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**THE MOTORWAY——
PRIME MINISTER NAWAZ SHARIF'S
GIFT TO THE NATION ON
PAKISTAN'S GOLDEN JUBILEE**

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NATIONAL ECONOMIC REVIVAL

Consequent upon dismal economic performance of major macro economic indicators in the past, the present Government introduced some significant structural reforms in Feb. 1997 Accordingly for 97-98, some ambitious targets were set to revive the national economy. The recent political crisis which loomed over the national horizon for a couple of months gave a serious set back to the national efforts of economic revival. To our goodluck, the crisis has been over substantially and the economic revival efforts are back on the track. The large manufacturing sector of the economic has already started showing signs of growth. Similarly, the agriculture sector is also indicating good recovery.

The completion and launching of the first phase of Pakistan Motorway is Prime Minister Nawaz Sharif's Gift to the Nation on the occasion of Pakistan's Golden Jubilee. It will certainly go a long way in our economic revival effort through better communication and industrial growth from the special industrial zones planned along the motorway

The economic targets fixed for 97-98 include interalia 6 percent GNP, inflation at 9% and the current account deficit (excluding official transfers) in targeted to be reduced to 5.3% of GDP, saving as a percentage of GDP are expected to increase from 11.8% to 13.5%. Exports and imports are projected to grow by 15% and 5% respectively. On the demand side budget deficit is expected to decline to 5 percent

of GDP while government borrowings for budgetary sport are to be below Rs. 58 billion in 97-98. After meeting fully the genuine private sector credit requirement domestic credit is expected to increase by no more than 13.5 percent.

There is one very important aspect to the economic recovery plans. Our macro economic planners concentrate mainly on the overall figures ignoring the real agents of change of growth and production. The micro factors on which the economic structure is built are forgotten. Vital parameters are not considered for restructure and reforms. Resultantly, the macro indicators fall short of targets. Here the role of engineers both in the public and private sector is very significant. They play key roles in development effort and productivity improvement. If they are given effective participation in policy planning and productivity efforts distinct from total reliance on the generalist bureaucrat in development planning and productivity operations, the economic revival effort can yield better results. Effective growth of professionalism is the need of the present and the future. It would certainly need effective service reforms and implementation in real terms. The general bureaucrat when put to manage technical departments/ministries and corporations normally makes unrealistic decisions, relies on turn key contracts and unnecessary foreign loans on account of absence of professional knowledge. This results in slowed development effort on the one hand and on the other, the national debt figures shoot up. It can be said with certainty that our national external debt to the tune of US \$ 30 billion would have been much less, had the professionalism and reliance on local talent been in place effectively during the last 50 years of national life.

LEADERSHIP: THE WORLD IS RUN BY THOSE WHO SHOW UP

**By Richard G. Weingardt, P.E., Fellow, ASCE*

ABSTRACT

Engineers have much to offer the world with their technical expertise and problem-solving skills. Engineers are, in fact, highly respected for these attributes. But they rank in the second tier of professions when it comes to prestige in the general public's perception, mainly because there aren't many engineers involved in visible pursuits. For instance, there are only four professional engineers (P.E.s) in the U.S. Congress and only three dozen among the 6,000-plus state legislators in the United States. This paper discusses the major weaknesses of engineers and the profession in not getting involved and in not showing up, and it also addresses the major strengths possessed by members of the profession that recommend engineers for leadership. Further, the paper details five premier strategies that engineers can use to become more involved, have more impact on public policy, advance their careers personally, and broaden the image and impact of the profession in the world at large.

INTRODUCTION

With challenges in technological advancements and the struggle of maintaining and advancing the quality of life in the industrial powers and the developing countries, the skills of engineers have never been more important to our communities, our country, and the world at large.

However, engineers are woefully underrepresented in the important policy-making bodies and boards, from local levels to the halls of Congress. This paper argues that engineers, by and large, have not been involved enough in the leadership opportunities available to them. This paper challenges engineers to "show up" and get more involved in leadership on any and all levels and offers several strategies to accomplish the move into leadership.

ENGINEERS AS LEADERS

As a professional engineer for over 35 years, as a businessman running my own consulting engineering firm for 30 years, and as someone deeply involved in engineering professional associations all my life, I take great pleasure in addressing one of my favourite subjects: engineers in leadership; engineers as leaders.

I'm one of those hopeful dreamers who happens to believe that engineers have the "right stuff" to be leaders; not just leaders in our companies or agencies, but leaders in our communities and in society at the top of the food chain.

You'll probably think I'm a hopeless romantic when I tell you something else. I actually believe something that David McCullough (1978), the historian and prize winning author, discovered about engineers. In his books engineers are the

heroes. Just read his histories on the building of the Brooklyn Bridge and the Panama Canal. He writes about the greatness of engineers, about our intelligence and problem-solving skills, and how what we do is so uplifting to the human spirit. But even more significant, and the thing I must confess to you I believe because McCullough says it's true, is that there is evidence in history that a few civil engineers actually had a sense of humor.

So there you are: engineers are intelligent, have the right stuff, and a few of us even have a sense of humor.

Bring on leadership. We are ready for it and we can handle it!

READY OR NOT

Or can we?

I'd like to share with you my thoughts on several aspects of leadership as it pertains to engineers.

First, let me address what I see as the three major weaknesses our profession has in this area of leadership. Second, I will address our major strengths the very things that recommend engineers for leadership. And finally, I will offer five strategies for action: five steps each and every engineer can take to build and apply leadership skills not only for themselves as individual but also as representatives of a profession worthy of leadership.

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AWESOME POTENTIAL

It is reported that there are 10,000,000 engineers in the world over 2,000,000 right here in the United States.

What an awesome potential for power, what an awesome potential for impact, and what an awesome potential for influence in public policy and controlling our own destiny.

Couple this with the fact that the world is becoming more and more dependent on technology and is impacted by technology and you can readily see what I'm getting at. Who is well equipped and trained to deal with the many challenges in an ever-more technological world? Engineers! Engineers from both the private sector and the public sector qualify.

And let's look closer at the numbers. There are 10,000,000 of us, but more importantly we outnumber lawyers worldwide 10 to 1. Now, unfortunately, most of the world's 1,000,000 lawyers are here in the United State, and in our own country we only outnumber them 2 to 1. Those are not great odds against that pesky group, but still better than having them outnumber us.

So we have to ask ourselves some questions. If there are so many engineers in the world, and if the world so much needs our technical expertise.

- Why aren't we more sought after to fill leadership positions?
- Why aren't our exploits more often headline news?
- Why aren't we more often listened to and our opinions more

often sought after on issues like environmental concerns, infrastructure investment or the lack thereof, and technological advancement?

Take the issue of sustainable development. President Clinton has a 50-member blue ribbon panel for sustainable development in America. Why aren't there any registered P.E.s or civil engineers on it? Don't we know something about the subject?

The answers to these questions and ultimately the solutions to these dilemmas are rooted firmly within the engineering profession. I believe our lack of recognition stems directly from what I term the "three weaknesses" we have as a profession.

1. Poor visibility
2. The public's perception of engineers
3. Inadequate involvement in our communities

Even though what we engineers do, add value, significantly contribute to this nation's economy, significantly impact everyone's standard of living and quality of life, and help to protect this earth for future generations. Few people in the general public ever hear about us or about what we do.

For instance, this year the United State is celebrating the 40th anniversary of the interstate highway system, certainly one of the greatest achievements of the modern world and one that has contributed nearly immeasurable benefits to both the social and economic advancement of our

great nation. Yet, the U.S. interstate highway system is almost universally called the greatest construction project of the century. Certainly, our highway system was indeed a mammoth and impressive construction project, and I don't want to take anything away from our friends in the construction business for the genuinely excellent work they did and continue to do.

But let's be honest: the feat, the challenge of putting in place millions of miles of highways and bridges and causeways, in every terrain imaginable from deserts and plains, through mountains and wilderness, over broad rivers and around and in little hamlets and major cities this all was and is, first and foremost, an engineering marvel. And yet there is little mention of engineers or engineering when talking about it. Likewise, the landing of a man on the moon a little over 25 years ago is hailed as the greatest scientific feat in modern history, again with virtually no mention of engineering or engineers. What a shame.

In poll after poll, engineers are always at the top of the list when it comes to asking what professions possesses high ethics, whose members are honourable and worthy of trust, and whose practitioners are notable problem solvers.

We don't rank so high, however, when it comes to the public's perceptions of what professions have high status or prestige. Last year in a Money magazine survey, for instance, engineers weren't even in the

top tier when it came to professions with status. The list included doctors and some of our favourites like lawyers and architects. We were in the second tier of professionals, listed behind accountants.

More and more, engineers are being thought of as technicians. We do not come to the forefront when the average man on the street thinks of a leader or a policy maker.

LACK OF ACTION

There are any number of reasons for this; however, as I mentioned earlier, I believe it stems from our own lack of action. For example, the number of engineers significantly involved in community leadership or holding elected public office seems to me to be inadequate.

There are only four registered P.E.s in the U.S. Congress; the majority of its 535 members are lawyers.

Of the approximately 6,000 State legislative seats in the United States, how many of these elected positions do you think are held by P.E.s? Thirty six. That's it; there are only three dozen registered P.E.s holding elected office in state legislatures throughout this country. Not exactly a crowd!

And there doesn't seem to be much of a groundswell under way to change these numbers. I don't think the lawyers are "shaking in their boots" and worried about us seizing power or taking decision-making positions away from them. Can we do anything, change anything, or is our fate sealed? Will we forever be called upon to

make things run but not called upon to run things?

The future holds some real challenges for engineers, there are some major forks in the road for us. So now, I believe, it is time to take the advice of that great sage of baseball, Yogi Berra. He said, "When you come to a fork in the road take it!"

WHICH WAY?

Okay, but which fork, which way?

We can continue to be technical advisors, advisors to decision makers and to others who are leaders. Or we can move into decision-making positions ourselves, into leadership, a step or two above being an advisor.

Oh there is nothing wrong with making things run or in being a technical advisor; it is certainly better than not doing anything. At least you get paid, and keep your staff some what profitable busy fulfilling someone else's vision. And, of course, not everyone wants to be, or should be, a leader. Hey, even in the law profession, not every lawyer is a leader; not every lawyer holds a public office or is in the U.S. Congress, thank God!

