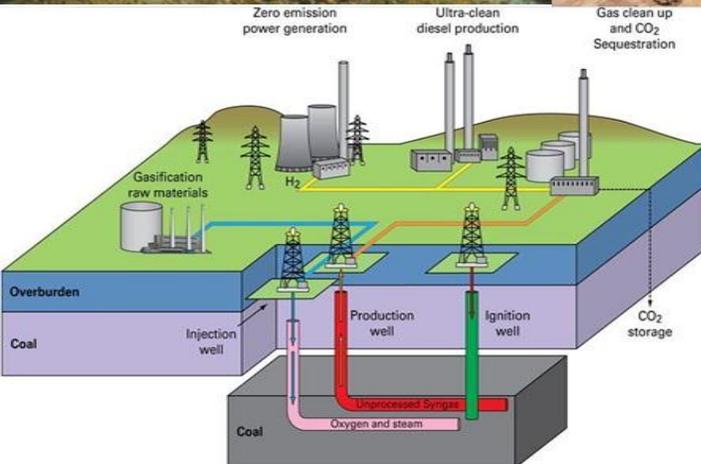




2012

“Energy Crises in Pakistan”



MUHAMMAD HAMMAD

MALIK

Chairman “Special Committee
on Energy Crises”

Youth Parliament Pakistan

7/30/2012

ACKNOWLEDGEMENT

It gives me intense pleasure to present a report of the “Special Committee on Energy Crises” Youth Parliament of Pakistan. The report is a result of extreme efforts done by the members of the committee on the topic of Energy Crises in Pakistan.

I am grateful to my colleague members of the committee Muhammad Taimoor Shah (YP23-Punjab15), Ushna Ahmed (YP59-Sindh11), Yasir Riaz (YP12-ICT02), Shaheera Jalil Albasit (YP56-SINDH 08), Ahmed Numair Farooq (YP21-Punjab 01), Gohar Zaman (YP25-Punjab05), Osama Mehmood (YP42-Punjab22), Anum Zia (YP23-Punjab03) and specially Touseef Abbasi (YP02-AJK02) for their cooperation, active participation in the meetings, deliberations and sharing their ideas and views in highlighting and resolving the issue of energy crises. I must acknowledge their wisdom because of which the Committee has been able to play its role, through recommendations to bring improvement in the areas, where needed.

I also appreciate the efforts of Pakistan Institute of Legislative Development and Transparency (PILDAT) for providing us a platform to play our role in the development of the country and also assisting us in holding the meetings with the related officials. I specially thank Mr. Ahmed Bilal Mehboob for his sincere efforts in providing such a platform for the Youth of Pakistan for the betterment of the future of the country.

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I am sure that the circulation of this report will certainly benefit the better understanding of the Energy Crises and will also help in devising the ways to resolve this key issue.

*Muhammad Hammad Malik
Chairman Special Committee on Energy Crisis
Youth Parliament Pakistan*

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PREFACE

Energy Crisis in Pakistan is one of the severe challenges the country is facing now-a-days. Electricity, natural gas, water and fuel are essential part of our daily life and its outage has severely affected the economy and overall living of our country. Thousands have lost their jobs, businesses; our daily life has become miserable. Pakistan is currently facing up to 18 hours of electricity outage a day and 2 days of Gas outage a week, is expected to face more if not dealt with in time.

A Special Committee was made by the Speaker Youth Parliament of Pakistan on the issue of energy crises in response to the motion put in the house by Muhammad Hammad Malik (YP16-KPK03), Mr. Yasir Riaz (YP12-ICT02) and Mr. Muhammad Taimoor Shah (YP35-Punjab15). Muhammad Hammad Malik (YP16-KPK03) was made the Chairperson.

The main purpose of this committee is to analyze the nature of this crisis and to propose some short-term as well as long-term solutions to this problem. For this purpose meetings were arranged with the concerned authorities and also the data was acquired from related departments like Wapda, Thar Coal Power Generation Project and Alternative Energy Development Board.

This study is exploratory in nature. We have done our best to conclude and sketch up some recommendations in the light of identified hurdles in the way of implementing the appropriate solution to our problem.

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Our study finds some major holes in our system if they are covered up we can not only overcome the deficiency of electricity in our systems but also we can be able to export it to our neighboring countries.

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MEMBERS OF THE COMMITTEE

MUHAMMAD HAMMAD MALIK	(YP16-KPK03) Green Party
TOUSEEF ABBASI	(YP02-AJK02) Blue Party
MUHAMMAD TAIMOOR SHAH	(YP23-Punjab15) Green Party
USHNA AHMED	(YP59-Sindh11) Green Party
YASIR RIAZ	(YP12-ICT02) Green Party
SHAHEERA JALIL ALBASIT	(YP56-SINDH 08) Blue Party
AHMED NUMAIR FAROOQ	(YP21-Punjab 01) Blue Party
GOHAR ZAMAN	(YP25-Punjab05) Blue Party
OSAMA MEHMOOD	(YP42-Punjab22) Blue Party
ANUM ZIA	(YP23-Punjab03) Blue Party

LIST OF ABBREVIATIONS

IPPs	Immediate Power Providers
AEDB	Alternative Energy Development Board
WAPDA	Water & Power Development Authority
IGCC	Integrated gasification combined cycle
LED	Light emitting Diode
AEDB	Alternative Energy Development Board
PCRET	Pakistan Council for Renewable Energy Technologies
FDI	Foreign Direct Investment
NREL	National Renewable Energy Laboratory
PMD	Pakistan Meteorological Department

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BACKGROUND

Pakistan has been facing an unprecedented energy crisis since the last few years. The problem becomes more severe during summers. Initially, during the peak crisis there was a power outage of 3-4 hours daily but it keep on increasing as the demand of electricity rises. According to the reports of Wapda, the electricity need of Pakistan increases more rapidly than it can be generated which cause a major increase in the duration of load shedding. The exact rate of demand and supply is given in the figure below:

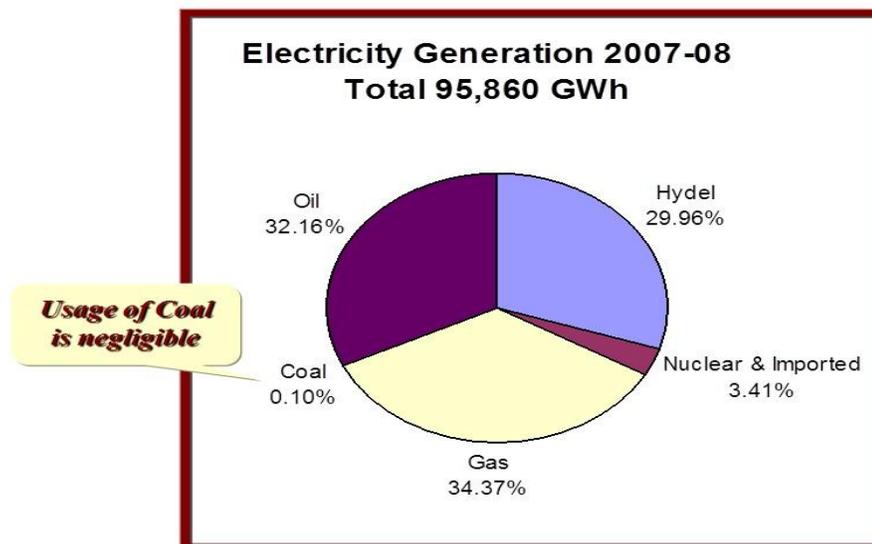
Current Installed (MW)	Projected Demand		Gap (MW)
	(MW)	Year	
17897	2010	24,474	6,577
	2015	36,217	18,320
	2020	54,359	36,462
	2025	80,566	62,669
	2030	1,13,695	95,798

Fig 1: Rate of demand and supply of electricity (MW) from 2009 to 2030

The rate of supply diminishes due to the lack of Government interest in establishing new resources for the power generation. The last effort regarding this was made during the second government of Benazir Bhutto when some independent power plants were set up. Had they not been setup then we would have had a much bigger crisis with life almost

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coming to a standstill. General Musharraf (R) after becoming Chief Executive used to talk about building dams especially Kalabagh Dam. This was one of the many promises he failed to keep. Even after that very few power plants have been set up to meet the demand for electricity and in a sense no actual effort for the electricity generation has been made since 1970s, that is when Tarbela and Mangla dams were put into operation and other dams, including Kalabagh, were actively pursued. When things start getting out of control, haphazard and quick-fix measures were sought. A typical example is the Independent Power Producers (IPPs) saga of the 1990s. In an attempt to avert an approaching energy crisis, as a result of negligible capacity addition during the 1980s and the early 1990s, the regime in 1993-94 decided to go for thermal generation through the IPPs. Undoubtedly, the IPPs provided a very healthy contribution at the supply end, enhancing power generation capacity by more than 5000MW but the effort did not meet the actual requirement of the cheap electricity for the country.



