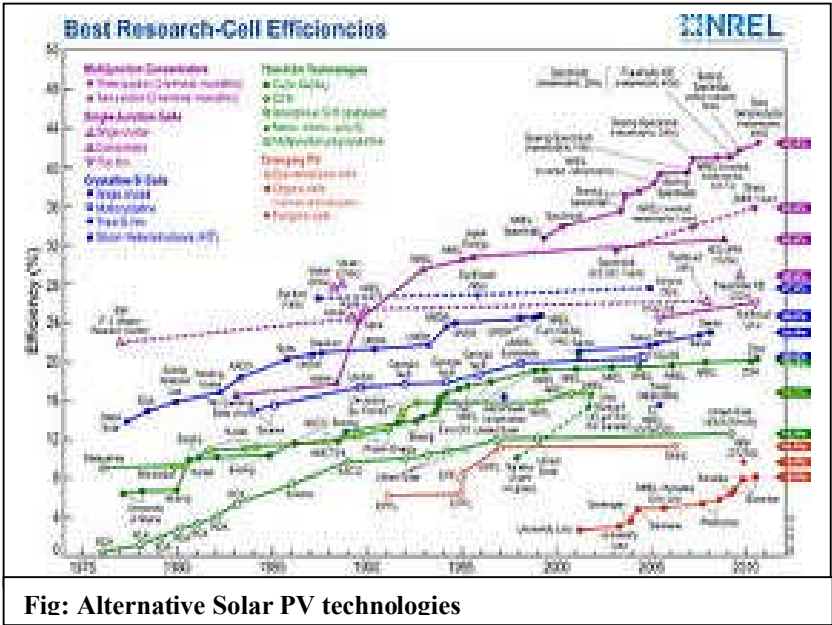
According to the DOE, SunShot is expected to work to bring down the full cost of solar—including the costs of the solar cells and installation—by focusing on four areas: technologies for solar cells and arrays that convert sunlight to energy; electronics that optimize the performance of the installation; improvements in the efficiency of solar manufacturing processes; and improvements in installation, design, and permitting for solar energy systems.

February 9, 2011

Solar Electricity Sunny and Cloudy in US cents per kWh		
Residential Installed System	\$14,604	-1%
Sunny Climate	30.53	-1%
Cloudy Climate	67.16	-1%
Commercial Installed System	\$264,413	-2%
Sunny Climate	20.87	-2%
Cloudy Climate	45.92	-2%
Industrial Installed System	\$1,920,330	-2%
Sunny Climate	16.27	-2%
Cloudy Climate	35.79	-2%

Source: Solar Buzz

- A sunny location (like Los Angeles, California, US) receives an average of 5.5 hours of sunlight per day each year.
- A cloudy location (like Hamburg, Germany) receives 2.5 hours per day of sunlight each year.
- A 1 kilowatt peak solar system generates around 1,600 kilowatt hours per year in a sunny climate and about 750 kilowatt hours per year in a cloudy climate.



13 Wind Power

Considerable wind power capacities have been installed in the world, of which total today exceeds 150,000 MW. China leads the world with an installed capacity of 44,733 MW, followed by the U.S. with 40180 MW, Germany 27214 MW, Spain 20,676 MW and India 13065 MW. Even smaller countries like Egypt and Turkey have respectively installed 550 MW and 1329 MW.

Wind Power cost (turbine etc) were unaffordably high up to the year 2008, since then the costs are gradually coming down. In the period up to 2008, the demand was too high and supply capacity was trying to catch up with the surging demand. So much so, that wind turbine suppliers would not even respond to the queries of buyers from this part of the world, or gave inordinately large lead times. There are two reasons for this; a) Wind turbine supply industry has expanded and supply bottlenecks removed; b) Gearless turbines have become more popular (gearing system used to be a supply bottleneck); c) Wind power is now getting increasing competition from solar, dividing the attention of investors.

More than 100 LOIs had been issued in Pakistan almost a decade ago, and many (20+) got lands allotted in the wind area. As mentioned earlier the progress in the sector has been marred by excessive supply bottlenecks and high capital costs. Some 13 parties, all of these not being land allottees, invested in feasibility studies, and 5 out of them acquired generation licenses and tariff approvals. Two or three parties got a power purchase agreement and one installed a small capacity of some 7 MW. Tariff enhancements are being requested and applied for, which is not justified as we shall examine later in this space.

Wind Resource in Pakistan

There is a wind resource of 50,000 MW in Pakistan, the most investigated region being around Ghara in Sindh, with a potential of 20-25000 MW. But the best of Wind resource happens to be in Chaghai, Balochistan, where a mineral complex and industrial cluster may be potentially expected due to the large mineral resources having been found there. The area is at the meeting point of Iran, Afghanistan and

