

Foreword
By
Engr. Ch. Ghulam Hussain
Secretary
Pakistan Engineering Congress

FOREWORD

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Engr. Ch. Ghulam Hussain*

There could be no life on earth without water; there is no doubt about it. And life without energy could be miserable let alone comfortable or easy; that is equally true. Man without energy would not have reached the pinnacles of evolution that he is enjoying today. Energy has made a blissful dent in every walk of life to such an extent that its consumption in households, traffic & freight carriers, Mills & Factories, and Agriculture, to quote a few, has become yardstick of any country's Economic & strategic ranking. In the mid Nineties a similar grave shortage of electricity was experienced in Pakistan as it is today, which was overcome by entering into contracts with Independent Power Producers (IPPS). It would imply that demand and supply for domestic and industrial development need to be greatly increased for the development of any country much less Pakistan. As the indices are obtaining today, it would be painful to note that Pakistan is among the countries who has the lowest per capita consumption of electricity in the world.

The current total power generation capacity in the country is 19500 MW. The demand for electricity during summer is about 17,500 MW and it falls down to about 11,000 MW. The installed power capacity is higher than current demand, but both WAPDA and KESC have been generating hardly one-third (about 6500 MW) of their installed capacities during the recent years, thus creating a big gap between demand and supply. Consequently a serious Power crisis, resulting in 10-15 hours load shedding has been created through out the country. With average power growth rate of about 8 percent per annum, the national grid is essentially required to be supplemented by 2500 to 3000 MW of power every year. Unfortunately, about 2000 MW has been added during the last decade. Construction of Kala Bagh Dam would for certain have obviated the creation of this Power crisis.

Nevertheless, the Government has realized the gravity of the situation and has planned construction of six rental power plants totaling 1002 MW, anticipated to start producing power by June 2009, an addition of 502 MW of hydro power to the system by 2011 and 22 IPPs with a grand total of 4608 MW which are expected to start operating by June 2012.

Generating capacity of Hydropower, which is the cheapest mode is only 6800 MW which is hardly 35 percent of the total installed capacity. Energy generating by IPPs has proved undependable source. For whenever payment of their bills becomes overdue, for any reason, they obviously switch off their generating units confronting the whole nation with dilemma of long durations of load shedding. While the misery of the general public in such an event is aggravated manifold, the wheels of the Industry come to stall, adversely bringing in its wake short fall in industrial produce and reduction in the wages of the labour already facing economic depression.

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The country by the grace of Allah is endowed with bountiful natural resources which have regrestfully not been tapped hitherto. To quote a few we have about 41,559 MW capacity of Hydropower, 185 Billion tonne of Thar coal, 5th largest in the world for production of 55,000 MW energy at 5.8 cents a unit and 10,000 MW of wind powered electricity.

Pakistan Engineering Congress the premier and oldest Engineering Organization of Professional Engineers in the sub-continent, established in 1912 is voluntarily engaged in the promotion of Science and Engineering. With a view to achieving these objectives it, interalia, arranges Symposia and Seminars on the acute Problems that tend to beset the National Economy.

The Congress has risen to the grave situation of energy crisis and has convened this Symposium on this most burning issue, which has virtually paralyzed the routine working of the whole nation. Ten Technical Papers by eminent authors on the causes of the shortfall, available resources and how best to avail of these resources are being presented for deliberations. A Panel of Experts, including the authors of the present papers would prepare recommendations to overcome current power crisis which will be submitted to the Government for its consideration.

**Address of Welcome
By
Engr. Husnain Ahmad
President
Pakistan Engineering Congress**

PAKISTAN ENGINEERING CONGRESS

Symposium

on

“Genesis of Power Crisis & its Management in Pakistan”

ADDRESS BY
Engr. Husnain Ahmad
President
Pakistan Engineering Congress

Chief Guest of the Symposium, the Honourable Syed Khursheed Ahmad Shah Sahib, Minister for Labour and Manpower, Respected Scholars, Executive Council Members, Distinguished Guests, Fellow Engineers,

Ladies & Gentlemen

Assalam-o-Alaikum

It is my profound privilege to welcome you all on such a critical and burning topic of this very moment. The ever increasing importance of the topic becomes much more relevant and amplified with the present day situation of power requirements vis-à-vis its availability in the country. The heat of power deficit is being felt by the entire Pakistani nation especially by the sector contributing in the economic development so very profusely.