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The last few years provide a perfect example of failure to make a timely response to the growing energy needs. A threefold increase in energy demand over the last two decades has been responded to with an ill-proportioned increment at the supply end. Consequently, with the advent of 2008 the gap between demand and supply grew to 4,500MW indicating a 40% deficit of electricity. The prevalent energy crisis has not appeared overnight – the omens were evident for a number of years but the authorities failed to react in time. Senior WAPDA officials claim that in 2002 the government was officially warned about the approaching electricity crisis and was asked to take immediate measures to enhance generation capacity. The timely warning failed to receive any appreciation. The attitude of the relevant authorities has thus indirectly contributed to the growth of the dire crisis.

Some of the examples worth quoting here is that of Kalabagh Dam and the 969MW Neelum-Jhelum hydroelectric project. Kalabagh dam has been politicized to such an extent that its orchestration now appears to be next to impossible. Evidences suggest that the issue has been used to serve the vested interest of regimes and certain political and ethnical forces. It was to be completely functional in 1986 at a cost of 6 Billion but was never constructed and now if it is to be constructed it cost a price of 600 Billion. The other example is of 969MW Neelum-Jhelum hydroelectric project which was to be constructed in 2003 at a cost of \$1.5 billion. It got abandoned until the present power crises intensified towards the end of 2007. The revised estimate is around \$2.25 billion. The delay is costing the

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country a fortune – an extra \$750 million in terms of project cost, apart from enormous monetary dents inflicted by the five-year delay. It is also noteworthy that WAPDA has traditionally pursued the major projects of national interest but failed to get the due positive response from the policy- and decision- makers. Interestingly, WAPDA plays the role of a scapegoat, because the common man blames WAPDA for his sufferings.

In order to tackle the existing crisis and ensure a prosperous energy future, the backbone of the future energy policies would have to be reliance on domestic resources (hydropower, coal and solar and wind energy) and energy conservation. Decisions on energy projects should revolve around national interest rather than naïve political and personal gains. Energy offices should be run by qualified, committed and deserving people equipped with due mandate. Relevant ministries and departments should also be overhauled.

Meetings held with the Concerned Authorities

To know the background of the Energy Crises and then its solutions, meetings were arranged with the officials of Wapda and other related authorities by the worthy members. We hold 4 meetings with different Experts in Energy Sector.

In our 1st meeting with Mr. Shams Ul Mulk we discussed the core issues involved behind Recent Energy Crises in Pakistan. We discussed the role of Hydel in our Power Generation and also the benefits of small Dams as well as Mega Dams. The Head of meeting in detail described the Kala Bagh Dam Project, its feasibility, its benefits, what are the concerns of people while making this project and the failure of this project. We also discussed the role of Rental Power Plants to fulfill the shortfall of 500MW in our Power Generation.

In our 2nd Meeting with Mr. Shams Ul Mulk we discussed some remaining Issues included in our agenda. We started with the role of Alternate Sources of Energy like Solar Systems, Wind Mills and Geo Thermal and how Govt. should facilitate local industry to import these Systems in order to get rid of recent Energy Crises. In our last phase of Meeting, we discussed the immediate solutions to fulfill the shortfall of 5000 MW in order to execute our full Power Generation. We also discussed our direction towards defeating recent energy crises in next 5-10 years. At the end of meeting we analyzed the position where we will be standing after 10 to 15 years.

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In our 3rd Meeting with Mr. Samar Mubarak Mand, we firstly analyzed the situation of recent Energy Crises. After that we discussed the potential of Thar Coal in Pakistan and its benefits. We also discussed the cost of the Thar Coal Plants to produce cheap electricity. Dr Samar briefed about the recent progress of Thar Coal in Energy Sector. We also analyzed the future of Thar Coal in our Power Generation and possible utilization of Thar Coal as an immediate solution to fulfill the shortfall of 5000MW in order to execute our full Power Generation.

The 4th meeting was held with Dr. Mirza Samad Baig, Director General Thar Coal Underground Gasification Project. Dr. Samad told us about the benefits of the Thar coal and its electricity potential and also mentions the problems related with the underground gasification of the coal for the generation of electricity. He mentioned that the Thar Coal is the world 2nd largest coal reserve that covers the area of about 9000 km² and estimates about 175 billion tons of Lignite quality coal which is equal to 175 billion barrels of oil and has electricity generation potential of 50,000 MW.

5th meeting was arranged with the Executive Pakistan Wind Energy Pvt. Ltd. He discussed the urgent need of wind energy for Pakistan to solve our recent energy crises.

MINUTES OF THE MEETINGS

The minutes of the meetings are given below in detail:

1st Meeting: With Mr. Sham Ul Mulk

The Delegation met on 9th March 2012 at 11:00 p.m. at H#04, Nazim Uddin Road, F-10/4, Islamabad. The Head of Meeting was **Mr. Shams Ul Mulk** (Ex. Chairman WAPDA).

The following Members were Present:

- **Hassan Ashraf YP01-AJK01**
- **Touseef Ahmed Abbasi YP02-AJK02**
- **Amir Abbas YP08-FATA01**
- **Muhammad Atique YP11-ICT01**
- **Yasir Riaz YP12-ICT02**
- **Salman Khan Shinwari YP18-KPK05**

Mr. Shams Ul Mulk urged everyone to introduce themselves. After a brief introduction by everyone, the discussion began.

The delegation was having an agenda about “Recent Energy Crises in Pakistan and its possible Solutions”. The Agenda was a complete questionnaire and the Head of Meeting was supposed to provide answers of these Questions.

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The Questions and their brief Answers are as follows:

- Is there any real energy crises in Pakistan or it's just an imaginary Crises? What are your findings about this issue?

Regarding this issue, Mr. Shams Ul Mulk responded that Pakistan is not such a country which should face Energy Crises Problem. There is no real Energy Crises; it's just the blame game between Govt. and the Power Generation Companies. Pakistan has no shortfall of Energy as the demand and supply chain is almost equal. We just need to increase our Power Generation for our Future.

- Problem of Energy Crises is due to the Shortage of Water or Miss-management of authorities?

Regarding this issue, Mr. Shams Ul Mulk responded that Indus River is the gift of God to Pakistan. There is no Shortage of Water as Pakistan has the potential of producing 50,000 MW of Electricity. There is just the Mismanagement of Authorities and lack of planning involved.

- What are the core issues causing the Energy Crises in Pakistan?

Regarding this issue, Mr. Shams Ul Mulk responded that our authorities have no interest in the prosperity of Pakistan. He further elaborated that our Rulers never becomes the victims of their Wrong Decisions. Due to their wrong decisions we are not able to overcome these Crises.

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- Why you always emphasize that Govt. should construct mega Dams except small Dams?

Regarding this issue, Mr. Shams Ul Mulk responded that “1 Kala Bagh Dam= 750 Small Dams”. He further elaborated that while making small Dams, we have to spend a lot of money as compared to 1 Mega Dam.

- Why people show so many concerns about Kala Bagh Dam?

Regarding this issue, Mr. Shams Ul Mulk responded that the people who are opposing this project, they have no interest in the Prosperity of Pakistan. They are doing politics just for their own purpose and interest and off the record everybody accepts the benefits of this project to Pakistan.

- Is this Project politicized or it's a real threat for Pakistan?

Regarding this issue, Mr. Shams Ul Mulk responded that Kala Bagh Dam was supposed to be completed in 1997 according to WAPDA Plan. There is no threat while making this project. The people of KPK will be getting most of the benefit of it and we will become safe in flood disaster while having this Dam. This project is just politicizes just because of no reason.