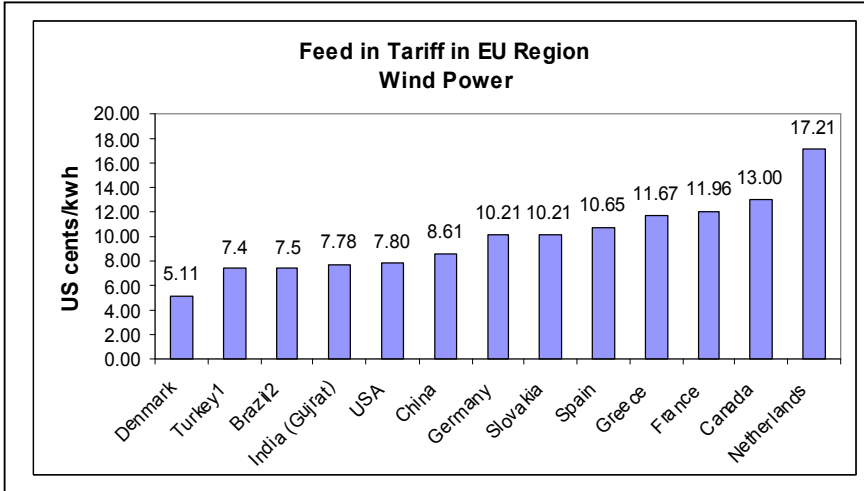
Pakistan. Currently, however, the demand is very limited in that region. There are some other scattered wind resources in Balochistan around the altitude joining Chaghai and Gawadar. Lack of demand and population are there as well. However, projects of 1-5W may have a potential there. Unfortunately around population clusters in Balochistan, there is no wind resource.

In Punjab, there is very little wind, except around Kallar-Kahar, where a small project is in the pipeline. NWFP wind resources ought to be investigated as well. In upper Peshawar region around Swat, there is a sizeable resource. There are competing hydro resources there that may, however, delay the onset of wind power there.

The Quality of Wind resource is high in Pakistan ; in Ghara Sindh , class 3-4 wind (moderate) is found ,but with a high Capacity Factor , as we will discuss later in this chapter in detail. Wind speeds are, however, higher in Chaghi area with a class 5 wind speed.

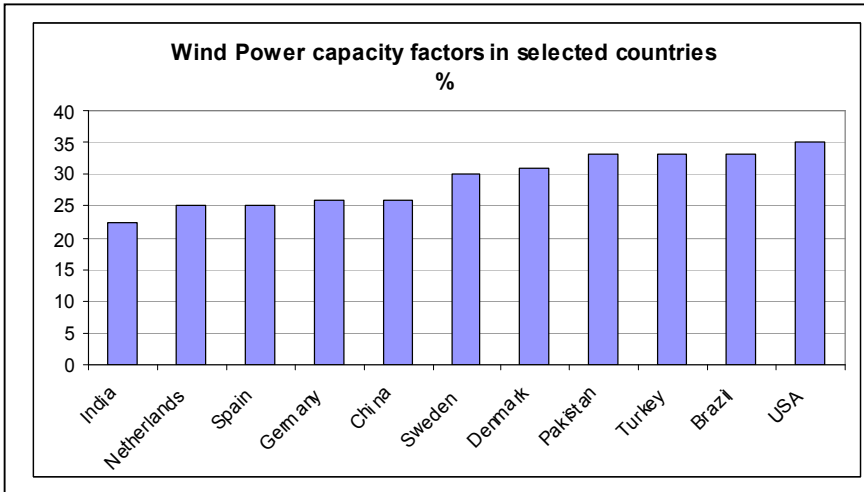
Wind turbines costs

In the period 2005-8, Wind turbines typically cost above USD 1500 per kW .Today, a typical turbine costs around 900-1000 USD per kW. The neo-comers like China and India offered the current level prices even in the high price period. In their domestic markets, China and India sold well and built formidable capacities. Today, India has an installed base of 13065 MW, adding more than a thousand MW every year. China, starting from zero, only a few years back, has installed a generation capacity of 44733 MW by the end of 2010, out of which 18928 MW has been installed in 2010 only. Due to considerable installed base, the financing agencies are less reluctant to finance projects which are supplied by these two countries. Today, the total capital cost for wind power allowed by regulatory agencies in India varies around IRs 4.3-5.35 crore per MW (900-1200 USD per kW). Allowing for 25-30% installation costs, the Wind Turbine cost comes out to be 750-900 USD per kW, which is about 75% Of the European cost. Earlier this cost differential used to be even higher.



Note: ¹ Auction prices in a recent tender 2010-11 came 12.5% lower than feed in tariff at 6.4cents; ² these are auction prices of August 2010; Average Values for Germany, Slovakia, Greece, USA, China; 1 USD = 0.6856 Euro = 45 Indian Rs = 6.5 Yuan; European data from EU Energy Portal; data for US and India from GWEC annual reports 2010.

Source: Compiled by the Author from the basic data in EU Energy Portal



Source: (1) Paul Schwabe, Sander Lensink, Maureen Hand, IEA: Multi-national Case Study of the Financial Cost of Wind Energy, IEA March 2011, (2) GWEC Reports 2010 for India and China

Table 13.1: Status of Wind Power Projects in Pakistan

S.No.	Company	Feasibility study done	Generation License	Tariff	Power Purchase Agreement
1	New Park	x	x		
2	Tenaga	x	x		
3	Green Power	x	x	x	x
4	Dawood	x	x	x	
5	Master	x			
6	Zephyr	x			
7	Fauji (FFCEL)	x			x
8	Lucky	x			
9	Zorlu	x	x	x	x
10	Wing Eagle	x			
11	Arabian Sea	x		x	
12	Makwind	x			
13	Milergo		x	x	

Source: AEDB

Table 13.2: Comparative Wind Power Tariff awarded by NEPRA (2006-2010)