But in this rapidly emerging world so dependent on technology, if we can double or triple the number of engineers in leadership; if we can increase the number P.E.s in state legislatures from 36 to, say a modest 100; wouldn't that be significant?! Wouldn't that make a difference in how certain policy decisions are made?

Consider Bill Ratliff, a consulting engineer who has

been a Texas state senator for eight years. He said, "It is amazing how much needed in government, are the problem-solving skills of engineers. And not just on technical issues. Engineering skills and logic are needed for decisions on budgeting, investment, for determining future goals and even on issues like education.

It is often said that the world is run by those who show up. Ratliff confirms this. His experience shows, he noted that "Engineers can make a difference. All we need to do is show up."

HONESTY POLICY

The real, true and basic strengths of our profession are

1. Our skill—our technical expertise
2. Our ability to do something—something that adds value
3. Our honesty

This last point, honesty, is probably most important because of what it means for the other two. It is an honesty founded on the principle that we are trained to make decisions and arrive at solutions based on logic and science. We don't modify facts or alter numbers, change the value of gravity for instance, just to make our answers come out right. No, we get the right answers, the honest answers.

What a potential for power and impact we would have if only we augmented, leveraged, if you will, these strengths with two other things.

1. Leadership in our communities

2. Outreach to the public and the general media.

These two actions are not necessarily mutually exclusive, and each alone can lead to the other. But if we just showed up more often and in more places our outreach would grow into leadership and our leadership would bring a greater understanding of what we do and the significance of engineering in the economic and social advancement of our communities, our country, and our world.

We engineers tend to keep to ourselves, talk only among ourselves, and stay ensconced in the ivory tower of our immediate colleagues and professional associations. But to make a real impact and get involved in the important work of setting public policy, we need to also be talking to and interfacing with people outside of our industry. In this way, we can be successful in letting the general public know how significant engineering was in the success of the moon landing and the interstate highway system and indeed, how significant it is now and will be in the challenges ahead, with things like housing, transportation, education, sustainable resources, and quality of life.

INVOLVEMENT

If any engineers have the urge or desire to be leaders outside of our industry or want to do more to help set public policy and direction, what can we do or get involved with? What specific actions can we take?

Here are five things you might want to consider. You don't have to do them all; just doing one or two would make a

difference. Remember, just showing up is the first step.

1. Get involved in politics
2. Serve on public boards and commissions.
3. Speak out-write and lecture
4. Join and be active on issue-driven coalitions.
5. Support your professional engineering groups.

Now let's take a closer look at each action item.

Get involved in Politics

You don't have to be the governor of your state though that would be great. You don't even have to hold elective office to be effective and impact policy. If you have no desire to run for office yourself, then support worthy candidates. Help get them elected. Let them know where you stand on issues. Advise them about issues they may not be aware of or up on.

Once they are elected, if you are on a first-name basis-they will remember you and your issues; they will listen to your concerns on legislation they are debating or indeed, on legislation they propose. They will also introduce you and your ideas and solutions to other legislators, council members, and policy-makers. Now you've gone beyond showing up; you've become influential. You can now make a difference.

I'll give you a real-life example. In my own state of Colorado, we are fortunate to have one of the 36 engineers in state legislatures. But our guy, Sen. Tom Norton from Greeley, who runs his own consulting engineering firm in that northern Colorado city, doesn't just serve in the State Legislature. He has

been the president of the Colorado Senate since 1993.

Senator Norton didn't, of course, begin his political life as Senate president, or even as an elected official. He began by being a consultant to municipalities, helping city officials grasp the technical and political aspects of public works. This led him to getting personally involved in local Republican Party politics, first as a supporter of other candidates, and then as a candidate himself, in 1986, for a seat in the Colorado House of Representatives. Norton finally ran himself, he said, because as an engineer he was frustrated by state government agencies and decided he would have a great impact by going down to Denver and becoming personally involved.

"It is critically important for engineers to be involved in politics at the day-to-day, grassroots level in our communities," Sen Norton said, whether it's serving on a school board, sewer board, planning commission, or a city or town council. Local political involvement, he added, can help engineers strengthen their interpersonal skills, move their issues to the forefront, and formulate public policy.

"Interpersonal skills, which are often difficult for engineers, are just as critical as problem-solving skills," the Senator said. Because of his grooming in party politics, Norton said he became better prepared to develop and advance policies. "I believe that an engineer's skills and problem-solving process can be adapted to public service," he said.

This process paid off well for Sen Norton and, I believe, it is paying off well for the people of Colorado and the profession of

engineering. Sen Norton, in addition to being Senate president, chairs the Senate Capital Development Committee, which authorized \$ 100,000,000 for infrastructure and prison construction. In addition, he has sponsored legislation in Colorado to overhaul the state's workers compensation system and has served on panels addressing telecommunications and education.

Sen. Norton best exemplifies an observation made centuries ago by Plato, and I paraphrase: "If intelligent people don't get involved in politics, they will soon find they are being led by the less intelligent."

And again, you don't have to become the president of your state Senate or the governor of your state; just showing up and getting involved will mean that you will have an impact. And in my next example on the action item list, there are good places to start.

Serve on Public Boards and Commissions

There are countless policy-making/policy-setting boards and commissions we can get involved with, at the local, state, and even national levels. In Colorado there are more than 2,500 such state positions; sadly, at last count less than 30 of them were held by a P.E.

We are missing a golden opportunity when we don't show up and participate. How much more of an impact we could have if only more engineers served on public policy-making boards, boards like long range planning commissions, capital investment committees, and economic development boards. You can find out what's available to you by checking with you county and city clerks, mayor's office, city or town

council staff, governor's office, and leadership in your state senates and houses. And don't forget to check with members of your Congressional delegations.

By the way, if you don't want to be in leadership on the board itself, you can have some input on decisions by serving on its advisory group; many of these decision-making bodies have advisory groups who play important roles. These positions don't necessarily require a certain expertise or political party involvement but, of course, these things never hurt. Most people who serve on these boards are involved or express an interest in getting involved. In other words, for the most part, they just showed up.

And just to show you that I practice what I preach, consider one of my own experiences. I used some of my contact with members of the state legislature and in the governor's office to express an interest in serving on the Colorado Historic Preservation Board, an entity that designates structures that are historically significant. Until I joined the board it was controlled by architects and lawyers, and not surprisingly, few engineering projects, bridges, dams, or tunnels were ever deemed to be significant or even publicized. Now they are. One person, a single engineer and it could easily be any of you, can indeed make a difference. It will be a rewarding experience for you, and it will certainly advance the cause of engineering.

There are also other ways of showing up.

**Speak Out-Write for
General Readership
Publications**

This is probably the most important suggestion of all because it is a way to reach so many people. The pen and often times its cousin the podium is mightier than the sword.

We can humanize and demystify engineering, or simply show that engineers care about things beyond engineering, by speaking out. I caution here that such writing and speaking must be made understandable to the average man on the street; you can't lull them to sleep with too much technical engineering. But I know from experience that many groups and audiences are very interested in what an engineer has to say.

How about getting involved with a public speakers bureau? Talk to community groups, schools, service and civic clubs, and chambers of commerce. Tell them how engineering impacts the state economy, their standard of living, their commute home from work, clean air, clean water, and sound infrastructure virtually anything.

Let them know how an investment in infrastructure that new bridge or highway or treatment plant is an investment for future generations. Advocate a position on an issue of local concern.

How about writing a monthly column for the largest newspaper in your city? Or you could write for a smaller paper or one of the many weekly or monthly business publications in cities and states around the country. I write a regular column in Denver's leading business magazine on leadership not on engineering but on leadership. I work with and interview the movers and shakers in my area, get their ideas on the

issues and see things from their perspective, and share them with a general business audience. Many of the leaders I interview and write about have major input on public policy and direction and I, of course, am always identified as a professional engineer.

The point is that all kinds of local, state, regional, and even national publications will accept guest columns or even regular contributions; all you have to do is ask. And an enormous variety of groups Rotary and Lions clubs, other professional organizations like bar associations and medical societies, and even classes in schools and colleges are always looking for good speakers with interesting topics.

But don't stop there.

Join and Be Active on Issues-Driven Coalitions

There are many coalitions that form sometimes permanently in response to a major problem or temporarily in response to a burning but fleeting issue that offer wonderful opportunities to meet a board cross section of people, have a significant impact, and, of course, get engineers involved. Mothers Against Drunk Driving (MADD), tax reform, and political term limitations are examples. Many times legislation inspired by these groups affects our personal lives and the well-being of our communities, and often it directly impacts our businesses and profession.

For instance, in Colorado a few years ago the cost and availability of liability insurance was at a crisis level and tort reform became a burning local issue. Individual engineers got involved and in fact were the leaders of the group pushing for reform. They headed up a coalition that

included other like-minded professionals, such as doctors, accountants, contractors, and day care providers, and they were successful in enacting tort reform legislation that has since served as a model for tort law reform in several other states.

And while you are reaching out to the world at large, don't forget where you come from.

Support Your Engineering Societies

Actively support with you time and money, with your ideas and wisdom ASCE and any other professional groups that are constantly lobbying on our behalf, and advocating positions we believe in and that are good for our profession, the public, and our country.

Always remember what that great American Teddy Roosevelt said: "Every man owes a part of his time and money to the business or industry in which he is engaged. No man has a moral right to withhold his support from an organization that is striving to improve conditions within his sphere.

Think about your own organization. ASCE is a major player in Rebuild America, the private-public sector coalition serving as the watchdog for this nation's infrastructure. The more you can get involved with this group and others like it, the better for all of us.

LEADERSHIP AND RUNNING THINGS

I will close with this. If more and more engineers take on leadership roles outside our industry and if more and more engineers show up at the top of

society's food chain of decision makers, society will truly benefit. The world, so dependent on technology, will surely be better served as well.

And we engineers will be better able to impact policy decisions and the future. More and more often, we will be called upon not just to make things run, but to run things.

I urge you all as strongly as I can to get involved not only in being leaders in this industry, in your companies, or in agencies, but also in your communities and in society. There are so many opportunities for engineers challenges we are more than capable of meeting opportunities to set policy and to constructively impact and contribute, now and into the future, that I, for one, am truly enthusiastic. I am convinced that the greatness of engineering is set for even new heights.