- Is Kala Bagh Dam Project in the interest of Pakistan?

Regarding this issue, Mr. Shams Ul Mulk responded that if we are serious to resolve the Energy Crises then we have to complete this project as soon as possible. He further elaborated that through Hydel, our per unit cost is just 1.2 Rupees/ Unit.

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- What was your progress about this crises when you the Executive of WAPDA?

Regarding this question, Mr. Shams Ul Mulk responded that when he was serving in WAPDA he was the project manager of Terbella and Mangla Dams. He prepared the complete feasibility of the Kala Bagh Dam and presented it to all Govt. Department. When he felt that no one is interest in these important projects then he voluntarily resigned from there.

2nd Meeting: With Mr. Shams Ul Mulk

The Delegation met on 12th March 2012 at 10:30 a.m. The Venue was H#04, Nazim Uddin Road, F-10/4, Islamabad. The Head of Meeting was **Mr. Shams Ul Mulk** (Ex. Chairman WAPDA) .

The following Members were Present:

- **Fahad Mazhar Ali YP15-KPK02**
- **Touseef Ahmed Abbasi YP02-AJK02**
- **Amir Abbas YP08-FATA01**
- **Muhammad Atique YP11-ICT01**
- **Yasir Riaz YP12-ICT02**
- **Salman Khan Shinwari YP18-KPK05**

Mr. Shams Ul Mulk urged the new participants in the delegation to introduce themselves. After a brief introduction, the discussion began.

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This was our concluding meeting on “Recent Energy Crises in Pakistan and its possible Solutions”. We completely diagnosed the problem, the reasons behind these problems and their concrete Solutions. The delegation was having the same agenda about “Recent Energy Crises in Pakistan and its possible Solutions” as in our 1st meeting we were left with some important question and the conclusion also. The Agenda was a complete questionnaire and the Head of Meeting was supposed to provide answers of these Questions.

The remaining Questions and their brief Answers are as follows:

- Instead of WAPDA, can Fund Allocation for the development of Mini Dams come under Provincial Fund Allocation in the Federal Budget?

Regarding this issue, Mr. Shams Ul Mulk responded that provinces are free to construct Mini Dams according to their needs. They can also involve Federal to allocate budget for their project but for the Mega Dams, federal is fully responsible.

- Power generation via Atomic Energy is cheaper than power generation via Hydal Energy; how can we increase our reliance on this source?

Regarding this issue, Mr. Shams Ul Mulk responded that power generation via Atomic Energy is not so simple. It needs so much investment and after that the power generation through this process is more costly than Hydel.

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Remember: Power Generation through Nuclear costs 5.30 rupees/Unit and Power Generation through Hydel Costs 1.2 rupees/Unit.

- Research says that the waste of Sugar-cane (the skin of sugar cane) can produce enough electricity that will be sufficient for most parts of Punjab. Is this a workable and realistic idea?

Regarding this issue, Mr. Shams Ul Mulk responded that this method is not feasible in Pakistan. To some extent it can be applied to some villages in Central Punjab which are the hub of Sugar-cane production. Gathering the waste of sugar-cane from all over Pakistan is a big issue.

- Do you think that Hydel Power Projects are the ultimate solution of the Whole Crises?

Regarding this issue, Mr. Shams Ul Mulk responded that, yes I strongly believe because you can't produce as cheaper electricity as Hydel can. As I already told u the reason of per unit costs which are as follows:

Through Hydel: 1.2 rupees/unit

Through Gas: 5.41 rupees/unit

Through Furnace oil: 12.4 rupees/unit

Through Nuclear: 5.30 rupees/unit

But for the immediate solution, we can utilize Alternate Energy Sources like Solar, Wind and Geo thermal Systems.

- Do you think that Rental Power Houses were feasible to fulfill the short fall of 5000 MW?? Why these Power Plants failed?

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Regarding this issue, Mr. Shams Ul Mulk responded that the Rental Power Houses were the key of corruption and fraud. There was a political lobby involved while importing there plants as they earned Million Rupees from this Fraud. It was an extreme joke with the people of Pakistan.

- Do you think that we should encourage and utilize Alternate Energy Sources in order to get rid of recent Energy Crises? (As making mega Dams will take many years to become the part of our Power Generation).

Regarding this issue, Mr. Shams Ul Mulk responded that I believe Hydel will be facilitating us after 2020 after completion of Bhasha Dam and Neelum Jhelum Project and others but to get rid of recent crise our Govt. need to facilitate power generation companies. Also we have to rely on alternate sources of energy like solar and wind systems.

- In your opinion what is the immediate solution to fulfill the shortfall of 5000 MW in order to execute our full Power Generation?

Regarding this issue, Mr. Shams Ul Mulk responded that to resolve the crises as immediate solution, we will be on a wrong way, it will cost 30 rupees a unit from rental plants.

There are few solutions which are:

- 1) Govt. should pay the dues of power generation Companies so that they can produce electricity at their level best.

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- 2) Immediately replace Street Lights of our Big Cities with an LED Panel Lights. Through this we can save approximately 1900 MW of Electricity.
- 3) Replace florescent Bulbs with Energy Saver bulbs and encourage the Citizens to use Energy Saver bulbs as through this policy we can save 1150 MW of Electricity.
- 4) We must collect reliable and credible data for solar and wind mills development. In meanwhile in few selected areas, projects of wind and solar energy should be taken up.
- 5) Whatever we do, it must be affordable. Symbolic Houses like PM House, and Presidency should be the part of load shedding schedule.
 - In your opinion, while facing this huge Energy Crises, where we will be standing after 10 to 15 years?

Regarding this issue, Mr. Shams Ul Mulk responded that firstly we have to sit and think what our mistake which results in huge Energy Crises was. Making correct the mistake is called the price of knowledge. If our rulers will not understand their responsibilities then our future will be bitter than present. We have to plan for next 20 years in Hydel because Hydel is the only cheap ultimate solution of the crises. Remember we are paying 132 billion Rupees per Year for not building Kalabagh Dam.

The Meeting Ended at 1:15 PM. The members of delegation thanked Mr. Shams Ul Mulk for his valuable time to Youth Parliamentarians for understanding this important Issue.

3rd Meeting: With Mr. Dr. Samar Mubarak Mand

The Delegation met on 15th March 2012 at 12:00 p.m. The Venue was Room # 139, 1st Floor, Planning Commission of Pakistan, Islamabad. The Head of Meeting was **Mr. Dr. Samar Mubarak Mand**.

The following Members were Present:

- **Elwina Rauf YP10-GB01**
- **Touseef Ahmed Abbasi YP02-AJK02**
- **Amir Abbas YP08-FATA01**
- **Yasir Riaz YP12-ICT02**
- **Salman Khan Shinwari YP18-KPK05**

Mr. Dr. Samar Mubarak Mand urged the participants in the delegation to introduce themselves. After a brief introduction, the discussion began. This was our 3rd meeting on “Recent Energy Crises in Pakistan and its possible Solutions”. In this meeting we discussed the role of Thar Coal in Energy Sector and its possible utilization to overcome recent Energy Crises. The Agenda was a complete questionnaire and the Head of Meeting was supposed to provide answers of these Questions.

- Why you always emphasize that Coal resources are the concrete solution for overcoming Energy Crises Issue? What is the logic behind your opinion?

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Regarding this question Dr. Samar Mubarak Mand responded that I always emphasize because we can produce so much electricity from Thar Coal which will be enough for next 40 years without any single second of load shedding. He further told that if all the oil reserves of Saudi Arab & Iran are put together, these are approximately 375 Billion Barrels, but a single Thar Coal reserve of Sindh is about 850 Trillion Cubic Feet, which is more than oil reserves of Saudi Arabia and Iran.

- Have you completed any project utilizing Coal Resources? What about its strength?

Regarding this question Dr. Samar Mubarak Mand responded that our first 50 megawatts (MW) project has been successfully completed and it's now the part of our Power Generation. He further said that the project was to cost Rs 8.898 billion with a foreign exchange component of Rs 5.847 billion that was approved by the Executive Committee of the National Economic Council.