Project		Zorlu ¹	FFCL	Green Power	Arabian Sea	Dawood
Year	Unit	2008	Aug-10	Aug-06	May-10	Jul-08
Capacity	MW	49.5	49.5	49.5	49.5	49.5
Annual Generation	Gwh	149	1436	127.1	141.3	141.8
Capacity Factor	%	34.39	33.12	30	32.59	32.7
Turbine Costs	MUSD	101.08				80.396
EPC Costs	MUSD	112	112.98	70.7	115.16	109.5
Non EPC Costs	MUSD	10	24.717	10.185	11.54	10.836
Total Capex	MUSD	122	137.697	80.885	126.7	120.34
Unit Cost	USD/kw	2465	2782	1634	2873	2400
Tariff (Total)	USc/kwh	12	17.89	10	11.92	9.475
O/W O&M	USc/kwh	1.48	1.29	1.48	1.24	1.45
Debt Equity Ratio			80/20	80/20		
Exch Rate (USD=)	Rs	61	85	61	84	80
Supplier		Vensys/Gold wind	Nordex 1.5 MW	GE 33x1.5	Nordex 33x1.5MW	

1=Zorlu has a submit a petition to increase its tariff determination to 15 Cents/kwh and unit capital cost of 2872 USD/kw

Source: NEPRA

Wind Power Tariffs in the world

The Feed-in-Tariffs (FIT) have also come down considerably. In most European countries, FIT is around or below 12 US cents per kWh. These are European prices, which have been on the higher side. Present Tariffs in EU countries were fixed in April 2010; the new tariffs are expected to be revised downwards reflecting the still lower wind turbine prices in the intervening period.

In Europe, typical wind tariff is less than 12 cents and in the US even lower. In some of the good sites in Germany, the wind power tariff is as low as 7 cents. In India, it is around 3.5 Indian rupees per unit, which makes it under 8 cents. It would have been still lower than this figure by a good 25% if India had the same high capacity factor wind resource as we have in Pakistan. Pakistan Capacity Factor approximates the US average which is among the highest in the world.

In many countries Wind power has started competing with coal and gas, having come as low as 7 cents per unit. It is widely known in Renewable Energy circuits and being talked about. In Turkey, another comparable example, Feed-in-Tariff is 7.3 cents, and an additional incentive for local content up to 3.7 cents depending on the level of local content. As per recent bids in that country, 12 of the 17 successful bidders offered a tariff of 6.4 cents, 12.5% lower than the basic allowed tariff. Admittedly quality of wind resource in Turkey is high, equal to Pakistan. So the trend is towards reduction in wind power prices, tariffs and equipment cost. Seller's market has gone. In Brazil recent biddings have resulted in Wind FIT of 7.5 us cents per kWh. Infact auction approach has expanded the role and market of wind power in that country due to lower prices. Same is seeming to happen in Turkey, where auctioning and resultant low tariff has brought wind power into the main stream.

Why should wind power cost be more expensive than in other countries?

It depends on the quality of Wind resource; wind speed and the capacity factor. Table---- shows the data variations in various countries of the world. Data from various sources have been put together in this table. Pakistan wind resource at Gharo is better than many countries in the world with a capacity factor exceeding 30% , while in India it averages around 22% at most locations. Similar is the situation of quite a few European countries on which data is available. In Europe, the capacity factor averages around 25%, although some sites may have a higher CF.

In Spain and Denmark, Capacity factor is generally high at 30%, resulting in the lowest wind tariff in Denmark. In Morocco and around Capacity factor exceeds 41.5 %. Turkey, Brazil and Pakistan have comparable CF between 30 and 35 %, only second to USA and Morocco.

Wind Power Tariff in Pakistan

Most of the approved Wind Power projects in Pakistan got their tariffs approved in the high price period. These were not implemented due to supply problems as mentioned earlier. There is a strong case for revisiting those approved tariffs, and bring these down appropriately reflecting the new cost realities. A reasonable wind power tariff today should not exceed Rs 10 (12 cents) per kWh. These days fuel cost for oil base power is Rs 12.00 per kWh. But these are abnormal and hopefully transient prices. There are all kinds of forecasts for oil prices. A more reasonable yardstick of oil reference price is 80-100 USD per barrel. As per NEPRA advertisement for fuel tariff hearings, the average fuel cost today for power generation is Rs 7.16 per kWh.

Table 13.3: Wind Power Tariff in India 2009

Description	Tariff		Capital cost		Return on equity (%)	Capacity Factor (%)
	(IRs. /kWh)	(US Cent /kWh)	(IRs. Crore/ MW)	Million USD/ MW		
CERC			5.15 indexed	1.14	19% 1st 10 Yrs 24% later	-
Andhra Pradesh	3.50 for 1st 10 years	7.78	4.70	1.04	15.5	24.5
Gujarat	3.50 for 20 years	7.78	4.62	1.03	15.5, Pre-tax	23
Haryana	4.08, Escalation @ 1.5% p.a.	9.07	4.30	0.96	16	20
Karnataka	3.70 for first 10 years	8.22	4.70	1.04	16 Post-tax	26.5
Madhya Pradesh	4.03 for 1-5 yrs 3.36 5-20 yrs	8.96	4.60	1.02	16 Pre-tax	22.5
Maharashtra	3.50	7.78	4.00	0.89	16	22
Rajasthan		0.00	5.25	1.17	16 Pre-tax	21%
Tamil Nadu	3.39	7.53	5.35	1.19	17.63 Pre-tax	27.5
Uttarkhand		0.00	5.15	1.14	Pre-tax, 19% for 10 yrs: 24% later	20-30%

Note: All figures in Indian Rupees; 1USD=45 IRs

Source: www.cwet.tn.nic.in

Wind Turbine prices have fallen to their lowest in recent years. This is the caption of a report released recently by *Bloomberg*, a highly respectable organization in energy finance sector. The report reveals that the wind turbine prices have come down by 18%, and are lower than pre-commodity price hike period. However we tend to live in a different world. Project promoters of wind projects are demanding higher prices than approved earlier. A NEPRA hearing for a 25% increase in approved tariff is scheduled for next month.