Not It's up to you. Show up.

Carpe diem! Seize the day!

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REFERENCE

McCullough, D. (1978). "Civil engineers are people." Civ. Engrg., ASCE, 48 (12), New York, N.Y.

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FIFTY YEARS OF PAKISTAN'S ACCELERATED GROWTH IN TELECOMMUNICATION

* *Engr. Sheikh Muhammad Afzal*

HISTORICAL PERSPECTIVE

Determination, vision & galloping success in the field of Telecommunication in Pakistan is a matter of pride for the nation. In 50 years, the country's telephone network has expanded 400 fold. The sheer magnitude of year's growth is again astounding, according to analysts and experts. The ministry of Communications is also following international trends by concentrating on improved customer service, adding directory assistance, creating data exchange networks, setting up Internet backbones and leapfrogging technology with modern digital mobile systems. Plenty of room remains, for continued exponential growth. The country should have 35 phone lines for every 100 people nationwide by the year 1998, 0.8 mobiles per 100 people. Long haul fibre optic from Karachi to Islamabad, extended to Peshawar (2716) and inter exchange junction network in multi exchange area enabling an improvement in technology, service quality and efficiency. The advances in world information technology and the globalization of telecommunications have also set a new task for Pakistan's telecom growth to closely keep in step with up-to-date

communications technology, accelerate growth. PTCL at various levels continue to expedite the pace of communications growth, further strengthen network construction, expand network capacity, upgrade network technology and actively increase comprehensive communications capability.

Telecom is still very much a collection of different services for voice, data, and minority applications such as video. Little integration has taken place to date and POTS is still the core of operator revenues. Telecom operators need to have an in-depth understanding of the changes which are taking place now and those expected in the next decade. By the end of the century the telecom environment will be radically different to even that of the recent past. Services such as Centrex, Virtual private networks, file transfer, a host of video applications including multimedia and a variety of new services will be provided by intelligent networks and be a common place. The wireless local loop will fundamentally alter the economics of traditional telephony and in the part-developed world, where infrastructures are largely non-existent, the fixed local loop is particularly important. Many of these services are expected to be highly profitable, the

challenge for a new industry player is to determine which role to play in the forthcoming information communications entertainment age. Almost every government, now a days, recognizes the need to deregulate and liberalize its markets, sweeping away the monopoly PTT status quo. Competition is the order of the day and expectations are high. However free market forces can bring about the delivery of a complex mix of telecom services for both domestic and business consumers.

The telecommunication services in Pakistan has been operating by the Pakistan Telegraph & Telephone Department, since its independence upto 1991, under the Ministry of Communication, Government of Pakistan. The Telegraph & Telephone Department has been headed by the Director General, assisted by Chief Engineers in the Directorate-General. PTC gained its status as a corporate body separate from the civil service in 1991, through promulgation of the Pakistan Telecommunications Corporation Ordinance, 1991. After the commencement of Ordinance 1995, reorganization of

* General Manager LTR with PTCL.

telecommunication system in Pakistan by establishing the Pakistan Telecommunication Authority, the Frequency Allocation Board, National Telecommunication Corporation, Pakistan Telecommunication Employees Trust and a company known as the Pakistan Telecommunication Company Limited has been established. The powers of general direction, administration and management of the affairs of PTC are vested in the Board, the members of which are appointed by the Federal Government.

The research organization has its headquarters in Islamabad and is called Central Telecommunication Research Laboratories. A training organization has its headquarters in Islamabad. The main training centre is in Haripur, which is called Telecommunication Staff College, the National Postgraduate Institute for Telecommunications and Telemetric (NPGITT) is in Islamabad. There are several Regional Telecommunication Training Centers, Divisional Telecomm Training Centers spread all over the Pakistan.

PTCL has three factories producing telecommunication equipment. The Telephone Industries of Pakistan (TIP) is situated at Haripur at a distance of about 70 Km. from Islamabad and is manufacturing telephone exchange equipment, telephone instruments and teleprinters. Another factory situated at Haripur is the National radio Telecomm. Corporation (NRTC), producing radio and VHF equipment. The transmission

equipment covering a wide range of product from first generation PCM system to 72 channels UHF equipment, multiplex equipment and allied equipment are being manufactured by the Carrier Telephone Industries (CTI) Islamabad.

At the time of independence in August 1947, West Pakistan inherited only 8750 automatic lines spread over 9 exchanges in Karachi, Quetta, Lahore, Faisalabad and Rawalpindi. These exchanges implied British Post Office (BPO) type of equipment. The installed capacity was raised to 23900 lines in 1955, with F-1 type switching equipment of Siemens by establishing a Telephone Industry of Pakistan at Haripur in 1952. The installed capacity was raised to 77000 lines in 1965 and to 212,000 lines in 1975. The telephone network of Pakistan was raised to 500,000 in 1985, connected to more than 1000 telephone exchanges throughout the country & were raised to 1100,000 in 1990. As telecommunication plays a vital role in the development of a nation, due importance was attributed in the development of telecommunications, the Telegraph and Telephone Department gained status as Pakistan Telecommunication Corporation during 1991, then as Pakistan Telecommunication Company Limited during 1995, which three folds the figure to 3,159,000 lines in 1997 & is expected to reach a figure of 4,500,000. The telephone density will increase from 2.33 telephones per 1000 population to 3.56 during 1998 and telephone exchanges will

increase from 2446 to 3000 nationwide. It has not only cleared the backlog in the demand as far as possible but also continue modernization and improvement of services. Modern techniques were adopted for the development of telecommunication services in Pakistan. Two factories were established for the manufacturing of digital switching system in Pakistan. Optical Fibre transmission system were established in the areas of Karachi, Lahore & Islamabad multiexchange areas. Long Distance Optical Fibre system was established to connect Rawalpindi with Karachi, a Synchronous Digital Hierarchy is used in the system (a distance of about 1500 km.) and extended to Peshawer. With the establishment of Optical Fibre Link it would have been possible to integrate switching and transmission leading ultimately to the Integrated Services Digital Network.

MOBILE TELEPHONY

Wireless communications are increasingly permeating work and home environments. The escalating need for mobile voice and data communications and the growing competition generated by new players entering each market are driving operators to offer attractive packages for expanding voice and value-added services. Such competition causes significant pressure on traditional voice-based revenue streams, especially in newly privatized markets. The handheld terminal era is drawing near as mobile technology advances and

computer-based resources become more common. The technology's main drivers are shrinking microprocessors and telecommunications components, communications and computing power enhancements, and affordable devices that increase productivity in the business community. Pakistan, although not a late comer to mobile telephony, put its cellular system in 1990, three operators in the major cities have clocked up more than 110,000 subscribers, using AMPS and GSM protocols, of 0.1 % penetration. The subscriber growth during seven years of introduction of mobile telephony is not encouraging, seems to be toughest. It seems to be the toughest place in the world for cellular, due to several reasons including high foundation charges, high air time charges and the limited radio coverage areas.

PAGING

While the government strives to modernize the country's communications and infrastructure, the new economy has created a growing middle class. The huge demand for new products and services greatly outweighs the ability to provide them. The lack of adequate phone infrastructure is one reason why paging has become one of the fastest growing telecommunication services in Pakistan. A growing demand for new products and affordable services makes pagers an economical choice for communications in Pakistan. Since paging services first became available in six cities in

1988, the paging industry in Pakistan has not grown rapidly. By the end of 1996, the total number of pagers across the country had reached to 43,000. The numbers are expected to grow more, but are limited due to high foundation charges and tariff. With the modernization in the telecommunication field and technological revolution on a grand scale, the paging system needs to be upgraded, either to go for a FLEX protocol (from Motorola) or ERMES (European Radio Messaging System) or both. As satellite technology and networking innovations continue to converge, paging operators are beginning to take advantage of "next generation". Smart paging hardware and flexible satellite transmission technologies permit paging system operators to tailor system availability to their own specific needs.

RURAL COMMUNICATION

Rural communication is an important component of the overall communications development plan. Accelerating the construction pace of rural phone networks and enhancing teledensity in rural areas would not only suit the needs of rural economic development but also offer a vast market for further expansion of the telephone network, especially after the teledensity in cities has reached a certain level. Therefore, rural telephone development has been considered as a new phone service market segment with great potential. PTCL in all parts of Pakistan have attached an importance to this area. All districts and several villages, are

now enjoying POTS and other value added services, which have brought about great scale economics. More than 2000 links of low capacity & medium capacity digital radios working in urban and rural areas to bring distant places on the national hook up.

SATELLITE COMMUNICATION

In the field of International communications, satellite systems became fully stable and sound when they replaced short-wave links and old submarine cables. The satellites have replaced advantageously replaced terrestrial system in many situations since they made possible the provision of reliable and high quality communications at lowest cost, both for international and domestic applications. Communications satellites show wide perspective, either as a complementary means for the terrestrial networks or in the applications for which their features are better adapted, or even as an alternative means.

PTCL is providing communications to Gilgit, Skardu and Gawadar via satellite due to obvious geographical limitations. Satellite Earth Station Malachh is working as hub for these Domestic Satellite Earth Stations. PTCL is providing international communication services through three satellite earth stations working with Atlantic Ocean Region Satellite and Indian Ocean Region Satellite through three gateway exchanges.