- What is the potential of Coal Reserves in Pakistan?

Regarding this question Dr. Samar Mubarak Mand responded that Thar contains 175 billion Ton reserves of coal, out of which 1000 MW electric power may be generated immediately for the next 30 years and can produce 100 million barrel diesel per year also we can expand it with the duration of time.

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He further told that just 2% usage of Thar Coal can produce 20,000 Mega Watts of Electricity, adding if the whole reserves are utilized, then it could easily be imagined how much Energy could be generated.

Dr. Samar said that Thar Coal reserves could play a pivotal role in meeting energy crises both in long term and short term which would enhance industrial competitiveness due to cost effectiveness. He said that the industrial sector could not wait for long and the government should present quick solution to fill in the gap between demand and supply of energy. He said that the current energy crisis was causing loss of Rs.230 billion and bringing 400,000 people jobless. Current dependable power supply hovers around 14,000MW in summer though it drops in the winter. On the other hand power demand in 2030 would be more than 100,000MW, he added. He emphasized that the development of the Thar coal was the only viable long-term solution for meeting energy demands of the country. “Only Thar Coal can provide guaranteed long-term energy security to Pakistan”, he maintained.

He said indigenous coal can be used, and added that coal gas power plants based on integrated gasification combined cycle (IGCC) plants would generate electricity at a cost of about Rs.7 per KWH. He further said that coal can also be converted into coal gas above the ground in machines called surface gasifiers,” Dr. Samar said, that the efficiency of the conversion of coal gas to electricity is about 40 percent.

- Is there any possibility of Natural Gas within these Coal Reserves?
Can we utilize it to fulfill of daily needs?

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Regarding this question Dr. Samar Mubarak Mand responded that these Coal Reserves in Thar estimated at 850 trillion cubic feet (TFC) of Gas, are 30 times higher than Pakistan’s proven Gas reserves of 28 Trillion Cubic Feet. Dr Mubarak Mand said that the success of the Thar coal project will lead to investment from the leading international companies. With the completion of coal-fired power generation project, the nation would get cheap and sufficient power supply thus resolving the current pestering energy crisis.

- What will be the cost while producing Electricity through Coal Resources than producing Electricity through other means?

Regarding this question Dr. Samar Mubarak Mand responded that Coal Power Generation would cost Pakistan PKR 5.67 per Unit while Power generation by independent power projects cost PKR 9.27. He further told that it requires just Rs. 420 Billion initial Investment, whereas Pakistan receives annually Rs. 1220 Billion from electricity Tax only.

- Is there any other Country Producing Electricity while utilizing their Coal Reserves?

Regarding this question Dr. Samar Mubarak Mand responded that 41 % electricity in the World is being produced from coal while India is producing 64.6 % electricity from it but Pakistan only producing 2.27 % from it.

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After this brief intro of the project the attendees raised certain questions which were answered by the honorable guest. These questions along with their answers are given below:

- The Pilot Project of Thar Coal Underground Gasification that was started in 2010, is it completely functional and producing electricity?

Dr. Samad said that it has been completed and they have achieved the goal to burn the coal that is present under the surface but there are certain technical problems they are facing which are to be overcome.

- Could the project be completed in near future and will it solve our energy problems?

Regarding this question Dr. Samad told us that they project is able to fulfill all the energy needs of the country for at least the next 50 years. But for this we need a lot of Funds and at least 5 years' time.

- Are there any other benefits of the project?

He said that by the burning of this Lignite quality coal we can get heat of about 5000 BTU value. This heat can be used to make steam which can also generate 38MW electricity further. The gases produced as a byproduct can be used for urea production and we can run a Fertilizer plant by them. Diesel generation can also be done by thermal cracking of the products.

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- What are the main issues in the project and why will it take that much long?

He told that for this purpose they need to dig 225 wells. Only 36 wells have been dug so far for the pilot project in 2 years. Also the unavailability of funds and lack of Govt. interest in the project are main issues. The policy makers must include technical people who are masters of their field in the policy making so that we can avoid the problems in our projects.

- How much was the cost of the Pilot project and how much energy can be produced from it?

The pilot project covers 65 km² area and has 3 phases:

Phase 1 is **Underground Coal Gasification** and cost about 494 million rupees.

Phase 2 is **Syn Gas Holding and Purification** and its cost is 490 million rupees.

Phase 3 is **Power Generation Phase** and its cost is 8898.7 million rupees.

After this 100MW electricity can be produced experimentally.

- Will the power generated from coal cheaper than the hydro power?

No, the power generated is not cheaper as it will cost about 5 rupees per unit which is more than the hydro generated power.

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- Why are we doing Underground Gasification? Isn't there any other method that we can use to extract the coal and then use it?

Dr. Samad told that the coal seams are located about 175 feet below the surface and also contain 1 water body above them and 1 in between the seams which makes it impossible to mine as an open pit. Also the cost of open pit mining is 3.5 times more than underground gasification and also has some environmental issues.

- Will underground gasification effect the water bodies present in the area?

Regarding this Dr. Samad told us that efforts have been made to save the drinkable water from contamination and we are successful in it.

- Is any such project operational in any other country of the world?

Yes Uzbekistan is producing electricity from Underground Gasification and there technical experts also visit Thar project and share their experience.

- After the completion of the Pilot project when can we expect over power crises to be solved?

He said that for this purpose we need the people which are loyal to Pakistan as the present Govt. is not showing any interest in the project. If the required funds are allocated on urgent basis the project can be functional in 5 years.

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- What do you suggest can be done to overcome the recent energy crises immediately?

Regarding this he said that there is no way that this crises can be solved immediately. We need both short and long term planning. Unconventional means of electricity production can be adopted like wind power, Solar power, Bio Gas and Diesel etc. Along with all other unconventional energy resources we must built dams to overcome over energy crises and Kala Bagh Dam is the key to it.

The meeting last for 1 hour and 30 minutes in which we had very fruitful discussion on the Energy and other crises that Pakistan is facing now-a-days. Dr. Samad also urges that the youth must come forward and do something for the betterment of the country as they are the only hope.

5th Meeting: With Mr. Muhammad Sarwar

The Delegation comprising the members of the Special Committee on “Energy Crises” meets Mr. Muhammad Sarwar, Executive at “Pakistan Wind Energy Pvt. Ltd.”

Attendees:

- **Shaheera Jalil Albasit** (YP56-SINDH08)
- **Ushna Ahmed** (YP59-SINDH11)

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Agenda:

The agenda of the meeting was to discuss the recent energy crisis and to devise ways to overcome it with the help of non-conventional energy resources like wind energy.

Minutes:

- Which wind Turbines are more feasible, particularly for the urban localities, Vertical Axis Wind Turbines or Horizontal/Lateral Axis Wind Turbines?

The Horizontal Axis Wind Turbines are tried and tested for 600 years; feasibility of the Vertical Axis Wind Turbines on the other hand has not yet been proven.

Problems with the Vertical Axis Wind Turbines are:

- The Lubricant-Losses in the Gear Mechanism of the Wind Turbines are increased.
 - The complicated design of the Vertical Axis Wind Turbines increases the R.P.M.
 - Turbulences are more frequent.
 - If Vertical Axis Wind Turbines are deployed at lower heights, then the speed of the ground wind does not provide sufficient power.
-
- Speaking regarding the projects of Alternative Energy and the role of Alternative Energy Development Board (AEDB), he was of the opinion that:

AEDB does not have any direct benefits to people like us who are running our companies dedicated to the spread of Alternative Energy Sources in

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Pakistan. AEDB shows no keen interests in most of such projects and only provides nominal facilitation. Corruption charges against AEDB go up, to PKR 1.5 Arab. The lands which have recently been allocated to us and other private companies, by the Government of Sindh are not very beneficial either because they are either disputed or have security threats by the locals. Apparently, Government of Sindh shows no keenness to address these issues of Law & Order so that we could initiate our projects immediately.