According to *Bloomberg*, global contracts signed in late 2010 for delivery in H1 2011 and H2 2011 were for USD 1.33 per MW in Europe, and in the US even lower at 1.27 USD per MW. Wind Power monthly in its Special Report on India in its April 2011, cites a deal among Dongfang of China and SKS energy of India signed in December 2010, for a supply of 166 Wind Turbines (249 MW) for a total price of 145 million Euros, which comes out to be 0.844 million USD per MW, to beat the local Indian manufacturers which are selling at even lesser rate.

To our information, Chinese turbines are being supplied in place of the originally approved German turbines in Pakistan projects. Including 33% construction costs, European total capital cost comes out to be 1.769 USD per MW, and Indo-Chinese price at 1.12 million USD per MW. In Pakistan, the current asking rate as per the latest tariff petition is 2.872 million USD per MW, which is 62% higher than installed costs in Europe, and 250% higher than the Chinese equipment installed in India. These are more akin to nuclear power plant rates which has a capacity utilization of 90%. Wind turbine is just one piece of equipment, and much simpler and crude comparatively. Who will pay for all this? Neither the government, nor the people have the money to pay for the consequential tariff?

NEPRA had till recently approved wind tariff at around 12 cents per kWh, and only in last August approved tariff for Fauji Fertilizer at 16 cents, giving cause to the others to share in the loot, so to say. The recent petition asks for an enhancement of 25% i.e. from 12 cents to 15 cents per unit. I do not have details of the new petition for increase in Tariff (except for what has been provided in the advertisement), as NEPRA has not posted the details on its web-site. There seems to be a trend in avoiding providing timely data and information to the stake-holders; so much for transparency.

In Pakistan people and other stakeholders make protestations at the wrong time, normally when NEPRA awards tariff to the distribution

companies. There is no use crying over spilt milk, The die is cast usually much earlier when Tariffs are awarded to power generating companies. Piece by piece individual tariff decisions cumulate to an unaffordable bulk. We need energy including renewable energy but at a reasonably competitive prices. Ideally it should be lower, keeping in view the low paying capacities of the consumer, but that is not possible. Every thing is imported, plant, fuel and the know-how. Neither subsidies are feasible; as government does not have the money .Unpaid subsidies have created circular debt problems, which affect electricity supply through under-utilization of an already low installed capacity. Therefore the relevant authorities have to be careful and judicious in making tariff awards.

Table 13.4: Wind Power cost in selected countries (2008-2010)

	Denmark	Germany	Netherlands	Spain	Sweden	USA
Unit size (MW)	2.3	2	3	2	2.4	1.7
Number of turbines	7	5	5	15	41	50
Full load hours	2,695	2,260	2,200	2,150	2,600	3,066
Capacity Factor(%)	31	26	25	25	30	35
Total Investment (€/kW)-2008	1,250	1,373	1,325	1,250	1,591	1,377
Total Investment² (€/kW)-2010-11	1000	1098.4	1060	1000	1272.8	1101.6
Converted total O&M costs (€/MWh)	12	21	28	20	11	7
Reference Case Weight	6.10%	3.80%	5.70%	11.40%	36.60%	31.80%
Return on debt %	5	5.5	5	7	5	6
Return on equity (%)	11	9.5	15	10	12	7.5
Debt share (%)	80	70	80	80	87	0
Equity share (%)	20	30	20	20	13	100
Loan duration (yrs)	13	13	15	15	20	15
National tax rate (%)	25	29.8	25.5	30	28	38.9
WACC (%)	5.2	5.6	6	5.9	4.7	7.5
LCOE (€/MWh) (\$MWh)-2008	61 (85)	85 (118)	94 (131)	83 (115)	67 (93)	65 (91)
LCOE (€/MWh)² (\$MWh)-2010-11	48.8 (68)	68 (94.4)	75.2 (104.8)	66.4 (92)	53.6 (74.4)	52 (72.8)
Feed in Tariff (2010)	0.035	0.05-0.09	0.118	0.073	n/a	

2=Extrapolated as per Bloomberg Report, www.bnef.com/PressReleases/text/139

Source: Paul Schwabe, Sander Lensink, Maureen Hand, IEA: Multi-national Case Study of the Financial Cost of Wind Energy, IEA March 2011.

The dubious merit of higher returns

Why is it so that we get higher energy tariff. In the US average consumer tariff is 10 cents .We are the only unfortunate country other than the oil rich countries, which produce electricity based on oil. Earlier oil had a 33% share in our electricity production and now it has increased to 50%.Most of the countries produces their electricity from coal, nuclear, gas and hydro. We have abundant coal but let us keep the sordid details to some other moment.

The other reason for expensive energy in Pakistan is what we are facing in case of wind power. The unabated tendency in Pakistan is to book higher capital cost. Regulatory agencies are supposed to check this trend. Earlier, there was a requirement of three quotations, now there is a requirement of open tendering. All can be managed in a country which is still one of the least documented. As it is Pakistan offers probably the highest return on Equity at 18% IRR and that in foreign currency. Add a 5% annual long term currency depreciation ,the allowed IRR on equity becomes 23%.In India ,return on equity of 16% is allowed in most of the states , and that is in local currency. In the US ,return on equity for wind power are typically at 7.5% , in Germany 9.5% and Spain 10%. In the most wind friendly country Denmark, it is 11%. Thus allowed rate of return should be enough of an incentive.