INTERNET

Amalgamation of telecommunication technology with computer technology has created what is called information technology (IT). Internet is considered as strong outcome of the information technology. In the past few years Internet has appeared as the largest information source for the whole world. Internet is something simultaneously more than and less than a network, but rather as a huge number of different computer applications trying to talk to each other. Millions of computer users and networks are now connected to Internet. The number of Internet users is increasing at a very fast rate. If we think of the Internet as equivalent to the Global street numbering scheme, we may be getting close. As it is a collection of smaller networks at different locations. One can enter into discussions on thousands of topics and search for information, computer software, picture, etc. and copy them on their computer. The Internet has become a major influence on the world which now stands as a resource of unlimited potential. Internet opens a whole new way to communicate and share information of all types, Businesses and Universities will be the biggest users. By the success of World Wide Web on the Internet, the world has entered in the era of information

super highways. World Wide Web provides a world of information on every topic using friendly interfaces. The concepts like Tele shopping, Tele marketing have now become a reality through Internet

Confidence is high that Internet traffic will overtake telephony traffic on the world's switched digital networks by the end of decade. However, while the Internet is daily becoming more and more of an opportunity for telecom. It is important to note that the Internet is not expanding at an equal rate, everywhere, simultaneously. Growth varies by region, and at present, the Asia Pacific is the area of fastest development. PTCL is providing Internet services through its Public Data network (PDN). The PDN nodes are located in 13 different cities. The limited size and capacity is not enough to cope with the growing information society needs. The growth rate in data, E-mail and information service in the developed countries is very fast according to the socio-economic development level of the country. Today more than 100 million people can access E-mail, Internet and other information networks all over the world. Access to medical, research and university data bases is of very high value as most latest information can be quickly retrieved and down loaded from remotest corners of the world. In

Pakistan we estimate explosive growth and aim at information network capacity close to 0.5 million Internet/E-mail and data customers by year 2003. PTCL has planned to build and enhance data network, nodes, servers, routers connectivity of PSTN to PDN, Fibre Optic artery and subsidiary links to meet emerging information society demands. PTCL is also expanding international data nodes, signing international agreements to increase data transmission connectivity. PTCL is also going for enhancement of three PDN gateways supported by fiber links to take care of information society needs with supporting routers, servers and other hardware operating on faster bit rates through information superhighway to accommodate growing traffic. While looking at the information society in Pakistan with a vision of next 5-7 years we anticipate very phenomenal growth in computer terminals, fax, multimedia information terminals and other allied fields including growth in PSTN and mobile networks. It is estimated that number of PC's will increase to more than 1.0 million in the next five years.

DIGITAL CROSS CONNECT

Information services is another development priority. With the "information-ization" of the national economy, people's needs for information services

rise daily. The basic phone network, the growing packet-switched data network, digital data, store-and forward facsimile, electronic data interchange(EDI) and frame relay provide various communications platforms for information services that can support different rates and meet

a variety of needs. An integration of advanced computer technology with the communications network has not only produced various information processing media, but also brought about a number of new information services that enjoy great popularity with customers.

Increase in value and volume of business information has increased the size, scope and complexity of Communication Network. Network is no longer just a technology rather it has become strategic asset, vital for a successful business and other requirements. This new technology of DXX has crossed the barriers of distance and time and put us on a global platform. Even otherwise telecommunication has revolutionized our lives and plays an important role in our day to day working. It is for this reason PTCL decided to start the service of networking of the networks to change the life style of the common man so that we enter the 21st century with the

capability to face the challenges the modern world has posed on us. Obviously things are not achieved over-night. PTCL Digital Cross Connect Network is spread over wide areas covering 31 cities. This is a leased circuit network covering all ranges from less than 64 kb/s to n-times 64 kb/s up to 2 MB/s. This end to end digital connectivity covers not only major cities but also far flung areas.

FUTURE DEVELOPMENT OBJECTIVES

The main objectives for Pakistan's future communications development are as follows:

- └ By the year 2000, the PTCL will basically meet economic and social development demand, and a unified and advanced communications network will be provided
- └ By the year 2010, the PTCL will be able to fully satisfy the demand of economic and social development progress, and Pakistan's telecom network will grow to one of the world's most advanced in size, technology and service grade.

To achieve these objectives the PTCL will continue to maintain high speed development during the 9th Five Year Plan period. For network construction, adjustments will be

made to network architecture and deployment, and the construction of basic, service and support networks will be stepped up to increase coverage, upgrade technological levels and improve the operating efficiency of the entire telcom network. At the same time, work on digitizing long haul circuits and extending satellite network coverage will proceed in parallel. The mobile communications network will be expanded significantly both in capacity and coverage to provide quality service for customers. Emphasis will also be laid on expanding data communication networks and building a multimedia communications network. Narrowband and broadband information services will be offered to meet market needs. Today by the grace of Allah we do have some face to show and can safely say that our network is comparable to any modern telecommunication network on the Globe. This is not the height as "sky is the limit". Nevertheless we are fully conscious of our basic weak areas of faults/complaints/ services of show windows etc. which too are in active process of modernization. Over, present and future telecommunications look good for Pakistan.



WELCOME TO NEW MEMBERS

The Executive Council of the Pakistan Engineering Congress approved membership of the following new members in their fold. The Engineering News congratulates them and welcomes to PEC.

MEMBERS ADMITTED ON 30TH SEP. 1997

S. NO.	NAME & ADDRESS		
1.	Mr. Qasim Iftikhar, 33-Ali Block, New Garden Town, Lahore.	15.	Mr. Rehan-ur-Rehman, Junior Engineer, NDC, Lahore.
2.	Mr. Imran Siddique, ADE, Electrical, DESCON Pvt. Ltd. Lahore. 3. IS, 14-D, Ghazi Park Lahore.	16.	Mr. Ashfaq Ahmad, St. Design Engineer, Akmal & Associates, Lahore.
3.	Mr. Nadeem Younis, IS, 14-D, Nasir Street, Ghazi Park, Lahore.	17.	Mr. Amjed Raza Khan, A.E/C&E, 12-B Wafaqi Colony, Lahore.
4.	Mr. Muhammad Younis, House No. 202/6, Medni Colony, Shalimar Link Road, Lahore.	18.	Mr. Saeed Ahmad, AEE/SDO, I&P, Govt. of the Punjab, Lahore.
5.	Mr. Muhammad Shafaq, Dy. Chief Engineer, Sui Northern Gas, Lahore.	19.	Mr. Faisal Qadeer Sheikh, 22-A/E-2, Gulberg-III, Lahore.
6.	Mr. Khawar Hamid, AEE/SDO, Irrigation & Power, Mianwali.	20.	Mr. Farooq Khan, 99-J-4, Phase-II Hayatabad, Peshawer.
7.	Mr. Faisal Bashir, House No. 104 Street No.3, Officers Colony, Cavalry Ground, Lahore Cantt.	21.	Syeda Basira Banuri Nadeemvilla, Street-4, Canal Town, Nasirbagh, Road, Peshawer.
8.	Mr. Muhammad Rafique, AEE/SDO, Buildings, Vehari-II.	22.	Mr. Jehan Zed, Design Engineer, OPCV/ CIP/PMU, NWFP Peshawer.
9.	Syed Zulqurnain Shah, Deputy Registrar, P.E.C. Peshawer.	23.	Mr. Khalid Mehmood, Design Engineer, OPCV/ CIP Consultants, Phase-5, Hayatabad, Peshawer.
10.	Mr. Irfan Gilani, 249-Ravi Block, Allama Iqbal Town, Lahore.	24.	Mr. Muhammad Khalid Nawaz, A.D.II, Road Divn, IV, C.D.A. Islamabad.
11.	Mr. Nadeem Ahmad, Senior Instructor, Govt. College of Technology, Lahore.	25.	Mr. Hamid Naeem, 249-N, Model Town Extension, Lahore.
12.	Mr. Nabeel Ajwad Butt, Nestle Milkpak, Lahore.	26.	Mr. Najeeb Naeem, Senior Engineer (Elect) NESPAK, Lahore.
13.	Mr. Khalid Riaz Wariach, SDO, I&P, Thal Remodelling, Mianwali.	27.	Mr. Jamshed Hassan Chishti, Electrical Engineer, NESPAK, Lahore.
14.	Mr. Anwar Ahmad, Assistant Director, IRI, I&P, Lahore.	28.	Mr. Imran Naseer Chaudhry, AEE, Overseas Pak Foundation, 82-Tariq Block, New Garden Town, Lahore.

- | | | | |
|-----|---|-----|--|
| 29. | Mr. M. Sana-ul-Mustafa
Sulehria, Street No, 15,
Mohalla Mujahispua, Lahore. | 34. | Mr. Arshad Saleem
Hashmi, 3/A, Fane Road, Lahore. |
| 30. | Mr. Shabbir Ahmad,
Electricl Engineer,
Jamwal, P.O, & Teh.
Shakargarh, Distt. Narowal. | 35. | Mr. Muhammad Waseem,
Site Engineer, Khalid
Rauf & Co. Lahore. |
| 31. | Major Hassan Iftikhar
Syed, 7-I, Shami Road,
Lahore Cantt. | 36. | Mr. Sajid Hussain,
Block-29, House-81,D.G.Khan. |
| 32. | Mr. Khurram Pervez,
Assistant Engineer,
DESCON, Pvt, Ltd, Lahore. | 37. | Mr. Muhammad Ijaz,
Assistant Director,
LDA, Race Course, JailRoad, Lahore. |
| 33. | Mr. Laurasab Khan,
AEE/SDO, C&W Deptt. Khushab. | 38. | Mr. Shahzadah Riaz-ul-
Qadeer, Asstt. Engr.
LG&RD Deptt. Jhang
Saddar. |

MEMBERS ADMITTED ON 18TH NOV. 1997

- | S. NO. | NAME & ADDRESS | | |
|--------|---|-----|--|
| 1 | Mr. Muhammad Jamil
Chak Sadiqabad, P.O.
Qutabpur, Teh, Dunyapur,
Distt. Lodhran. | 8. | Mr. Muhammad Zahid Nadeem,
Tariq Bin Ziad Colony,
Sahiwal. |
| 2. | Mr. Zulfiqar Saeed,
1-Saeed House, Vokla
Colony, Lodhran. | 9. | Mr. Muhammad Ashraf,
143-Sir Syed Hall, UET,
G.T.Road, Lahore. |
| 3. | Mr. Muhammad Shahid
207-D, Phase-I,
LCCHS, Lahore Cantt. | 10. | Mr. Nisar Ahmad,
Electrical Engineer,
LHR. P. Tech. Institute.I
Yatim Khana, Lahore |
| 4. | Mr. Mehdi Hassan,
Junior Assistant, NDC
(Regd.) Lahore. | 11. | Mr. Ahmad Naveed
E-25/6-B, Al-Noor Town,
Walton Road, Lahore Cantt. |
| 5. | Mr. Abdul Sattar
72, Sir Syed Hall, UET,
G.T. Road, Lahore. | 12. | Mr. Saqid Nawaz Rana,
D.E. Electrical, DESCON,
Lahore. |
| 6. | Mr. Muhammad Nadeem
Akhtar, 229-D, Faisal
Town, Lahore. | 13. | Syed Hasnain Khurshid,
25-B, Model Town,
Lahore. |
| 7. | Mr. Raheel Sultan,
ADE, P&D, North Buildings
Department, Lahore. | 14. | Mr. Khurram Shahid
Qureshi, H.No. 24, St. No,2,
Riaz Ahmad Road, Shalimar
Town, Lahore. |

RECORDER
Wednesday 15 October 1997, 12 Jamadi-us-Sani 1418
PEC demo

October 1997, 12 Jamadi-us-Sani 1418

PEC demands funds for working on space technology

RECORDED REPORT
LAHORE: Engineering Co. Pakistan Press

PEC urges more funds for Ministry of Science

On the other hand our neighbouring country has already deployed missiles along our border posing a security risk for Pakistan and now India has launched space rockets which indicates the advancement it has made in this field, the PFC Executive stated. This calls for urgent attention of the concerned authorities towards revamping and reinforcement of our own programme in space technology so that we could move ahead quickly to catch up with the time, they pointed out.