- Answering the question regarding the potential of wind energy in Pakistan, he said:

Wind Energy has the potential to add 85,000 Megawatts to the national grid. 50 kilo Megawatts can be generated from Sindh and Balochistan, particularly the coastal belt. Khyber-Pakhtunkhwa, especially the areas of Chakwal and Kallar-Kahaar, can add 5000 Megawatts. Currently, Duddar camp in Balochistan has various areas which function on wind turbines. Also, from K. T. Bandar to Bhambuur, there are 175 villages which function on wind turbines.

- Discussing the loopholes in the current system of electricity generation and power supply, he added:

Owing to the shocking state of corruption in the power sector, Pakistan has lost 40 percent of its industry, which has shifted to Bangladesh. There are extreme logistic difficulties in the current system of power supply. For instance, one High Tension Tower costs up to PKR 5 to 6 lacs and there are multiple such High Tension Tower deployed in Balochistan, near Hub Chowki. If one Power Grid is to be spread over a distance of 20 kilometers, it would cost up to PKR 1.5 crore. If the same grid is to provide electricity

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to 1,400 villages in Interior Sindh, it would mount the costs to PKR 2,100 crore. To address this issue, our company suggested to Hyderabad Electric Supply Company (HESCO) that we could provide electricity to those 1,400 villages right there, through our sources of alternative power generation via Wind Energy, but we did not receive any encouraging response from HESCO. The current power supply mechanism includes costs incurred by the Spreading of Transmission Lines and Maintenance of Grid Stations; these costs can be cut-down if management becomes transparent and sincere. Our company is also working on a very practical application of having Pre-paid meters. These pre-paid meters can be interfaced with mobile phones of the consumers and they will be able to pay their bills more effectively. Pre-paid meters, if deployed, will also minimize chances of monetary corruption.

- Talking about the idea that their company presented to HESCO for those 1,400 villages in Interior Sindh included:
 - Under-ground spreading of wires.
 - There would be only 1 office in which meters would be installed.
 - Only 1 person per village would be employed for maintenance.
 - No heavy vehicles would be required nor would high-tech engineers be needed, which will make this project cost-effective.

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“Electricity Generation Potential in Pakistan”

Few years back Pakistan used to get half of its electricity from hydel power and remaining from thermal generation. However there is a limit to the extent of exploitation of hydel resources and thermal power plants due to environmental and other concerns. Modalities for overcoming the energy crisis are multifold. To meet the challenge there is a dire need to go to the alternate sources of energy.

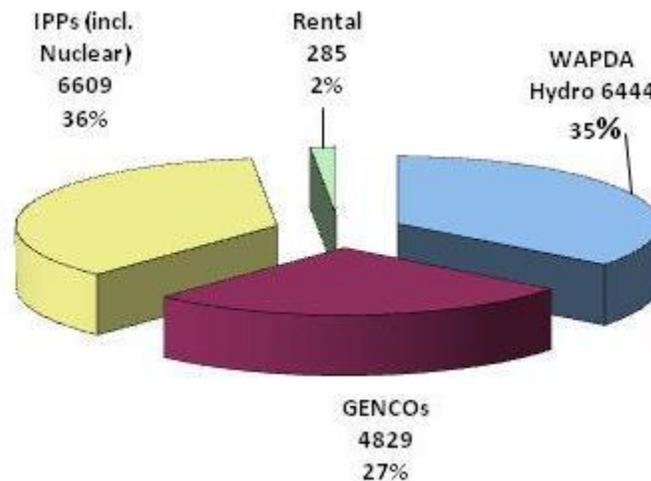


Fig: Different methods of Power Generation in Pakistan

WE are fortunate to live in a country that offers us a multitude of natural resources yet to be harnessed for their entire potential. Arguably the most important of these, with reference to the present atrocious energy crisis and the intensifying effects of climate change, are the renewable sources of energy.

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The Pakistan Council for Renewable Energy (PCRET) has already undertaken some groundbreaking work in this regard by researching the potential of renewable sources of energy for commercial and personal use through localized design and development principles.

Pakistan, tracking the UK, Germany, Bangladesh can encourage banking sector to finance individual homes to shift to renewable. It will save trillions being lost to corruption, line losses, administrative cost and maintenance. Specially, Punjab government needs to spearhead the drive to adopt renewable energy as the most populous province and support agri-sector.

Renewable energy can be used to reduce Pakistan’s ever increasing \$10bn annual fuel imports. By adopting mass transport, Pakistan can cut diesel fuel imports, which reportedly constitutes 80 per cent of total national fuel import. It can help Pakistan fight poverty, generate millions of jobs, end privatization of national silver and bring more than \$100bn annually in foreign direct investments (FDIs). In 2010, \$230bn was invested in renewable energy in worldwide; due to friendly policies, private sector alone has invested \$191bn in renewable energy.

Renewable energy can save our future generations from being unemployed. Our leaders need to use renewable energy to educate and employ youth, attract billions of dollars in FDIs and revive and sustain economy.

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Nations are using renewable energy, transport policies and eco-cities to overcome poverty, create millions of jobs, expand industries, attract direct foreign investment and strengthen economies. In conclusion, Pakistan can solve its energy crisis and join modern world provided our leaders are willing to adopt effective laws, transparent policies, get rid of corrupt practices, and adopt renewable energy.

Wind Energy:

Pakistan can have wind energy on lines of China to generate 20,000 MW. China has planned to generate or 30GW with wind energy by year 2020. Gansu province alone is going to add 7Gw to its existing 10GW installed capacity by 2015. Wind energy project costs have dropped to below US \$625 a kilowatt, making wind power generation a profitable business in Gansu. China is going to harness 750GW of offshore wind energy. In G-20 countries, 48 per cent investment in clean energy has gone in wind energy and it has added 40 GW of generating capacity, which is enough to power 30 million homes.

Pakistan has been gifted with an immense wind resource. The wind map of Pakistan has been developed after extensive analysis carried out by National Renewable Energy Laboratory (NREL), USA in collaboration with USAID, Pakistan Meteorological Department (PMD) and Alternative Energy Development Board (AEDB) using data available from PMD met sites and satellite imaginary.

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The Ghoru - Keti Bandar Wind Corridor spreading 60 km along the coastline of Sindh province and more than 170 km deep towards the land alone has a potential to generate more than 60,000 MW of electricity.

AEDB also approaching relevant forums for installation of wind masts in Balochistan province and other parts of the country to assess the wind potential to explore the opportunities of investment for private sector. This will enable public sector investment in promotional, demonstrative and trend setting wind energy projects that would result in devising measure to support the private sector in mobilizing and financing wind power projects in Balochistan province and other parts of the country.



Fig: Zorlu Wind Farm (6MW) at Jhampir (Sindh)



A wind turbine at Zorlu Wind Farm (6MW) Jhampir (Sindh)

Solar Energy:

Solar sector is the fastest-growing clean-energy industry in the world. Prices of solar panels have declined by more than 60 per cent in the last 30 months. By the end of this year, solar modules are expected to cost half as much as they did four years ago. In 2010 alone, 17 GW of solar-generation capacity was added in the world which could power more than 12.5 million homes. China produced 48 per cent which is about 13GW, of the world's solar panels in 2010, in coming two year time it will be the world's largest market. The solar feed-in tariff, the price of solar-generated electricity, could drop below 12.5 cents for each kilowatt-hour (kWh) by 2015, equal to conventional coal-fired electricity by that time.

India is encouraging individuals to develop 12-acre solar farms to sell energy to state. Almost entire textile sector of India has shifted to renewable energy. Pakistan needs to legislate to shift industry to renewable energy to free gas, end energy theft, and meet international emission standards and competitiveness. Though initial cost of installing solar panels is comparatively high but through them the highest levels of efficiency can be reached.

Solar Energy is available at a rate of 1000 watts per square meter in Pakistan (about 19 Mega Joules per square metre of solar energy) according to the Alternative Energy Development Board (AEDB) sources. This can be converted to DC electricity with the help of Solar Photovoltaic cells, which may be used to pump water, operate fans, TV and telecommunications

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directly during daytime. The electrical energy generated during the day time (5-8 hours of sunshine), can also be stored in deep cycle lead acid batteries which can be used at night to provide power for lighting, radio, Television and fans. The system will be user-friendly and designed as a stand-alone system for each household, who will be trained to operate and maintain it. The user will only be required to switch on/off the system, as is done in normal home lighting systems. In addition, Solar Photovoltaic Panels can generate enough electricity to pump water from depth of 350 ft, 700 ft and up to 1000 ft.