Energy is the life line of economic development but unfortunately Pakistan lacks integrated National Energy Security plan for the 21st century and, therefore, the country is faced with a crippling power shortage to the tune of almost 1890 M.W. The peak demand is around 19600 M.W vis-à-vis supply of 17710 M.W necessitating Electricity outages of 10-12 hours daily. Non-availability of power & the frequent interruptions have wreaked the economic fabric of the country culminating in:

- De-stabilized the entire economic structure of the country.
- Given a stunning blow to Agriculture sector for acute shortage of water supply & non-availability of power for tubewells.
- Industrial Production has suffered enormous set-back. Textile, Garment and host of other Industries are at a stand still.
- Un-employment Conditions have further worsened exacerbating law and order problems etc.
- Large Scale Manufacturing (LSM) has shown 7.7% negative growth.
- GDP growth is sliding down (will be only 2%).

The ironical position is that the devastating situation is not a bolt from the Blue but a simmering sore since the last about a decade. The planners could not be oblivious that there is massive influx of Electric gadgets and the demand for electricity was accelerating at an annual rate of 8% – 10% an increase from 15500 MW in 2005 to 21500 MW in 2010 and that the industrial and agricultural advancement needs steady & cheap Electric supply. However, there was abject disregard for increasing the power potential of the country.

In fact, it tantamounts to criminal neglect and is full of ominous portents coming as it is at a time of worst global economic recession.

The abysmal lack of planning has been aptly described by Mr. Shahid Javed Burki a noted economist:

“Public Policy comes to the front burner only when there is a real crises on the supply side – when serious shortages have appeared in the power sector; when oil prices suddenly go up; when natural gas, once considered to be an abundant resource, also experiences supply shortages”.

Ladies and Gentlemen

Looking at the situation in a bit of details reveals that Hydel Generation in 2004 was 6459 M.W & is almost the same now a bizarre situation. The Country boasts off Hydel Potential of more than 20,000 to 25000 M.W (13981 M.W alone in upper Indus basin as can be seen as follows).

Upper Indus Basin Potential of Hydropower Schemes

Rank	Scheme	River	Power (MW)
1	Dasu	Indus	3700
2	Bunji	Indus	4710
3	Thakot	Indus	1043
4	Patan	Indus	1172
5	Rakhiot	Indus	670
6	Yulbo	Indus	710
7	Kalangai	Swat	256
8	Kohala	Jhelum	740
9	Munda	Swat	740
10	Karot	Jhelum	240
		Grand Total:	13981

Here it would not be out of place to look at the figures of Dams of more than 15-feet height in some neighboring countries, which are as shown below:

Sr.No	Country	Number of Dams Constructed upto December, 2008
1.	China	26000
2.	India	4050
3.	Turkey	591
4.	Iran	310
5.	Pakistan	71

Kala Bagh Dam

Kala-Bagh Dam had a storage capacity of 6.1 MAF & Electricity Generation Potential of 2400 M.W initially & ultimately 3600 M.W. However, the Dam was not constructed and 3-decades lost in Political wrangling of a purely Engineering issue and in the meantime 40-45 MAF water flowed un-tapped in the sea.

Diamber Basha-Dam

The Dam will have a storage potential of 8.1 MAF & Electricity Generation potential of 4500 MW. However, it was kept on back burner for 3-decades. It has been taken-up belatedly and now we would have to wait upto 2019 to eke out any benefits out of it.

Neelum Jhelum Project

It is run of River Project with Electricity Generation potential of 969 M.W but we will have to wait at least upto 2016 before it comes in operation & starts giving benefits.

Also given below is the potential of Hydel / Thermal & IPP's Projects in pipe-line & likely to come into operation in the year 2009 to 2011.