RECORDER REPORT
HORE:

The Council members, according to press release, showed great concern over the growing unemployment among the engineers, and pointed out that most of those who graduated in the engineering in the recent years, had not been able to find any job so far. The majority of these engineers "are forced to switch over to other professions," the

press release added.
The PEC C

The PEC Council said that in view of unemployment of engineers, the parents are hesitant to choose engineering as a profession for their wards and this trend would be extremely dangerous for the development of the country. "No country can develop and march ahead towards progress without the active participation of engineers and technologists", the Council added.

The Council also urged upon the Punjab government to appoint immediately a regular, vice-chancellor in the University of Engineering and Technology (UET) Lahore, as education of the students had been suffering in the absence of a regular vice-chancellor, and there was growing indiscipline in the campus.

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DAWN

Lahore, Wednesday, October 29, 1997

Call to do away with foreign consultants

By Our Reporter

LAHORE, Oct 28: Pakistan Engineering Congress President Khalid Latif Khwaja has urged the government to do away with foreign consultants and contractors.

In a statement here on Tuesday, he said that their main aim was to extract maximum profits and drain out major part of foreign loans. He said that hardwork put in by Pakistani engineers had proved that Pakistan had become self-sufficient in engineering of structures and consultants be replaced to save huge amounts spent on them.

He said he and 50 other members of a PEC delegation recently visited the Rs 94 million Kohala bridge over the river Jehlum to study the latest techniques being applied on its construction by Pakistani engineers.

The bridge is being built by the National Highways Authority with a technical assistance for construction supervision by NESPAK. The bridge, being constructed by the Gammons Pakistan Limited, has been designed by Mr Sameer, an eminent Pakistani engineer in such a way that it would remain safe even if there is a land slide adjoining the bridge.

Explaining salient features of Kohala bridge, NESPAK vice-president Muhammad Ehsan told delegates that the bridge height would be safe to withstand floodwater level similar to the one that had destroyed the old bridge in 1992. He said that the bridge was being constructed under 1992-flood damage restoration projects. He said the 165 meters long and 8.5 meters wide two-lane traffic bridge was scheduled to be completed by March next. One of the major features of the bridge is the construction of a RCC underpass on the right bank which would carry the approach road over the existing Kohala access road.

Gammons Director R A Farooqi informed the delegates that his company was employing local manpower and was using two crane gantries specially designed to construct the bridge from both ends to produce quality construction at a very difficult location.



روزنامہ جنگ لاہور (14) 29 اکتوبر 1997ء

حکومت غیر ملکی انجینئروں اور تعمیراتی کمپنیوں سے چھٹکارا حاصل کرے: خالد لطیف خواجہ
نیا کوہالہ پل ساڑھے نو کروڑ کی لاگت سے مہلک میں مکمل ہو جائیگا

لاہور (پ ر) پاکستان انجینئرنگ کانگریس نے حکومت سے مطالبہ کیا ہے کہ غیر ملکی انجینئرنگ اور تعمیراتی کمپنیوں سے جلد از جلد چھٹکارا حاصل کر لیا جائے کیونکہ یہ فریضہ صرف بھاری مبالغہ بکھیرتی قرضوں کا پتھر حصہ بھی باہر منتقلی کرنے میں مصروف ہیں۔ جنہاں پاکستان انجینئروں اور محکمہ دار قرضوں سے بڑے بڑے منصوبے خود بخود ہی اور خود انصاری سے تیار کر کے جرت پاتی سطو 17 لاکھ 7

خالد لطیف خواجہ

گروہ ہے کہ ملک اپنے منصوبوں کو اپنا بن کر نہ لے اور تیار کرنے میں خود کفیل ہو چکا ہے اور اب وقت آ گیا ہے کہ ملکی انجینئروں کی خدمات سے ہرگز مستفادہ کیا جائے۔ ان خیالات کا اظہار پاکستان انجینئرنگ کانگریس کے صدر انجینئر خالد لطیف خواجہ نے دریائے جلم پر زیر تعمیر کوہالہ پل سے واپسی پر کیا۔ وہ پچاس رکی وائر کے سرگرم اس سٹے پل کے مطابق دور دورہ دیکھے تھے۔ یہ پل تینوں پانی دے اٹھاتی مسابک کی زیر نگرانی تعمیر کر رہی ہے۔ اس پل کا اپنا ایک پاکستانی انجینئر میر تیار کیا تھا۔ پراگہالہ پل 1992ء میں دریائے جلم میں آنے والے زبردست سیلاب کے باعث ٹوٹ گیا تھا۔ ساڑھے نو کروڑ روپے کی لاگت سے اس کے سالانہ مہلک میں یہ پل بنائے پل سے اپنا گھر گھر دور مکمل ہو جائیگا۔

THE NEWS INTERNATIONAL

Thursday
October 30, 1997

PEC opposes hiring foreign consultants

By Our Correspondent

THE Pakistan Engineering Congress (PEC) has opposed hiring the services of foreign consultants for engineering projects. In a statement on Wednesday, PEC President Khalid Latif Khawaja said the main aim of these consultants was to extract maximum monetary benefits. Pakistan was producing enough engineers to fulfil its needs, he remarked, adding that hiring local engineers and consultants was more economical. He appreciated the role of the Gammons for their country in the development of the

The Nation

SATURDAY, SEPTEMBER 27, 1997

PEC stresses need to build at least 3 dams

By Our Commerce Reporter

LAHORE — Pakistan Engineering Congress (PEC), has stressed the need to urgently harness the rivers for the benefit of common man and utilise for irrigation and hydel power, more than 40 million acre feet (MAF) of flood water which has been flowing waste into the sea every year. Uncontrolled river water, during floods, causes untold misery and losses to vast population in the river valleys which the country can ill afford.

Stating this here Friday, the President of Pakistan Engineering Congress, Engr. Khalid Latif Khawaja said that if flood water was not contained in storage schemes and used for augmenting food supplies, Pakistan would face a severe food famine as the country enters into the 21st century.

According to an estimate, floods of 1988, 1992, 1994, 1996 and 1997 had caused damages to the tune of Rs 42 billion which was a colossal loss to the economy of the country, the PEC chief said.

Engineer Khawaja stated that there is an urgent need to construct at least three more major storage dams of the size of Tarbela, construction of storage schemes at the available sites like Kalabagh, Basha, Thakot, Pattan, Dasu and Skardo and also in the Cholistan deserts, is imminent, he added.

While Kalabagh scheme is ready to take off, several years will be required for carrying out preliminary investigations and geological studies at other sites. Kalabagh Dam was declared technically feasible in 1984 by the engineering experts after 10 years of detailed investigations which cost Rs 200 crores to the national exchequer, the PEC Chief pointed out. The Pakistan Engineering Congress President warned that it is already late but never too late to realise the past mistakes and to make a good start.

Engineer Khawaja appealed to the Prime Minister to issue orders to take immediate steps for constructing the much needed river water storage reservoirs.



ہفتہ 27 ستمبر 1997ء

تربیلہ جیسے مزید 3 ڈیم بنائے جائیں، پاکستان انجینئرنگ کانگریس

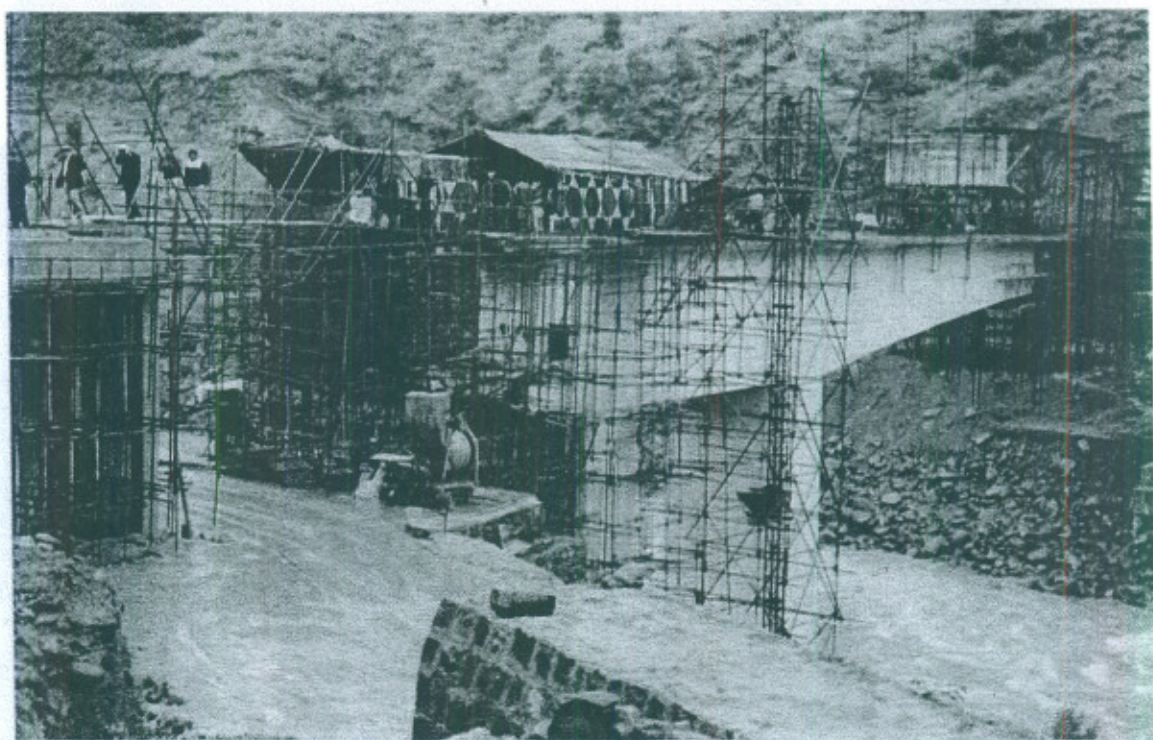
سیلابی پانی پر قابو پانے کیلئے پیداوار میں اضافہ کیا جاسکتا ہے، انجینئر خواجه