Fig: Solar Powered Tube well.

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On 29th May 2012 Prime Minister of Pakistan Syed Yousaf Raza Gillani inaugurated the first ever Solar Power Generation plant. The project was the joint venture of Pakistan Engineering Council (PEC) and Planning Commission of Pakistan and was funded by Japan International Cooperation agency (JICA) under its “Cool Earth Partnership Program”. The system has been completed in 3 years at a cost of 553.63 million. Under the project, 178.08 KW photovoltaic system each in the premises of PEC and Planning Commission has been installed. The combined generation capacity is 356.16 KW.

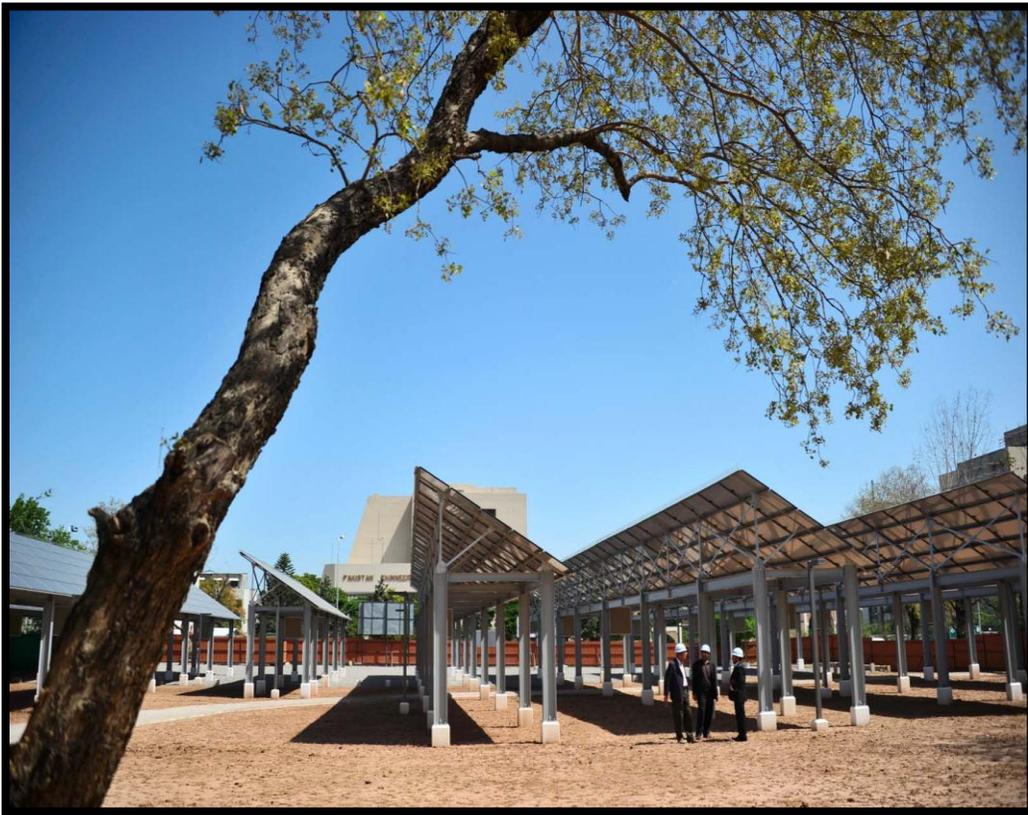


Fig: Pakistan's First Ongrid Solar Electricity Generation System installed by Pakistan Engineering Council. The capacity of the project is 178.9 KW.

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Baluchistan has great solar potential. It is not only the valley of minerals but it has a lot of wind and solar energy, having a scattered habitat and ample sunshine. But the number of solar panels installed there are very few. Some important advantages which favor the use of solar energy use in Pakistan include low operational and maintenance cost, environment friendly dimension etc.

In the last few years, PCRET has designed and developed 10 solar dryers for drying of dates, a solar hybrid system for dehydration of apricot on commercial scale and more than 500 solar cookers handed over to NGOs for dissemination and popularization.



Fig: Solar Panels used for the drying of dates in Gilgit.

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A commendable initiative taken by the CDA is giving a local manufacturer the approval to install solar-powered lampposts along the strip of Jinnah Avenue in the Blue Area, Islamabad, with no cost to the city exchequer. The manufacture, installation and maintenance costs are to be borne by the providing company, which will recover its project cost by renting out advertising space on the lamp posts.



Fig: Solar Powered LED Street lights

The Karachi administration has also announced that the city will utilize solar power for lighting in public places. Solar PV technology, coupled with LED lights, has a high potential for saving significant amounts of energy.



Fig: Solar panels installed at Mazar-e-Quaid Karachi.

Solar energy is the best and suitable form for Pakistan as the country has a potential of generating 100,000 MW electricity or over 2.324 million MW electricity per annum through solar system.

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Coal:

Few years back Pakistan used to get half of its electricity from hydel power and remaining from thermal generation. However there is a limit to the extent of exploitation of hydel resources and thermal power plants due to environmental and other concerns. Modalities for overcoming the energy crisis are multifold.

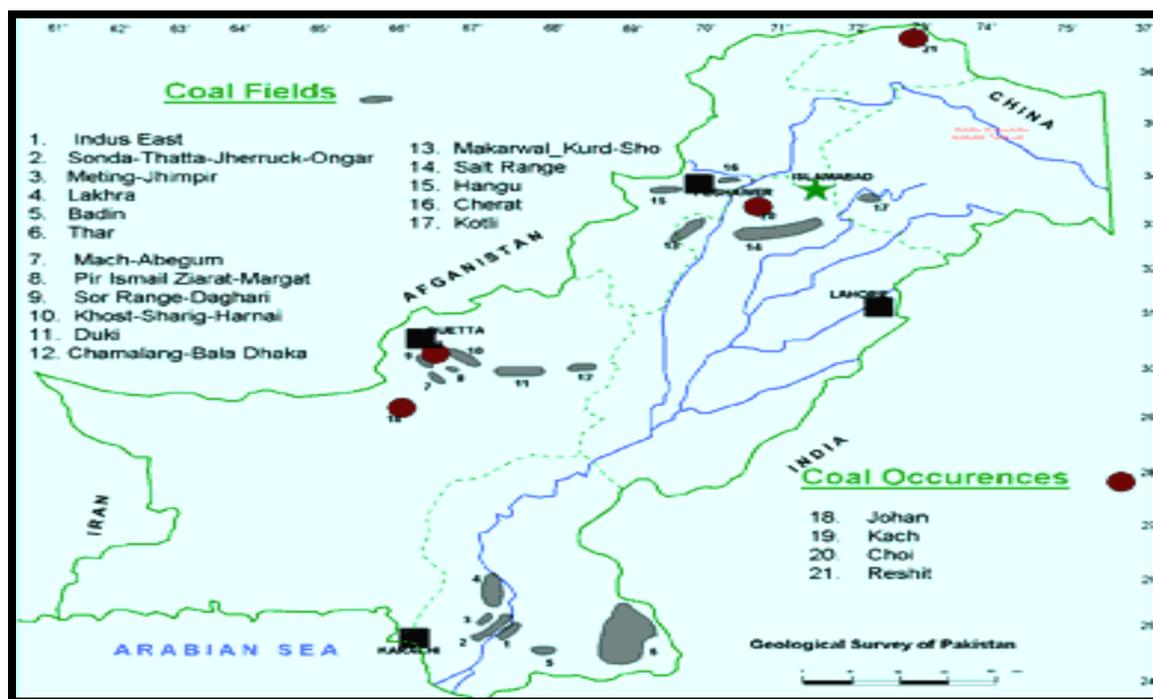


Fig: Coal Fields of Pakistan

To meet the challenge there is a dire need to go to the alternate sources of energy. Some people suggest that process of converting coal into product gas underground can be a good alternate source of energy. Technically this process is called as underground coal classification. Through this the

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underground deposit of coal is treated with controlled fire. Gradually the coal turns into gas.