	Year 2009	Year 2010	Year 2011
Hydel	-	298	121
Thermal	-	-	1701
PEPCO	-	-	-
Independent Power Produces (IPP's)	2277	200	-
Total	2277	498	1822

In the Presence of abundant Hydro-Electric Potential and not constructing any large-Dam in the last 3-decades to provide cheap Electricity for Industrial & Agriculture advancement, saving precious Foreign Exchange used on import of Fuels for Thermal Generation shows intellectual bankruptcy (in planning) and all this has happened when the storage capacity of Mangla & Tarbela Dams has been reduced by almost 28% due to Silt, when enough water is not available for the crops, when sub-soil aquifer has dropped to 300-400 feet due to heavy Tube-well pumping & above all when India is building scores of small Dams on Indus and Chenab to deprive us of the invaluable Water Resources. It is high-time that Political wrangling & deplorable lethargy in planning are set-a-side & immediate work is started on the following Hydel Projects.

- Kala-Bagh 6.1 MAF
- Akhori 7.6 MAF
- Skardu 2.0 MAF

In addition, Small Dams need to be constructed at all available sites. Rain Water & Water of Hill-Torrents particularly in the area of Koh Sulaiman to manage it profitably & to minimize the devastation of floods due to heavy rains.

Thermal Generation

Thermal Generation in Public sector was 11234 M.W in 2004 and remains almost the same without any significant increase till to date. Position of Thermal Generation in private sector (IPP's) was 6070 M.W in 2004 & is now 6227 M.W.

The dismal lack of planning in Thermal Generation is nakedly glaring. Huge foreign exchange earnings have gone down the drains in import of furnace oil / other fuels as well as Gas Resources of the country depleted to dangerous levels. This has happened when the country has been endowed by nature with Coal Resources to the tune of staggering 185175 Million Tons as given below:

➤ Sindh	184623 Tons
➤ Punjab	235
➤ Baloochistan	217
➤ NWFP	91
➤ AJK	9
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Coal contributes to 38% of World's Electricity supply & 23% of global primary Energy needs. Coal contributes 16% of Energy supply in U.K, in China 67%, Canada 24%, USA 23%, India 55%, whereas, in Pakistan the contribution of coal is limited to only 7%.

➤ Natural Gas	48 (Percent)
➤ Thermal	30
➤ Hydro	13
➤ Coal	7
➤ Nuclear	2
	100

It may also be noted that unlike Pakistan, where contribution of the coal remains minimal, fast growing economies are making full use of their Coal resources.

Had sanity prevailed with our Planners, Economists and those at the helm of affairs of the Country and the more than abundant Coal resources of the Country had been profitably exploited.

- There would not have been any shortage in the Electricity Supply & no recourse to electricity outages.
- It would have ushered a boom in the economic development of the Country & valuable foreign exchange earnings saved & channelized in creation & Modernization of Industrial Machinery.
- Opened-up employment opportunities & Poverty alleviation

It is imperative that Power Generation Projects based on Coal are launched with minimum possible delay & in this connection use of clean Gas Technology formulated in USA may also be used as far as economically feasible.

Nuclear Energy

Nuclear Energy Contributes immensely in the economy of Advanced Countries as would be seen by the following table:

Sr. No	Country	Share in Total Generation %
1.	U.S.A	19.4
2.	France	76.8
3.	U.K	15.1
4.	China	1.9
5	India	2.5
6.	Germany	25.9

We have 2-Nuclear Power Plants "Karachi Nuclear Power Plant" (KANUPP) & "Chashma Nuclear Power Plant", and a 3rd Plant is under construction.

Nuclear Energy contributes only 2% of supply mix (400 MW). It is envisaged to raise the out-put to 4000 MW by 2030. In France almost 77% of energy is Nuclear energy. Infact, as per some specialists it is the most reliable source of energy supply especially in Fuel starved countries.

Renewable Energy Resources

Pakistan is blessed with abundantly available and inexhaustible Renewable Energy (RE) resources, which if tapped effectively can play a considerable role in contributing towards

energy security and energy independence of the country. Given the current global energy scenario in general and Pakistan's energy scenario in particular, the adoption and deployment of ARE technologies makes perfect sense as it inherently favours indigenous, inexhaustible energy resources which also happen to be efficient options by default. This is also in line with the objective of the Government of Pakistan to develop RE technologies in the country so that RE has a share of at least 7.4% of the overall energy mix by the year 2030.