لاہور (پ ر) — پاکستان انجینئرنگ کانگریس نے آج شہر لاہور میں منعقد ہونے والے اجلاس میں کہا کہ دریاؤں میں ہر سال ہونے والے 40 ملین ایکڑ فٹ سیلابی پانی کو بچھڑا کر کے وسیع پیمانے پر کاشتکاری اور پیداوار میں اضافہ کیا جاسکتا ہے۔ انجینئر خواجه نے کہا کہ اگر حکومت اس مسئلے کو سنجیدگی سے لے کر دریاؤں کو قابو کرنے کیلئے اقدامات کرے تو پاکستان میں پیداوار میں اضافہ ہوگا۔ انجینئر خواجه نے کہا کہ اگر حکومت اس مسئلے کو سنجیدگی سے لے کر دریاؤں کو قابو کرنے کیلئے اقدامات کرے تو پاکستان میں پیداوار میں اضافہ ہوگا۔ انجینئر خواجه نے کہا کہ اگر حکومت اس مسئلے کو سنجیدگی سے لے کر دریاؤں کو قابو کرنے کیلئے اقدامات کرے تو پاکستان میں پیداوار میں اضافہ ہوگا۔

NEWS IN PICTURES

A group of members of Pakistan Engineering Congress led by Engr. Khalid Latif Kh. President PEC visited Kohala Bridge near Murree on October 21, 97. Below are some scenes of the visit. The bridge a special feat of accomplishment by Pakistani Engineers.





PEC EXECUTIVE COUNCIL IN SESSION

(BELOW ARE GLIMPSES OF THE EXECUTIVE COUNCIL MEETING OF THE CONGRESS HELD IN LAHORE IN DEC 97)



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PEC COMPUTER CENTRE SPREADING COMPUTER LITERACY

It is a matter of great pleasure for Pakistan Engineering Congress and the Committee of the Computer Centre Pakistan Engineering Congress to state that under the dynamic and charismatic leadership of Engr. Khawja Khalid Latif and his team, the generously donated 15 No. computers along with hardware and necessary software by his excellency, Mr. Farooq Ahmed Khan Leghari, Ex-President of Islamic Republic of Pakistan, has been fully availed and advantage drawn to the optimal limit.

The Congress has exerted very hard to achieve the results in line with the spirit behind the said donation. It has not only established a coaching centre to make technocrats and others, computer literate but has also managed to achieve a very high reputation in imparting technical skills. The centre has rendered great contribution through congenit coaching and persistent hardwork by offering

varied courses of computer to enlighten its students having diversified educational and professional backgrounds.

Though the progress of computer centre in initial years was not remarkable due to lack of resources and minimal marketing budget yet during the current session alone the number of beneficiaries exceeded 700, apart from upgradation of existing 15 No. 486 based Computer System to 21 Pentium based machines.

Despite a lot of hardships, constraints, scarce resources and small available space comprising of only two labs not only the aspiration level of Computer Committee remained very high but untiring efforts made the centre in complete success.

At present the following courses are offered:

- * Windows 95, PowerPoint & Internet.

- * MS DOS, and Winword
- * Auto CAD for Professionals.
- * MS Access/Foxpro
- * Project Scheduling.
- * C ++
- * Html, JAVA
- * SAP 90 Basic and Advanced.
- * Visual Basic.
- * MS Excel

The future plans include not only uplifting of Computer Equipment and software to keep with the changing trends and to equip its students with the state of the art but also to upgrade the level from certificate to full time diploma/degree courses.

The basic principle to serve the nation has always been foremost aspect in view of Pakistan Engineering Congress for which the fees of these courses are not only at a bare minimal level, just in order to meet with a part of the running expenditure but also a significant No. of deserving students are offered to take these courses free of cost.

OBITUARIES

THEY LEFT US FOR GOOD!

The following engineers/members of the Pakistan Engineering Congress breathed their last. The Executive Council of the Congress has condoled their sad demise and parade for their Maghfirat and fotide to the grieved families.

1. Engr. Kh. Mahboob Hassan Retd S.E. Irrigation & Power.
2. Engr. Zafar Ahmad Khan Barki, Retired S. E. Irrigation & Power.
3. Engr. Ahmad Khan, Executive Engineer, C&W Department.

EFFECT OF CEILING HEIGHT ON THERMAL COMFORT

A RESEARCH STUDY OF BUILDING RESEARCH STATION, LAHORE

*Yousaf Amin Chaudhry**

*Muhammad Safdar***

SYNOPSIS

It is a general belief that in dry climates, increase in the ceiling height results in greater thermal comforts in a dwelling. Even these days when building materials are scarce and costly, people are tempted to construct buildings with higher ceilings, with more cost of construction, with the aim that they will provide appreciable additional thermal comfort.

A detailed study for observing effect of ceiling height on thermal comforts in a building was carried out in the Building Research Station, Lahore, for eight months of the year 1985, covering both hot and cold weather. Investigations were made by taking temperature observations in three rooms of ceiling height 9 feet, 10 feet and 12 feet, constructed by construction wing of Building Research Station. The present paper describes efforts made in this regard. The experimental data collected and investigated has been discussed for the thermal comforts. It is concluded that an increase in ceiling height beyond the minimum (9 ft.) does not add any significant additional thermal comfort in a house.

Introduction

Ever since the creation of a human being, man has been trying to live in a comfortable way in a dwelling which not only saves him from rain, solar heat and storms etc. but is also thermally comfortable; a thermally comfortable residence is one where inside temperature is such that a human being can perform/live without any difficulty. Therefore, designers have to pay maximum attention to the performance standards of residences. There are basically following three aspects requiring consideration in the thermal design of structures.

- i) An evaluation must be made of indoor environmental conditions conducive to comfort and well being of occupants.
- ii) Representative or typical weather conditions are to be taken into account to suite specific requirements.
- iii) Physical properties of different structural materials are to be effectively utilized to ensure the best possible control of living working environments.

Thermal comfort temperature in a dwelling house varies from region to region in summer. In tropical areas, it

ranges from 71°F to 74°F. For Pakistan the figure is 74°F. Thermal conditions in buildings can be achieved by a proper design with selective use of materials on existing knowledge concerning the thermal performance of structures in relation to characteristics of climate. However, primary consideration is to select the weather data of temperature, humidity and solar radiation values which are representative of the typical hot days in summer and typical cold days/months in winter.

The wide spread belief, that in warm climate a high ceiling makes an appreciable contribution to thermal comforts, has been investigated abroad. Experiments in this regard have been carried out on the completed structures in South Africa, Israel, Australia, England and India etc. The results, from experiments revealed in all such studies, had been contrary to this general belief.

Comfort conditions, in tropical areas, can not be achieved without cooling by mechanical means. Pakistan being a developing country can not afford this particularly when one B.T.U. of "Cold" costs about three times as much as one

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** Research Officer, Building Research Station, Lahore.

B.T.U. of "Heat". Efforts, at best, can aim at keeping the indoor temperatures near about the daily mean temperatures. Temperature peaks can be delayed and the inside temperatures can be made comfortable during certain hours. All this can be achieved by the use of selected building materials with proper ventilation, orientation and shading for minimum solar exposure.

General

Three main requirements are to be satisfied when fixing height of ceiling of a dwelling.

- i) There shall be an adequate head-room.
- ii) The proportion of all the rooms shall be such that they will not cause mental discomfort to occupants.
- iii) The ceiling height adopted shall not prejudice physical comforts indoor.

Discussions have already been made in this respect in various conferences and conclusion is that in dry climates efforts are required to have lower temperatures during the afternoon by use of heat resisting structures with special reference to their conductances. On the other hand, in wet climates, light open structures with effective thorough ventilation is all that is desired. Reduction in solar exposure by proper orientation, shading and use of reflective techniques are common

requirements for both the regions, adequate ventilation being necessary for dry climates during the sticky months.

Purpose of a Dwelling

A dwelling performs the following two thermal functions:

- i) Provides shelter from rain, wind, dust and sun etc.
- ii) Delays dispersal of heat developed/stored inside in cold climate and disperses rapidly the heat stored inside in hot climate.

As such, a thermally comfortable house in the tropics is one which is designed to dissipate heat freely outwards and prevents it to enter into it. The job, therefore, is not easy but is to be accomplished at a moderate cost. One factor in this regard is to adopt an appropriate ceiling height. Increasing the height results in more cost while too low ceiling may adversely effect the thermal comfort.

Scope of Study

The present study was restricted to observe effect of ceiling on thermal comforts in a dwelling. The study was limited to similar type of rooms but of different ceiling heights i.e. 9 feet, 10 feet and 12 feet. The minimum ceiling height was assumed as 9 feet. Specifications for all the three units for walls, roofs, floors etc. were same. Inside temperatures under identical conditions of ventilation

were observed. All conditions in rooms of various ceiling heights were kept identical.

There are various methods which can reduce the ceiling temperatures such as external surface treatment, increasing thickness of roof or by providing various insulating materials. For normal domestic conditions with white wash on exposed flat roofs, temperature difference upto 1°F has been observed with low and high ceiling, difference mostly in favour of low ceilings. However the study in this Research Station was to observe temperatures inside rooms of various ceiling heights and to investigate and discuss effects on thermal comforts due to variation in ceiling heights.

Observation Rooms

The Building Research Station, Lahore constructed three rooms each of 9, 10 and 12 ft. ceiling height. All rooms were identically oriented with unobstructed solar exposure. Each room was 12 ft. x 10 ft. with one door 6 ft. x 3 1/2 ft. and a window size 3 ft. x 4 ft. provided on the western side. Specifications for construction for all the rooms were as under :-

- i) One inch R.C.C. precast roof slab over precast R.C.C. battens. The slabs were laid in 1:3 cement sand mortar and were over laid with 3 inch earth and 1 1/2 inch tiles.