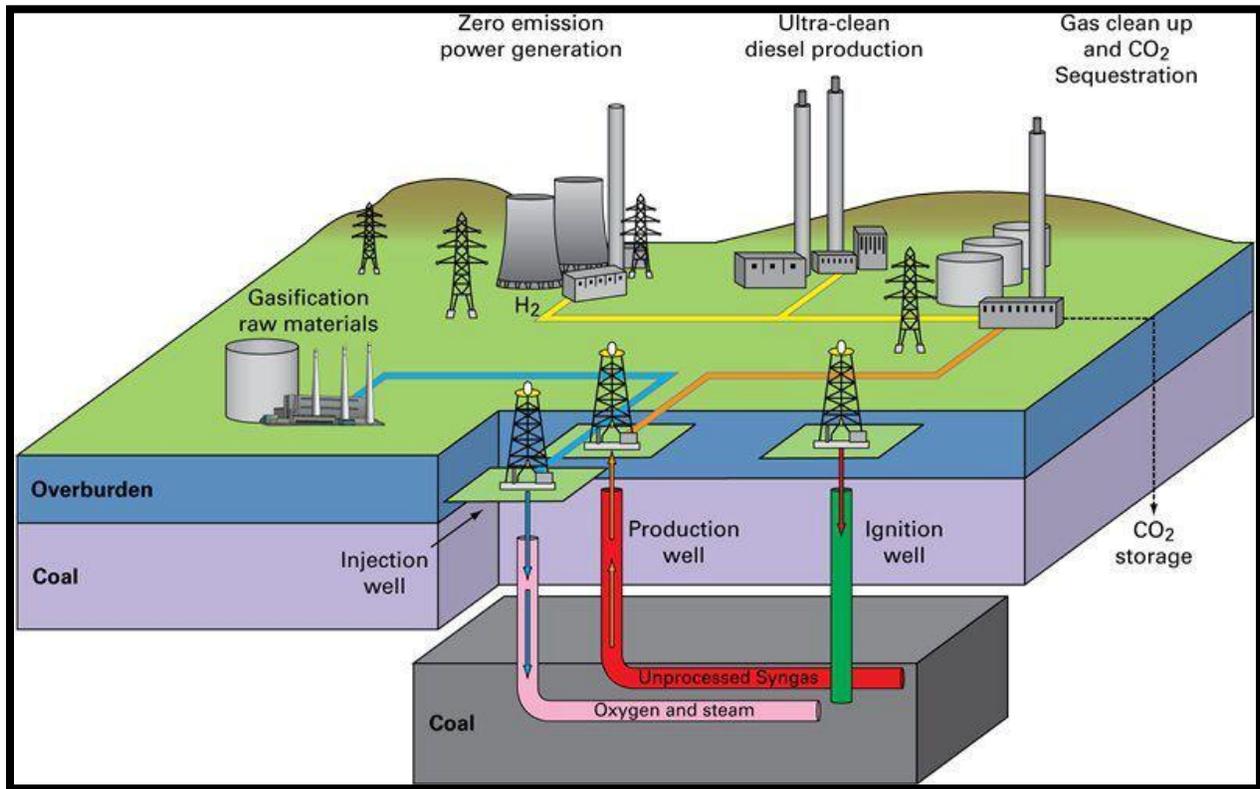


Fig: Underground Coal Gasification process.

The largest coal reserves of Pakistan exist in Thar which are about 175 Billion Tons or 850 Trillion Cubic feet. There this source can be cashed. A pilot project has been completed for the generation of 100MW electricity. Although the project has certain complications but they can be overcome by the allocation of needed funds according to the Thar Coal Underground Gasification Project sources.

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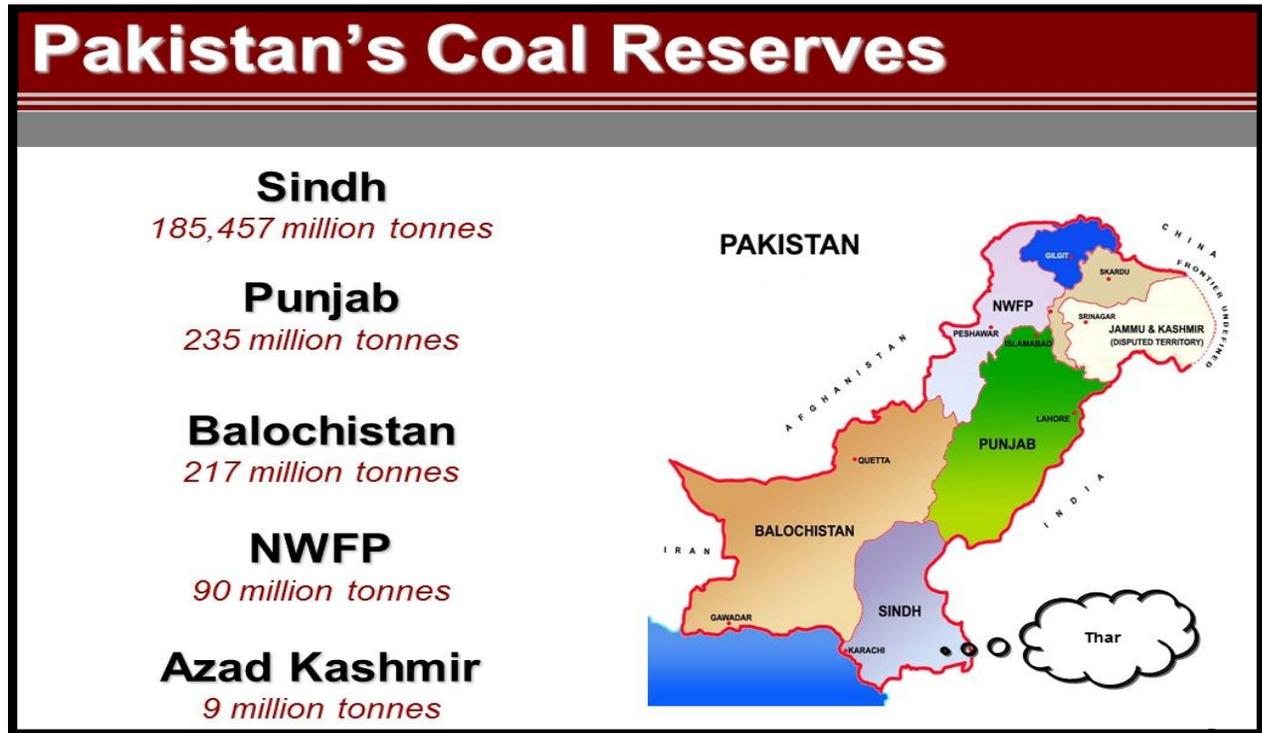


Fig: Coal reserves of Pakistan along with Thar Coal

Australia	80%
China	78%
India	69%
USA	50%
Germany	47%
Pakistan	0.1%

Fig: Global Power Generation from coal

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Hydro:

The total hydroelectric potential in the country has not been fully investigated, but conservatively estimated to be 45,000 MW. This consists of all sizes of hydropower plants, including storage-based and high-head schemes on mountainous streams in the north and low-head, run-of-the-river plants on rivers and canals in the southern plains.