The idea of awarding higher and higher rates of return on Equity, especially in the context of inflated capital cost bookings, may be revisited; as the average energy costs keep going high .There is an upper limit to what the consumer can pay. The rising circular debt has shown the gravity of the problem, neither the government nor the consumer can afford the energy subsidies and the bills respectively. Renewable energies pose an extra problem. Capital costs are twice as high, which tantamounts to a virtual fuel cost of 50%. Higher return on Renewables such as wind power actually means paying higher return on fuel cost in the parlance of conventional energy. More than 80% of the cost of renewable energy tariff is capital cost.

The merit of auctioning

If wind power is not beset by unreasonably high capital costs, there is now a chance for wider scale penetration of wind power. Wind power tariff rather than the high rates of return on Equity may become the driving force, as the trend is emerging in many countries. An immature market offering risky high returns often encourages unstable investors.

Except for exceptions, most wind energy project promoters do not fall into the category of stable parties, if compared with the IPP list.

It may be advisable for the agencies to either auction the projects or announce pre-tariff. In India, auctioning has been done in case of solar power. The received bids were considerably lower than the reference price. Auctioning is very simple for wind, as all projects have the same basic data that affects cost. But nothing absolves the officialdom from doing the necessary homework and adequate verification and seeking expert neutral advice where it is required. There is yet another issue that is current and the public ought to think about it.

The issue of Wind Risk and Capacity factor

At the beginning of launching Wind Power initiative, the data history of Wind Cluster at Gharo was limited. Bankers and investors required a much larger back data on wind speed and resource in order to assure a minimum rate of return to the companies' share-holders. AEDB/GOP undertook to assume wind risk below a benchmark figure i.e. if wind speeds are lower than the bench mark, then the buyer/GOP compensates the differential and if it is more, the buyer/GOP takes the additional electricity free of cost. In the mean time, a sufficient data history has been available through measurements of various projects and other agencies. The understanding of the issue worldwide has increased over time. There are independent wind risks as well due to long term climatic changes. I am not sure what kind of actual risks are being assumed.

Is a minimum wind speed curve is guaranteed or a minimum capacity factor is guaranteed. If it is the former, there may be a defensible rationale for it. But if the latter (the capacity factor), is guaranteed, then it may not be justified. Capacity factor is not just a function of the characteristics of the wind resource (wind speed and its seasonal variations), it is also a function of turbine design and installation factors and operational efficiencies. Experience of the last few years experience has shown that the actual capacity factor realization in Europe and elsewhere is much less than the measured wind speed data from the data loggers. As against measured wind data of 35% capacity factor, the actual realization has been 20-25 %. On the other hand companies have been able to improve their capacity factors over the years, while the wind characteristics have remained the same and constant in those locations.

Local Manufacture of Wind Turbine

We have argued earlier that there would not be a foreign exchange advantage in wind power in the current situation, despite wind being a local resource. The imported fuel cost of fossil fuels is almost replaced by the twice expensive capital cost. Local manufacture can, however, do away with this disadvantage. There are various approaches to it. India gives no preferential treatment, as local equipment is cheaper. Turkey gives an incentive up to 50% in the feed-in-tariff for local content.

While deliberating on the prospects of the local manufacture of wind turbine, it is vital to have a deeper look into the Indian Wind Power sector, and the Wind Turbine manufacturing sector. They are producing wind turbines, at half the international cost. What are the sources and reasons for such drastic differences in the production cost? Some ready answers would be in every body's mind. The issue deserves a more serious investigation in the context of replicating the same in Pakistan. Wind Power in India is today competitive with fossil fuel. There are no subsidies. A study mission to India may be organized either through UNDP, bilateral govt-to-govt channels, or through private sector contacts, which ever may be feasible.

Contacts with the Indian Turbine industry may be useful in many respects. It may be a door to reach their parent companies in Europe. Ideally JVs with Indian companies may have been an option worth pursuing, but it may falter at the door of politics. Still, the idea would remain on the table due to its tremendous potential. Buying straight from India may be more feasible option politically than a longer term involvement. An Expert Working Group may be organized comprising of the relevant Industry leaders, leading persons and professionals and stake-holders, including representation from the relevant ministries and the Power (transmission) and regulatory sector.

An integrated package can be developed incorporating the following elements and competitive proposals from international companies be invited ;a) a guaranteed purchase of 500-1000 MW of Wind Power ,at fossil fuel competitive prices , over a period of 5-7 years ;b)accompanied by a local manufacturing plan ala deletion plans of the automotive sector's)inclusion of one of the public sector companies like HMC in a privatization context. The transaction advisor of PC implements the package. Part or full HMC may be warded to the contending wind turbine manufacturer. It may be worthwhile to try to attract Gold Wind of China .It has emerged as a respectable in company from scratch over a

short period of last 2 or 3 years. It is located in Urumqi, adjacent to Pakistan and linked via Qaraqoram Highway. Putting Urumqi and HMC together implementing the propose package may be worth while exploring.