- ii) 9 inch thick walls were of brick masonry in 1:6 cement sand mortar. Walls were cement plastered inside with 1:6 cement sand mortar.
- iii) 4 1/2 inch brick flooring on edge cement sand grouted.

Experimental

Resistance thermometers were used which were electrically connected in a machine box for recording temperatures inside the rooms.

These resistance thermo-meters were fixed at 5 ft. level in each room to observe the temperature. Readings were recorded from January to August. As such temperature observations covered the winter as well as the summer months. Doors for all the rooms were closed during all this period. This was adopted in order to find out the reproducibility of the experimental data under severest conditions. Temperature observations were recorded six days a week with 2 hours interval. For two weeks in each season, observations were recorded round the clock, day and night.

Metreological Data

The out-side daily max./min. temperatures, relative humidity, wind velocity and the rain fall, during the experimental period, were recorded in this Research Station for the period under study.

It will be seen that during January to March, the maximum outside temperature varied from 55.4°F to 95°F, the highest occurring in the last week of March. In summer (April to August), the maximum varied from 71.6°F to 112.1°F the highest being in the 3rd week of May.

The average wind velocity during this period varied from one mile to five miles per hour. No significant rain fall occurred during the whole period except some downpour in July and August.

Maximum and minimum inside temperatures have been recorded in Table No.I to Table No.II. Outside air maximum and minimum temperatures have also been tabulated in these tables. Monthly mean maximum and minimum temperatures for all three rooms have been drawn as figure-I and figure-II.

DISCUSSION

Inside temperature is the result of accumulation of heat flow through walls, doors and roof, the roof contributing about 70% of the total. Changes in the atmospheric temperature bring corresponding change in the inside temperature depending on the material of construction, the time lag, the area exposed to the atmosphere, orientation and ventilation conditions. These, in our study, were as follows :

- i) Materials of construction were similar for all three observation rooms.
- ii) All rooms were identically oriented.
- iii) Closed conditions were adopted for all the rooms to observe temperature variation under the severest conditions.
- iv) Equal area of roof of each room was exposed to solar exposure while walls area exposed was different in all the three rooms.
- v) Shading of rooms was nearly equal for all the three units.

A perusal of inside mean maximum temperature from January to March shows that for room of 9 ft. ceiling height, it varied from 57.7°F to 78.1°F while the range was from 57.5°F to 77.7°F for 10 ft. high room. The corresponding range for 12 ft. ceiling was 58.4°F to 75.9°F. Similarly the inside mean maximum ranged for the period from April to August was 85.5°F to 102.4°F, 87.3°F to 101.4°F and 86.4°F to 100.6°F for rooms of 9, 10 and 12 ft. height respectively.

The mean minimum in winter ranged for 9, 10 and 12 ft. as 50.7°F to 69.7°F, 50.3°F to 69.2°F and 51.2°F to 69°F respectively. The corresponding range in summer was 79.6°F to 93.5°F, 79°F to 93.5°F and 78.3°F to 93.1°F.

An average of 1°F difference was observed in summer in 9 ft. and 10 ft. and 10 ft. and 12 ft. rooms i.e. only difference of 2°F temperature was recorded between rooms of 9 ft. and 12 ft. in the morning hours but with the advancing time of the day, the progressive difference set in. The maximum difference was found in the afternoon. In winter the difference in inside air temperature was present but the regular increase in air temperature was less marked as compared to that of the corresponding one in summer. As is evident from table-1 and table-2, in general, the indoor air temperature was found to be higher than the outside during morning and in the night and less at other time of the day. Observations further showed :-

- i) Inside mean maximum temperature in all the three rooms was above the comfortable temperature of 74°F in summer while the mean minimum was lower in winter.
- ii) Because of influence of the height of the room, the difference in the mean maximum and minimum temperature ranged between 1°F to 2°F in summer for a corresponding range of 85.5°F to 102.4°F in the outside temperature of the rooms. In winter it ranged

from 1.5°F to 2.5°F corresponding to variation of outside temperature from 57.1°F to 85.2°F. Usually the inside maximum was lower and the minimum higher for all the rooms than that of the outside maximum and minimum.

- iii) Generally there was no difference in the time of occurrence of maximum and minimum temperatures inside all the three rooms. The difference in time lag being about 2 hours in summer and 1 1/2 hours in winter.
- iv) The small difference in inside temperature in the three rooms indicates that greater heat flow through greater wall area exposed in higher ceiling is offset by the increase in greater heat flow through roof of the lower ceiling.

CONCLUSION

Increase in ceiling height beyond the minimum one, 9 ft., practically has no significant advantage on thermal comforts. The average difference between 9 and 10 ft. and 10 and 12 ft. ceiling is merely 1°F. Difference of temperature of 2°F was consistently found inside the rooms of 9 ft. and 12 ft. heights inspite of the fact that the walls were not shaded. However this little difference does not have

any pronounced effect on the thermal comforts.

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TABLE - 1

DAILY MAXIMUM INSIDE TEMPERATURES (F°)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January'																															
9' Ceiling	-	53.0	49.0	-	53.0	55.0	54.0	56.0	56.5	56.5	-	56.5	56.5	56.5	54.5	56.0	-	-	62.5	59.5	60.0	61.5	61.0	61.0	-	63.0	61.5	59.5	60.0	60.0	60.0
10' Ceiling	-	52.5	48.5	-	53.0	54.5	53.5	55.0	56.0	56.0	-	56.5	56.0	56.0	54.0	55.5	-	-	62.0	59.0	60.0	63.0	62.5	61.5	-	62.5	61.0	59.5	59.5	59.5	59.5
12' Ceiling	-	54.0	50.0	-	54.0	56.0	54.5	56.0	57.0	57.0	-	57.0	57.0	57.0	55.0	56.5	-	-	63.0	60.0	61.5	62.5	62.0	61.5	-	64.0	63.0	60.5	60.5	60.5	60.5
February																															
9' Ceiling	-	60.0	62.5	60.0	63.0	64.0	65.0	-	65.0	64.5	65.0	66.5	66.0	60.0	-	68.0	70.0	72.0	71.0	66.0	68.0	-	70.0	67.0	74.0	-	-	-	-	-	-
10' Ceiling	-	58.0	61.5	59.5	62.0	63.0	64.0	-	63.0	62.5	63.0	64.5	64.5	59.0	-	61.0	76.5	70.0	69.0	64.5	67.0	-	69.0	65.0	70.0	-	-	-	-	-	-
12' Ceiling	-	58.5	63.0	59.5	62.0	64.0	64.0	-	64.0	64.0	64.5	66.0	66.0	60.0	-	68.0	78.0	72.0	70.0	65.5	68.0	-	70.0	66.5	72.0	-	-	-	-	-	-
March																															
9' Ceiling	-	73.5	73.0	78.5	74.5	78.0	74.0	-	76.0	77.0	78.0	74.0	72.5	75.5	-	81.0	79.0	75.0	73.0	78.0	76.0	-	-	83.0	85.0	82.5	86.0	85.0	-	80.0	83.0
10' Ceiling	-	73.5	73.0	81.0	75.0	80.0	75.0	-	78.0	79.0	80.0	76.0	75.0	74.0	-	79.0	77.5	74.0	72.5	76.0	74.5	-	-	81.0	83.0	81.5	84.0	83.5	-	79.0	82.5
12' Ceiling	-	73.5	73.0	77.0	74.0	76.0	72.5	-	74.0	74.5	76.0	73.0	72.5	73.5	-	76.0	76.0	72.5	71.5	74.0	74.5	-	-	78.0	81.0	81.0	83.0	83.0	-	76.0	82.0
April																															
9' Ceiling	81.5	80.0	81.5	83.5	-	82.0	84.5	82.5	75.0	80.0	79.0	-	82.5	82.5	84.5	90.5	91.5	93.5	-	97.5	96.5	96.5	95.5	91.5	94.5	-	96.5	99.0	101	99.5	-
10' Ceiling	80.0	79.0	80.0	82.0	-	81.0	83.5	82.0	74.5	79.0	78.0	-	82.0	81.5	84.0	89.0	90.5	91.5	-	95.5	95.0	94.5	93.5	90.0	92.5	-	95.0	98.0	100	98.5	-
12' Ceiling	79.5	78.0	79.0	82.0	-	80.5	82.5	81.0	74.0	79.0	77.5	-	81.5	81.5	83.0	88.0	89.5	90.5	-	94.0	94.0	94.0	92.5	89.0	91.5	-	93.5	96.5	98.0	97.0	-
May																															
9' Ceiling	-	92.0	-	93.0	96.0	99.5	102	103	98.0	-	96.0	98.0	96.0	96.5	98.0	99.5	-	104	100	104	103	100	102	-	96.5	107	105	106	105	104	-
10' Ceiling	-	90.5	-	92.0	94.5	99.0	100	101	97.5	-	95.0	96.5	95.0	95.5	97.0	97.5	-	102	99.0	102	101	98.5	100	-	95.0	104	103	104	104	102	-
12' Ceiling	-	90.0	-	91.0	93.0	97.0	99.5	100	97.0	-	94.0	95.0	94.5	94.0	95.5	96.5	-	101	98.0	101	100	98.0	99.5	-	95.0	103	102	103	104	101	-
June																															
9' Ceiling	107	98.0	99.5	102	105	106	-	94.5	99.0	103	92.0	101	100	-	105	106	106	109	-	-	-	106	109	104	107	110	108	-	96.5	94.0	-
10' Ceiling	105	97.0	98.5	101	101	104	-	93.5	98.0	102	92.0	101	99.0	-	103	105	105	107	-	-	-	105	108	103	106	108	108	-	96.5	92.5	-
12' Ceiling	104	96.5	97.5	100	102	104	-	93.5	97.0	101	92.0	101	98.0	-	103	104	104	106	-	-	-	103	106	101	106	108	106	-	95.5	92.5	-
July																															
9' Ceiling	98.0	103	105	107	-	107	98.0	98.0	92.5	87.5	94.0	-	98.0	91.5	90.0	90.0	86.5	86.0	-	84.0	-	90.0	93.5	97.0	87.5	-	85.5	93.0	94.5	-	85.5
10' Ceiling	96.5	102	104	106	-	105	97.5	97.0	92.5	87.5	93.5	-	97.0	91.0	90.0	89.5	86.5	86.0	-	83.0	-	90.0	93.5	96.5	87.0	-	85.5	92.5	94.0	-	86.0
12' Ceiling	97.0	101	102	103	-	104	97.0	69.0	92.0	87.0	93.0	-	96.5	91.5	90.0	89.0	86.0	85.5	-	84.0	-	90.0	93.5	96.5	87.0	-	85.5	92.5	93.5	-	86.0
August																															
9' Ceiling	87.0	-	86.5	87.0	81.0	79.5	83.5	85.5	-	92.0	93.0	93.0	95.0	-	94.0	-	93.5	94.5	91.0	96.0	95.5	92.0	-	96.0	96.0	-	-	-	94.5	-	96.0
10' Ceiling	87.0	-	85.5	87.0	81.0	79.5	83.0	85.5	-	92.0	93.0	93.0	95.0	-	94.0	-	93.5	94.0	94.5	95.0	94.5	92.0	-	96.0	95.0	-	-	-	94.0	-	97.0
12' Ceiling	87.0	-	85.5	87.0	81.5	79.0	83.0	85.5	-	92.0	93.0	93.0	95.0	-	94.0	-	93.0	94.0	94.5	95.5	95.0	92.0	-	96.0	96.0	-	-	-	94.0	-	96.0