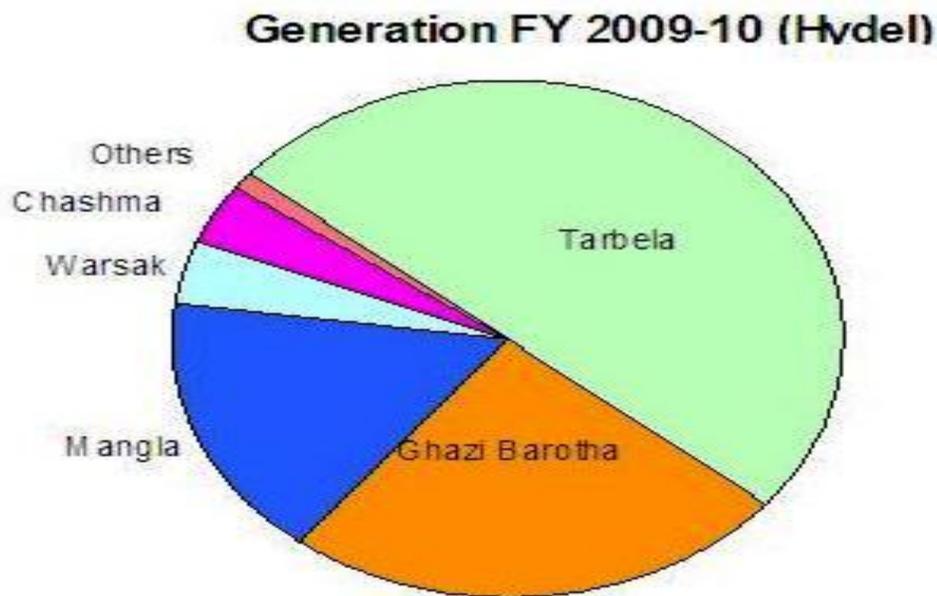
Pakistan has an installed hydroelectric capacity of 5,928 MW of large (>250 MW), 437 MW of medium (>50 MW and <250 MW), and 253 MW of small to micro (<50 MW) plants, mostly in the northern parts of the country. This amounts to 6,608 MW of total capacity, or less than 15% of the identified potential.

EXISTING INSTALLED GENERATION CAPACITY				
Type of Generation	Installed Capacity (MW)	Derated / Dependable Capacity (MW)	Availability (MW)	
			Summer	Winter
WAPDA Hydro	6444	6444	6250	2300
GENCOs	4829	3580	2780	3150
IPPs (incl Nuclear)	6609	6028	5122	5402
Rental	285	264	250	250
Total	18167	16316	14402	11102

Fig: Existing Installed Power Generation Capacity in Pakistan

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Gilgit-Baltistan has maximum hydroelectricity resources as compared to anywhere in the country. The region has an area of 72000 square kilometers and a population of nearly two million. It is a mountainous region and the population is widely scattered. A large number of micro hydro power station units have been established in the area.



The major hydro-electricity sites are as under:

- Diamir Basha Dam 4500 MW
- Bunji 7100 MW
- Munda 740 MW (9 years for completion)
- Akhori 600 MW (5 years for completion)
- Kurram Tangi 83.4 MW (4 years for completion)
- Other small and medium size projects: 22,986 MW
- Total Potential: 31,000 MW
- Total estimated investment: 60 billion US\$



Fig: Proposed view of Diamer Basha Dam project

Kala Bagh Dam:

Kala Bagh Dam is the most important project that must be completed to overcome the energy as well as water crises of Pakistan. It was to be completely functional in 1986 at a cost of 6 Billion but was never constructed and now if it is to be constructed it cost a price of 600 Billion. The project has its too much importance for the future of Pakistan but is under high political monopoly.

Conclusion

After all the literature that we reviewed we can sketch up some rough hurdles that are there that won't let implement our identified solutions. These hurdles are explained in short below;

Hurdles Implementing the Solutions to this Crisis:

1. Circular Debt:

We identified that the Government is not serious in paying the IPP's circular Debt. Once this debt is paid off, the IPP's can pay off their petroleum import expenses and start producing at optimum levels. As long as the debt is left un-paid, we may continue to have such crisis forever.

2. Line Losses:

We identified that WAPDA is facing huge line losses due to electricity theft or illegal usage of electricity. The burden is beard by the Government so in order to cover up such losses and to ensure adequate and clean facility of electricity; we must ensure that no body breaks into the transmission system.

3. Inadequate Power Generation Capacity:

We identified that most of the systems here run on either Gas or Coal i-e they are thermal systems. Both Gas and Coal are considered as scarce and expensive commodities for electricity producers. We must not rely mostly on such production systems. We must ensure usage of efficient Thermal plants instead of in-efficient ones to conserve the scarce resources.

4. Lack of Capacity of Transmission of Electricity:

We identified that most electricity transmission lines here in Pakistan are incapable of transmitting electric voltages of more than two phases. This makes them in-compatible to carry higher voltages, so even if we produce 3 phase electricity, it would be of no use in this case. We need to upgrade our transmission lines.

5. Lack of Capacity of Distribution of Electricity:

We identified that we lack high quality lower end grids that are used to carry electricity from power houses to the ultimate consumers via grid stations. The infrastructure is old and deteriorated. The system is unable to sustain extreme weather conditions hence most of the grids shut down at extreme temperature or either completely stops working.

6. Privatization of K.E.S.C:

After the privatization of K.E.S.C is enhanced its production capacity but the Government for a certain reasons did not provide it with adequate distribution network. As production alone is not sufficient, the

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Government must provide a clean transmission system for IPP's especially to K.E.S.C as it is responsible to provide electricity to two of our provinces Sindh and Balouchistan.

7. Government's dependence on IPP's:

The IPP's at current are responsible to provide electricity to half of our country. As the Govt. did not pay their debt so now they are charging or demanding higher per unit prices from the consumers. This hike in electricity prices is affecting not only our local industries and homes but is also affecting our exports of manufacturing goods. The govt. must intervene and pay out the circular debt. Or provide subsidy on electricity.

8. Lack of Government's interest in building dams:

Pakistan being rich in hydro-electricity resources can generate all of its electricity through water but this sector is totally neglected by the Government and no mega Dam project is initiated for the last 30 years. Hydroelectricity being the cheapest is the need of the country but was totally neglected. The govt. should take this seriously and allocate funds for the initiation of Mega Dam projects.

Recommendations

Following are some recommendations for resolving the energy crisis in the country:

1. Funds must be initiated on the priority basis to solve the biggest and most important problem of the energy crises.
2. To overcome the problem on urgent basis, electricity from the neighboring countries can be utilized and during this duration means should be adopted to generate energy.
3. Removing the Circular Debt of WAPDA and PEPCO. This requires a lot of investment to be put into WAPDA for the purchase of oil however with the current financial condition the government cannot take such a valiant step. A proposed solution is giving electricity on credit to the industries as well as the government institutions.
4. Ensuring payment of dues by the government departments and agencies. This will require moral courage on part of the government but the payment of outstanding dues by the government agencies is imperative for removing the circular debt of WAPDA.
5. IPPs should be paid on regular basis so that no short fall from the Thermal power sector is encountered.
6. Improvement of the efficiency of various Thermal Power units. This is very important for utilizing the installed capacity of the National Grid. The investment required for the rehabilitation of the Thermal

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Power units in various parts of the country is very less as compared to the money spent on Rental Power Projects.

7. Mega projects like construction of Big Dams should be initiated on priority basis and for this purpose foreign investment should be taken.
8. The funds allocated by the Federal Government are not large enough to initiate mega generation projects such as Bhasha Dam and Bunji Dam, funding for these projects has to be brought in from International monetary agencies, for which rescheduling and improvement in debt to GDP ratio is required.
9. The funds allocated for solving energy crisis should be used for rehabilitation of thermal power units, establishment of small and medium sized hydroelectric power plants.
10. Along with big dams, small dams and micro-hydro projects must also be started for the short term solution.
11. Government should take all the provinces onboard and solve confusions regarding Kalabagh dam keeping in view of its importance for the betterment of the country.
12. Alternative energy from unconventional means like Thermal, Solar, Tidal and wind must be encouraged. For this purpose private sector can be involved.
13. The government should also enhance partnership with trade partners like China to establish Photo Voltaic cell manufacturing units in Pakistan in order to promote solar energy.

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14. The electricity for agricultural sector can be provided by covering the irrigation canals with solar panels. The initial funding required for this project can be derived from the agricultural subsidy.
15. Bank loans without interest must be initiated for the private sector and people for the use of Solar and Wind and resources locally.
16. Immediate funding must be done for the completion of Thar Coal project and the project must be extended to the large scale for the utilization of Thar coal for energy purposes.
17. In northern areas, Private sector must be encouraged for the installation of turbines on high energy streams to overcome the energy need locally. For this purpose community funding can also be done to meet the initial cost.
18. The air corridor of Gawadar must be utilized completely only for the purpose of wind energy.
19. Industries that consume 32% of our electricity, must apply Energy Conservation Systems and Management measures. They can start producing their own energy with their own investment without depending upon the grid.
20. Industrialists and new investors must consider the Energy Sector as good an investment as any other. Needs image building.