Table 13.5: Local manufacturing potential of WT components

Component	Material	Manuf. order of process	Difficulty 1-7	Local Manuf. Potential	Deletion value %
Tower	Carbon steel	Rolling welding in sections Annular	3	A	10 – 15
Rotor-hub	SG Iron	Casting complex machining	5	C	8 – 9
Shaft	Forged steel	Forging machining simple	4	B	1
Gear Box	Steel & GI castings	Complex machining	7	D	15 – 17
Blades	Polyester & Epoxy glass fiber	Fiber glass molding & casting	6	D	16
Brakes	Malleable Iron castings	Casting; simple machining	4	B	3
Bearings	Standard Item	Standard Item	7+	D	2
Electronics	Standard & Proprietary	Electronics 3rd party	7	D	5
Generator	Bought-out	3rd party	7	D	10
Bolts	Forging steel	Forging, simple machining	3	A	1
Chassis	Carbon steel	Steel fabrication	4	B	5
Misc					10

Source: Wind pact, PEI & Another's estimates

1	- simplest	A	highest potential (18-22%) deletion value
7	- most difficult	B - C	medium 30% potential (30%)
3 - 4	- average	D	lowest potential (51%)

Better market conditions are emerging on the international scene. Supply situation has improved .Demand for wind power stabilizing at lower ends due to environmental opposition(noise and birds issue and bad look compromising the real state value of host communities and most importantly competition from Solar ; a new technology romance has begun).Prices coming down and inventories building up. The companies which were not talking to Pakistani buyers are now responding. This is the time to launch the Wind Turbine initiative.

In practical terms, a wind project built on the assumption of 30% capacity factor and guaranteed accordingly, may only be able to achieve a capacity factor of only 25%, but gets payment as per capacity factor of 30%. Its incidence on tariff would be 20% higher than the approved reference tariff. It is time to revisit the wind risk issue, and try to understand its full implications. Also, as sufficient data is available now, the idea of assuming the wind risk may be done away with altogether. As per my exploration of world data and practice, there is no such precedence in any part of the world in this respect.

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14 Institutional Issues

Constitutional issues in the Energy sector

Energy sector not only faces high price and low supply issues, but there are constitutional difficulties and issues as well; some old and some new. There are four issues; a) Tarbela hydro-power royalties that we have already discussed; b) that gas (resources) be first used to meet the requirements of the producer province before being exported to other provinces, which is causing great hardship in Punjab, and may cause many problems to other provinces including Sindh with respect to other energy sources in future, has also been covered; c) hydel dams can only be built by a province under the approval of the CCI (Council of Common Interest); d) 18th amendment has reserved electricity sector for the federal domain only along with the regulatory functions of all kind including NEPRA and OGRA.

During the recent deliberations of the CCI, Prime-minister Raza Gilani has reportedly allowed the provinces to handle their energy projects themselves and deal with the foreign investors and countries themselves. While so many powers and functions have been devolved to the exclusive provincial domain, electricity and the regulatory agencies have been kept with the center. There is either and or situation of exclusivity and no room for joint determination, the concurrent list having gone under the 18th amendment.

First of all, the constitution cannot be taken so lightly, if in the case of gas it is being implemented so tightly. In the absence of the constitutional amendment, what is the actual worth of CCI's resolutions, constitutional experts may know better, but it has certainly caused uncertainty. Already many proposals are circulating around, such as the creation of a unified Ministry of Energy by the merger of the Ministry of Power with the Ministry of Petroleum and the merger of NEPRA and OGRA as a corollary (which I greatly support as do many other knowledgeable experts and most importantly the international financial institutions).

There has been a long drawn tussle between federal and provincial bureaucracies on the Thar Coal issue. Sindh government would like to

handle the project directly and exclusively, as they believe it to be their right under mineral sector provisions of the constitution. But coal is both a mineral and an input for electricity which is a federal subject only, as there is no concurrent list any more. The additional problem is that the main demand and market for electricity is Punjab, without which no power purchase agreement whether on Thar based electricity or other cannot be signed. Lacunae in this would enhance project risk perceptions and may result in an increase in the interest rates which are laden with risk ratings. Sindh may be well advised to play the resources autonomy card a bit carefully.

On the other hand there is a point of view that elements in the federal government have not been taking due interest in Thar coal. Earlier a military general heading WAPDA is blamed for sending the Chinese company Senhua away, refusing a very reasonable offer. Since then, practically no meaningful development or progress has occurred. Many think that it is the lack of interest and support from the federal bureaucracy that things have not moved. Thar Coal or any other power development project of its size requires massive foreign investment. Under the current dispensation, the federal government negotiates with the foreign parties and countries. And it is blamed that the latter does not take interest. On the other hand, on projects of such nature, movement takes place under the momentum of the top political hierarchy, no less than the President and the Prime-minister. It may be unfair to blame the federal bureaucracy totally in this respect.

Prime-minister has reportedly permitted the Sindh government to deal with the foreign investors and the countries directly. Lately Chinese interest seems to have revised once again though not by the same earlier company. China is no more a monolith communist monopoly. There is now competition among Chinese companies as well, although it may still be integrated at government level. Chinese government is too busy with its momentous growth and launching its own projects and agenda. Initiatives have to come from individual Chinese companies. Thus from our side initiatives should focus both at the company and as well as the government level. Finally, one of the ten major contributions President Zardari can do for himself, his party and the country is to get going on Thar Coal by taking personal interest in Thar coal and get a Chinese governments decision in this respect.

Coming back to the constitutional questions, it is debatable whether the expansion of provincial domain would be feasible and effective. For us at the receiving end, we would not mind whoever manages to deliver. This

leads us to a larger question on which all have to ponder; our institutions are often considered and found to be a hindrance or just another stop for files to accumulate. People complain this often, and now governments are complaining. It is not only Sindh government, but the Punjab government too seems to have joined the chorus and has demanded similar curtailment of federal authority for its energy projects.