Another unique feature associated with the deployment of ARE technologies is the positive and various direct & indirect impacts it has on poverty alleviation and accruing social benefits. These technologies can be easily deployed in areas where conventional grid electricity cannot have access and entry due to technical and / or economic reasons. The lowest strata of the society can thus benefit from ARE technologies thereby improving the livelihood and quality of life; meaning ARE technologies can play an effective role for meeting the Millennium Development Goals (MDGs) as well.

It is encouraging to note that Renewable Energy technologies have reached a stage where they can effectively play their part in tackling the current energy crisis we face today. Wind energy projects are a commercially viable reality. Construction of Pakistan's first ever wind energy project of commercial scale is hopefully the first drop of water that will eventually transform into an ocean. However the Government must continue its efforts to utilize the immense wind potential available throughout the country and should not limit itself to Gharo-Keti Bandar wind corridor alone.

Approximately 73900 M.W of Electricity is being generated through Wind-Power the world over especially in the following Countries while Pakistan has recently established a project of Wind power of 50 MW in Thatta:

Sr. No	Country	Electricity Generation Wind-Power (M.W)
1.	Germany	18000
2.	Spain	8000
3.	U.S.A	7000
4	Pakistan	50

The Government should also announce incentives for the use of Solar Energy which has extremely broad-ranging applications; not just in the electricity sector but also gas sector. Shifting to Solar Water Heating can result in considerable gas savings, ranging in excess of 100 Million MMBTU annually. All new public / street lighting should only be Solar based in future. Domestic users should also be encouraged to meet a portion of their energy needs through Solar Energy. Net metering is an established, tried and tested incentive provided for use of Solar Energy throughout the world and should also be employed in Pakistan.

Alternative Energy is not just limited to wind and solar; alternative fuels also form a major portion of Alternative & Renewable Energy sector and should be encouraged as such. Government of Pakistan has announced its targets for replacing diesel with Biodiesel, which is a welcome start. But it must be realized that Biodiesel is perhaps the most challenging and complex sub-sector of the Alternative Energy Sector. The issue of food security can cause great concern and must be dealt with in an appropriate manner. Similarly selection of land for energy plantations also needs to be restricted to waste, marginal lands. Success of National Biodiesel Programme will not only reduce our dependence on foreign oil imports, it will also bring about an upturn into the quality of lives of the under-privileged farming communities and generate significant economic activity. The Government must show its resolve in supporting AEDB's initiatives.

Suggestions

1. Experts have envisioned that the country should plan a “Capacity” generation increase of 3000 to 4000 M.W every year which would need long term planning on pragmatic basis.
2. Pakistan ought to go all-out for construction of Mega Dams for conservation of Water & Generation of cheap Electricity. However, it will be unwise to rely on Hydro-Electricity alone as it could suffer due to droughts.
3. Maximum utilization of Coal Resources to
 - Curtail Fuel imports
 - Open-up employment opportunities & to meet “**Capacity**” Shortage.
4. Leap-Frog in the domain of Nuclear Energy as the existing 2-Plants have already completed design life of 30 years.
5. Build Big Refineries to plug “Fuel” shortage & to obtain Petroleum By-Products such as Diesel etc.
6. Maximum utilization of Bio-Fuels “Wind Energy” & “Solar Energy”.
7. All-out efforts to conserve energy by encouraging installation of savers, curtailing unnecessary shop illuminations.
8. Import of Gas from Iran & Central Asian countries & storage of Gas.
9. Private Sector especially Foreign Investment in Hydel Projects may be invited as well as facilitated.
10. In the Short-Term LNG Imports may be resorted to.

Ladies and Gentlemen

I would like to conclude here with a hope that this symposium shall not only contribute positively towards evolving a policy for combating the issue of power deficit in Pakistan but shall go a long way towards defining the direction for the decision makers. I also believe its already late and lets act now before it gets too late. I earnestly urge that putting political wangling aside and keeping national interest supreme, on an issue of a purely technical nature we need to pay heed to the advice of technical experts / professionals for our economic growth rather the national survival. I thank you all for being with us here today and also for giving me a very patient hearing.

“PAKISTAN PAINDABAD”

Key Note Address
By
Engr. Rana Khursheed Anver
Vice President / Convener
Symposium Committee

SYMPOSIUM ON “GENESIS OF POWER CRISIS AND ITS MANAGEMENT IN PAKISTAN”

KEY NOTE ADDRESS

By

ENGR. RANA KHURSHEED ANVER*

It is no secret that our beloved country which abounds in natural resources is under the threat of economic tsunami, haunted by an impending doom. The situation is exacerbated by crippling Electricity blackouts, dangerous food shortages, rampant inflation and above all the lethal disinformation that Pakistan with its porous mountainous borders on the North West is a safe haven for all terrorists and is producing suicide squads for dispatching the World over imperiling the mankind.

An irresponsible attitude and lack of dedicated leadership nurtured by international intrigue has brought us to this precipice. National Resources have been plundered recklessly. Who so ever scrambled to power could only manage a precarious balance because of perpetual subversion by his distraught associates and restive colleagues. The moment any one maneuvers to the top his desperate opponents start rocking the boat, mostly at the behest of foreign powers who never want to see a stable Pakistan.

Even with best intentions, high vulnerability of top leadership impels the incumbent to focus on self preservation alone, thus scurrying for mere short-term measures while genuine long-term measures remain a far cry. No leader can plan and pursue long-term goals effectively on hot bed of subterfuge. As a nation we display little patience.

Massive funds with venomous disinformation are being continuously injected to destabilize our motherland. Our sacred country has been made a bastion of intrigues and conspiracies. Some 38 years back we succumbed to nefarious designs of the enemies. A gruesome trauma split our country into half and pushed us to an inglorious fate.

In spite of macabre episode we are yet not out of the vicious circle – No change in our attitude even today. Instead of forging ahead we are still fumbling at the door steps pushing against each other.

It goes without saying that hydropower is the cheapest, perpetual and environment friendly of all alternates. No mega hydropower project has been installed after Tarbela because of the machinations and chicanery cultivated by foreign agents. Our gullible public is conjured to believe that a number of small dams can be good substitute of multi purpose large dams. Nothing is more irrational and farther from truth than this sugar coated paradigm.

Is it not an irony of fate that a country with enormous hydropower potential of around 45000 mw was coerced to switch over to 10 times more expensive thermal power dependent on imported fuel in mid 90's? This action did give a stopgap respite to power

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outages but unleashed a phenomenal wave of inflation all over the country. Once again, the grim Energy Crisis is casting its ominous shadows and pushing us to the exorbitant thermal power generation for our past lapses.

Is it not a tragedy of circumstances, there appears to be no immediate solution, as all other alternates have longer gestation period? Our decadence in Power Sector above can be gauged from the fact that in 60's, ratio of hydel vs. thermal power generation was above 60 : 40, which reversed to about 32 : 68 in 1997 due to the faux pas and inept decisions by different governments. Kudos to our foresight as a nation ! Mega Hydro Projects awaiting in wings for implementation were forcibly pulled up on flimsy grounds through political arm-twisting. The Mega Hydel Projects still remain under political ransom. No significant generation could be added up to late 90's.

In view of the escalating power shortages in 2006, WAPDA / Pepco had again to resort to heavy power outages which disrupted all development activities. With yawning demand supply gap, the time being the limiting factor, oil propelled Thermal Power Stations are to be installed at 10 times the cost of Hydel Power and payment of fuel in foreign exchange.

Our leadership never gave weightage to the up-coming grim scenarios and sacrificed the priorities of the Hydel Projects as a potential stratagem to prolong their stay. With rapidly burgeoning population and ever expanding agriculture and industry, the energy demand would upsurge to about 50000 mw by 2020. The present installed capacity being only 20000 mws, we would again be facing serious management issues and would have to add generation projects of about 30000 mw on fast track. Under the present crunch, we have to inevitably resort to Thermal Generation for a substantial capacity which is the quickest but indeed with outrageous fall out.

In view of the overriding significance of the current energy crunch and its devastating effects on the national economy, the Executive Council of Pakistan Engineering Congress decided to hold this symposium on "Genesis of Power Crisis and it's Management in Pakistan". A call for papers on this highly important issue was made to all members of the Congress and experts working in energy sector. The response was encouraging. As a result the following ten (10) papers are being presented.