There are propositions to devolve NEPRA as well, if not OGRA. The constitution and the 18th amendment are certainly against it, although it is true that in most federations this is the practice. There are provincial electrical or energy regulatory authorities. This is certainly true for the US, Canada and India. However, there are peculiar circumstances of Pakistan. A unified pricing and subsidy system operates here in this country which is rather complicated extending over several commodities and energy elements. While there are already insurmountable problems, further fragmentation and transition than has already been put in place may be counter-productive. As it is there is a performance and efficiency issue with these bodies, it may be argued that provincialization may make it even worse.

National Electric Power Regulatory Authority (NEPRA)

Energy costs are going up, and may continue to go up, mostly for the international reasons and trends. We are increasingly getting dependent on expensive imported energy. However, there are other components of energy costs such as capital costs where efforts can be made to reduce costs. In this respect NEPRA can play a genuine constructive role by improving upon its regulatory function.

Well-wishers and knowledgeable people have been counseling NEPRA over the years to remove several inadequacies from its regulatory practices, especially, in the area of power generation capital cost approval. These days, all it is busy in, is the quarterly determination of distribution (DISCO) tariff. The distribution margin is hardly 60-70 paisa per unit, which is only 10 % of the average unit cost or even less.³⁶ quarterly determinations are made every year in a week per year 45 weeks per year of working time. Expensive advertisements are run on newspapers. Amazingly, a lot of needless, useless and inopportune interventions and litigations are made by consumers and trade bodies. The die has been caste much earlier. Nothing can possibly be achieved unless the consumers persuade or possibly even force NEPRA through

interventions or litigations amend their processes, and adopt transparent and professional practices in awarding tariff. Holding public hearing is not enough and does not meet the requirements of objective criteria. Let me explain to you what I mean.

First of all let me report to the readers some of the most egregious, if not scandalous, Tariff determination cases. Tariff approval of a low Btu combined cycle power plants has been made based on an excessive capital cost of 1350 USD per KW on an existing already developed site, while the powerful project promoters have been lobbying for more and have withheld project implementation, while managing to block a unique and cheap gas resource.

The nation is paying for expensive oil based electricity and rental power. Comparable projects of KESC and Guddu are being installed at 60 % of the project in question. IC engine base projects have been approved at capital cost of 11 60 USD per KW. Wind power projects are being approved at around 2500 USD per KW, as against international prices of less than 2000 USD per KW for similar projects, and in India of 1100 USD per KW. It is a big joy ride of project promoters. It is a common knowledge in Pakistan that no body puts in equity out of his own funds. It is all built in borrowing. But the variations in true and actual project cost appear to be higher than this margin, which has been willy-nilly accepted over the years. The problem is that the pampered investors become shy or even reluctant if this kind of free for all is resisted. This is perhaps the best defence that could be made for NEPRA's lack of interest in putting a break to such practices. A whispering campaign is usually launched by the entrenched vested interest against officials who try to put an end to these practices. After all the vested interest is an important stake-holder.

Almost all generation tariff is awarded on cost-plus basis, as there is possibly no other alternative bringing in competition. In theory project promoter is at liberty to maximize his cost and charge it to the customer, unless a conscientious and efficient regulator checks it. Easier said than done, but it can be done. We have earlier mentioned the incentives on the part of regulators not to do so. Regulators are handicapped in ascertaining the true costs, as the number of projects is very few to offer any meaningful historical data. And whatever reference costs are available, these are mostly of inflated costs, and thus do not serve any useful regulatory purpose. Infact regulator becomes a victim of his own past decisions and determinations. There is no other alternative but to seek meaningful data from credible international consultants and

agencies, and do some home work on it and announce permissible regulatory capital cost rates, as is done by regulators in India. Their advantage is that most equipment is locally produced and there is a large market and project experience.

NEPRA charges a lot of money for processing the cases, but seldom spends it adequately, towards acquiring professional services for cost ascertainment. Instead, it saves on it, and naively shows profit and invests the money in meaningless lavish office projects, as it has already done. NEPRA is perhaps the only regulatory body in the world, which decides in total darkness and without any back-up reliable data. It relies in either brow-beating or input from inadequately informed intervener, and it is very seldom that it has accepted the propositions of the intervener, but usually listens to them rather patiently. Some regulators, for example in Canada, have started the practice of paying the public interest intervener their expenses in preparing and presenting their interventions. Others such as California Energy Commission has associated and financed a consumer interest department on a permanent institutional basis. The logic is simple. Companies and project promoters have technical and financial resources, while public does not have the corresponding muscle.

There are some safeguards that are built in the process but are seldom implemented adequately. Project promoters were earlier required to submit three quotations, which every body knows what that mean. This was later converted into an open tendering requirement, but the process suffers from inadequate oversight and controls. And there is the famous whispering syndrome as mentioned earlier against all those who may try to put some seriousness into the process. There are other alternatives that may be selectively applied such as tendering the specific project sites and fuel combinations. These options have been tried in the past with varying levels of success. The possibility of collusion among the bidders is very real and feasible, and where the rope is to tight, bidder interests are limited.

It is imperative that NEPRA corrects this situation without further delay, stops making savings and spend in acquiring reasonable professional input of foreign consultants in making a policy in this respect and as well scrutinizing individual projects. Honorable courts and litigants are also advised to ask NEPRA to explain its bases of tariff determinations and certify that they act based on knowledge and reliable data.

Concluding, this is not an attempt to malign individual persons or private or public agencies. Nor this should be seen as a criticism on the present government. These are old and systemic problems, and sustain beyond the tenures of individual governments. But we have seen that inadequacies have been removed from executive and regulatory processes, once the problems have been discussed robustly and objectively. I can cite many bad practices which appeared to be very difficult to remove, but eventually were eliminated. All is not that bad and impossible and let us hope for the best.

Oil and Gas Regulatory Authority (OGRA)

OGRA is in news these days. Its parent ministry MPNR is criticizing it in public and other senior parliamentary leaders from the ruling party have led onslaught on it. Earlier OGRA chairman came into limelight when public heard of its board members being fired by the latter. Is it a personality syndrome or conflict and infighting or there is something more germane into it. ? What is the role of OGRA and for that matter any regulatory agency of this kind. What role it has been given and what role it could have carved out itself by creative maneuvering and internal negotiations with its main stake-holder which is the Ministry of Petroleum and Natural Resources itself. Its counterpart NEPRA has been more successful in having a working relationship with its parent ministry.

First of all, a regulatory agency may be associated administratively with a ministry, but for all practical purposes it is independent. However, its independence may be circumscribed by the statutes and the rules that are usually made by the Ministry itself. Sometimes the issues are multi sectoral and multi-ministerial and are thus to be handled by the PM himself and his Cabinet Division. It is through the statutes that ministries can control or dictate their way and policies and not through administrative orders. Regulatory agencies can strengthen themselves by bringing in public discussions and hearings and oversight and making it more effective and integrated with their processes. Public consultation process may at times be overbearing and impeding speed and convenience in decision-making , but it is worthy enough to be welcome and built into the decision making process. It is perhaps the only defence and support the regulators have to fall back upon in performing their function.

As to the regulatory agency's independence, it can vary greatly from country to country and its relevant legislation and from sector to sector.

The most powerful regulatory agency in a country is normally the Central Bank or State Bank as we call it here in this country. Obviously, it is much less independent than its US counterpart, in theory and as well as practice. Energy regulatory agencies are more powerful in India than these are in Pakistan. Perhaps size and multi-polarity matters, and makes central organizations more powerful and effective. Even after 18th amendment, all regulatory agencies and functions have been given under federal domain. Conflicts are going to arise, when the implementation begins. It would be highly debatable, if except for Punjab, any smaller province can have the resources to run these agencies, technical and financial both.

It has been alleged that OGRA has not been able to perform its function. The latest case that is cited of is the unduly rising prices of LPG. A broader criticism, and perhaps legitimate, is that it has not been able to carve out space for itself. Space is granted by the legislation and statute but the statutes themselves are influenced by the lobbying and input of the regulatory agency itself. In Pakistan, perhaps it would be too much to expect from the retired bureaucrats for whom these positions are lucrative parking places. The salaries are too high to be risked? Ministries generally would like to maximize their power for legitimate and not very legitimate purposes and commercial interests would also not like to be constrained. The maximum support should therefore come from the legislature and the public.

Now coming to the two specific charges on OGRA; LPG prices and the charge that OCAC performed better. LPG is a fuel for the poor. Its prices have been going higher and higher, whether it is justified on some grounds, is a separate discussion. The real policy issue is that LPG has been kept out of the regulatory process and thus it is beyond OGRA's purview. The culprit is the classical phony and naïve argument of freeing the pricing and the misconception that opening up prices leads to market efficiency and would ultimately lower the price. There are several reasons that these ideologies do not work in societies like ours, for the following reasons:

- 1) We are always supply scarce countries. Only population and demand is abundant. Supply is usually restricted by a germane shortage of capital. Price signals are not strong enough to attract foreign and local capital. There are other factors such as political instability and the law and order which over-ride economic factors and signals.

- 2) The regulatory and legislative processes are weak. Consumer is poorly represented in the power structure. Producer is powerful and integrated into the power structure.
- 3) Anti-competition and price collusion behavior is rampant and generally well entrenched. Competition protection legislation is weak, ineffective and perpetually sabotaged as we have been observing in the case of Competition Commission of Pakistan.
- 4) We can not wait for the ultimate rationalization and resource allocative process to show its promised results. It may never happen or may be too little too late. Our consumer is poor. One-third of our people lives in abject poverty and cannot get the minimum nutritional requirement. And others are only marginally and slightly better off except for a very thin minority.

Thus the price unfreezing and letting it to be decided by the market and in fact by the producers does not seem to be working and resulting into lower prices. Price decontrol of such things as energy and LPG is a fools' paradise. It should be shun at the first opportunity indeed immediately. Only when price decontrol is lifted by the ministry of petroleum, OGRA cannot do any thing in this respect. People can do it in the long run, but they rise only occasionally and randomly and such processes are only disruptive, as there is ample history to suggest.

Now coming to the case of oil pricing, it is alleged that OCAC (Oil Companies Advisory Committees) has performed and could perform better than OGRA. I have no mandate or axe to grind with OGRA to defend its performance. As for OCAC, there could not have been a more shameless and disgusting name for an entity that is to set prices; a producers club setting prices for consumers with the support of the ministry. This may have been valid in military oligarchies of the past but it is very disturbing to find support for this coming from the ministry of petroleum.

Oil prices used to be set on a cost-plus basis earlier and supported an essential but basically inefficient oil industry which made huge profits in the past. Now that the more saner policy of oil pricing based on landed price parity with imports, the oil industry is crumbling. It would need support like many other inefficient but essential entities. OGRA's job today is implementing a formula, calculate the price and publish it. There are many ifs and buts in it, which OGRA should have made a practice of discussing in broad day light in public hearings than adjudicating on these quietly and slipping into the pricing system. No wonder it has not managed to attract a lot of respect from the stake-holders and the public.

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