1. ROLE OF HYDROPOWER IN MANAGEMENT OF POWER CRISIS IN PAKISTAN
By Dr. Izhar ul Haq, Engr. Khawar Munir
2. INTRODUCTION OF NEW TECHNOLOGIES FOR RENEWABLES AND DEMAND SIDE MANAGEMENT IN THE POWER SECTOR IN PAKISTAN
By Prof. Dr. Zahir Ahmad Fikri
3. GENESIS OF POWER CRISES AND ITS MANAGEMENT IN PAKISTAN
By Amjad Agha
4. POWER CRISIS, CAUSES AND MANAGEMENT
By Engr. Riaz Ahsan Baig

5. SELF GENERATION TO COMBAT POWER CRISES
By Dr. Engr. Javed Younas Uppal
6. PUBLIC PRIVATE PARTNERSHIP TO MITIGATE POWER CRISES
By Dr. Allah Bakhsh Sufi, Zahid Hussain Khan, Muhammad Javaid Iqbal
7. GENESIS OF POWER CRISES AND ITS MANAGEMENT IN PAKISTAN
By Engr. Tahir Basharat Cheema
8. NATURAL GAS TRANSMISSION & DISTRIBUTION INFRASTRUCTURE DEVELOPMENT IN PAKISTAN & ITS ROLE IN POWER GENERATION
By A. Rashid Lone
9. BARRIERS IN RENEWABLE ENERGY DEPLOYMENT IN PAKISTAN
By Syed Tahawar Hussain
10. RENEWABLE ENERGIES – AN ULTIMATE SOLUTION TO OVERCOME POWER CRISES OF PAKISTAN
By Muhammad Ammad Riaz, Sara Amin

Ladies and Gentlemen,

Each paper is of top quality in it's own right and I am sure would lead to an active brainstorming discussion. To be brief, our illustrious authors and elite engineers have generally advocated for special priority to Hydel-Power followed by Generation through a gigantic coal reserve hither to lying unexplored. Some how our Leaders in Command, never anticipated the looming energy crunch to exploit the enormous resources well in time. Were it so, this could have provided a prodigious boost to the National Economy. Besides, solar, winds and bio-thermal generation have to be actively pursued ; also to promote demand side management and conservation steps through public awareness, use of energy saver lamps LED and solar bill boards. Outcome of the recommendations would be thoroughly discussed, synthesized and sent to the relevant forum for appropriate action.

Last but not the least, it may be stated that our country has a vast potential of at least 45000 mw of Hydel-Power awaiting to be harnessed. It includes 10000 mw in side-valleys and another 600 mw of low capacity in the Plains. Feasibility studies, detailed investigations and design of one mega hydro project were completed more than 25 years back to be followed by several other hydro powers. Substantial ground work was done, but later not-with-standing it's overwhelming merit, the project was mercilessly killed at the altar of political expediency. Had the mega project been constructed in time followed by the others, Pakistan would have emerged as a real tiger of Asia rather than still facing humiliation with a begging bowl in hand. Taking us as rudderless people locked in perpetual scuffle, unmindful of precious 40 maf water going waste to sea, our evil neighbours picked up the courage to usurp Pakistan's head-waters and initiated construction of multiple hydel projects throttling the down stream flows on fast track – all that with impunity. Any further choking of river supplies would simply be appalling especially during low flow period spelling famine and disaster in Pakistan – and a weakling strife-torn Pakistan would at best lodge a formal complaint at relevant forum.

It is already too late and specter of doom is closing on us. We must see the writing on the wall. The nation has suffered irretrievably and is languishing at the mercy of super powers who demand their own share of flesh. If only a miracle could pull us out of this quagmire and vicious trauma, our national top priority has to eschew mutual suspicion and rancor, forge unity amongst our ranks above personal interests and start with mega hydel projects right away. Multi purpose dams like Basha, Kalabagh, Dasu, Khori, Kuram Tangi and Munda should be taken up on fast track. These may have longer gestation period but would inter alia lead to much lower cost and ever lasting benefits.

“PAKISTAN PAINDABAD”