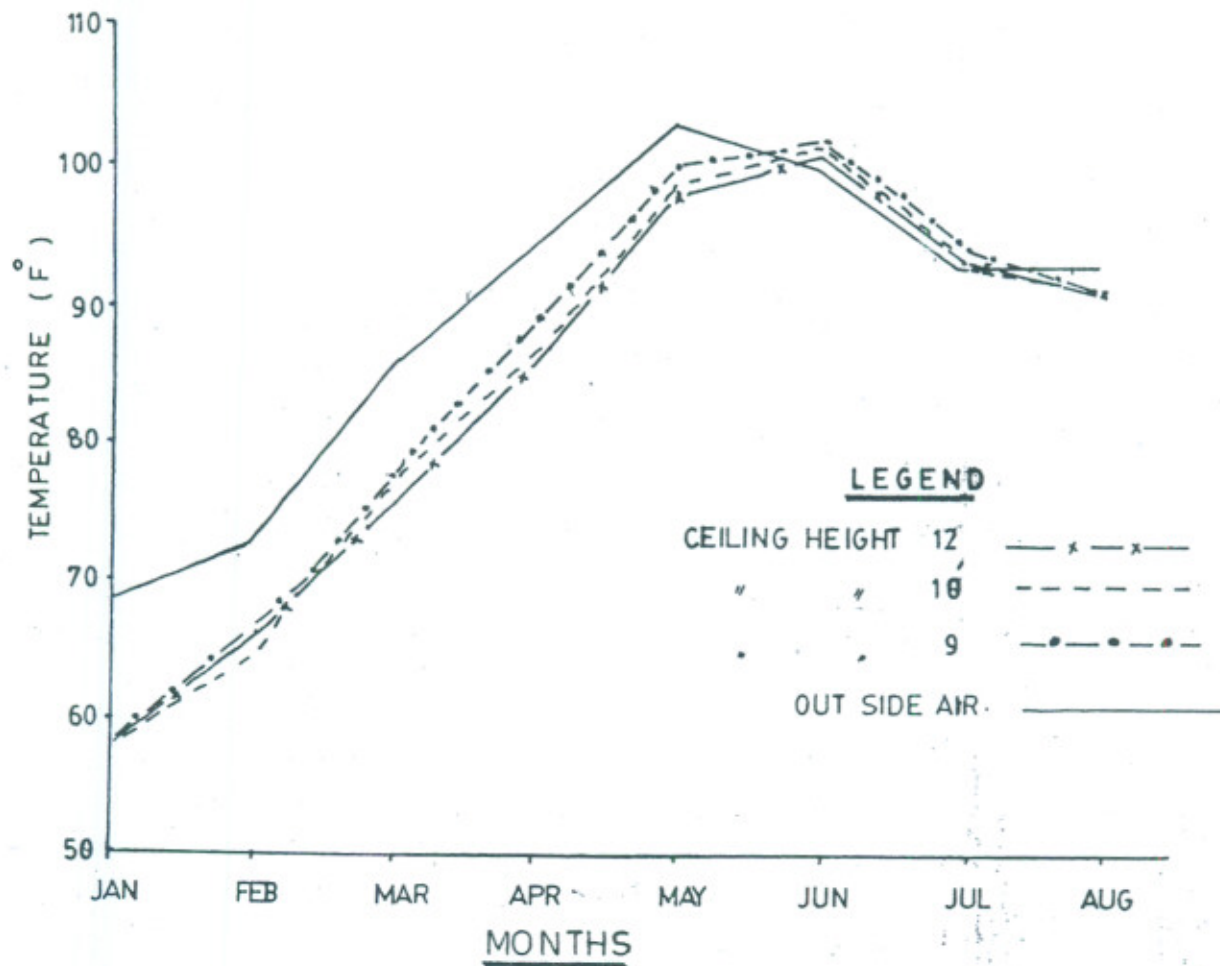
TABLE - 2

DAILY MINIMUM INSIDE TEMPERATURES (F°)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January*																															
9' Ceiling	-	48.0	47.0	-	48.0	46.0	48.0	48.5	48.0	49.5	-	49.0	48.0	49.5	50.0	48.5	-	-	50.0	56.0	55.0	54.0	52.5	52.0	-	57.5	54.0	53.0	52.5	52.0	52.0
10' Ceiling	-	47.5	46.5	-	47.0	45.0	47.0	48.0	48.0	49.0	-	48.5	48.0	49.0	50.0	48.0	-	-	50.0	56.0	54.5	54.0	52.5	51.5	-	57.0	54.0	52.0	52.0	51.0	51.0
12' Ceiling	-	48.5	47.5	-	48.0	46.5	48.0	49.0	49.0	49.0	-	49.5	49.0	50.0	52.0	49.0	-	-	50.0	57.5	55.5	54.0	53.0	53.0	-	58.0	54.0	53.0	53.0	52.5	52.5
February																															
9' Ceiling	-	53.0	57.5	58.5	56.0	53.5	55.0	-	56.0	54.0	55.0	56.0	55.0	57.0	-	58.0	59.0	60.0	61.0	62.0	57.0	-	61.0	61.0	68.0	-	-	-	-	-	-
10' Ceiling	-	52.0	57.0	57.5	54.0	52.5	54.0	-	54.0	53.0	53.0	55.0	54.0	56.0	-	57.0	58.0	59.0	60.0	61.5	56.0	-	60.0	61.0	67.0	-	-	-	-	-	-
12' Ceiling	-	53.0	57.0	58.0	55.0	53.0	54.0	-	55.0	53.0	54.0	56.0	55.0	57.5	-	58.0	58.5	59.5	61.0	62.0	57.0	-	60.0	61.5	61.5	-	-	-	-	-	-
March																															
9' Ceiling	-	67.0	67.0	66.0	70.0	70.0	66.0	-	66.5	67.0	66.5	68.0	64.0	65.0	-	70.0	70.0	68.0	67.5	66.5	67.0	-	-	70.0	74.0	76.5	75.5	74.5	-	68.0	71.0
10' Ceiling	-	66.0	67.0	65.0	70.5	70.0	68.0	-	67.0	67.5	67.5	68.5	64.0	64.5	-	69.5	69.0	67.0	67.0	65.5	66.0	-	-	69.0	73.0	76.0	76.0	74.0	-	67.5	70.5
12' Ceiling	-	67.0	66.0	67.5	70.0	70.0	68.5	-	67.5	68.0	67.5	69.0	63.0	64.0	-	69.0	69.0	66.0	66.0	67.0	65.0	-	-	68.0	72.0	75.0	74.0	73.5	-	66.5	70.5
April																															
9' Ceiling	74.0	75.5	72.5	70.5	-	76.5	77.0	78.0	73.5	66.0	70.0	-	76.0	74.0	77.0	79.5	80.0	82.5	-	86.0	88.0	87.5	85.5	82.5	83.5	-	86.5	87.5	89.5	90.0	-
10' Ceiling	73.0	76.5	71.5	70.0	-	76.0	76.0	77.0	73.0	66.0	70.0	-	75.0	73.5	77.0	78.5	80.0	81.5	-	85.0	87.0	86.5	85.0	81.5	83.5	-	85.5	87.0	88.5	89.0	-
12' Ceiling	72.0	76.0	71.5	69.0	-	75.0	75.0	76.0	72.5	65.5	70.0	-	75.0	72.0	76.0	78.5	80.0	81.0	-	85.0	86.5	86.0	84.0	79.5	82.5	-	85.0	86.5	88.0	88.0	-
May																															
9' Ceiling	-	82.5	-	85.5	85.0	88.5	92.5	94.0	93.5	-	88.5	86.5	88.5	85.0	86.0	87.0	-	92.0	93.0	94.5	96.0	96.5	95.0	-	91.5	94.0	95.0	95.5	95.0	97.0	-
10' Ceiling	-	82.5	-	85.0	85.0	88.0	92.0	93.0	92.5	-	87.5	86.0	88.0	84.0	95.5	86.5	-	91.5	92.5	95.0	95.5	96.0	94.0	-	91.0	93.5	94.0	93.0	94.5	96.0	-
12' Ceiling	-	82.0	-	84.0	84.0	87.0	91.0	93.0	92.0	-	87.0	85.0	87.5	84.5	85.0	86.0	-	90.9	91.0	93.0	95.0	95.0	94.0	-	90.5	93.0	93.0	94.0	94.0	95.0	-
June																															
9' Ceiling	98.0	97.0	84.5	90.0	93.5	96.0	-	89.5	87.0	92.0	82.5	85.5	89.0	-	94.5	96.0	96.5	98.0	-	-	-	97.0	99.0	94.5	97.0	98.0	101	-	95.0	85.0	-
10' Ceiling	97.0	95.0	84.5	89.5	93.0	96.0	-	89.0	86.5	91.5	83.0	86.0	90.0	-	94.5	96.5	96.5	98.0	-	-	-	97.5	99.0	94.5	97.5	98.0	101	-	95.0	85.5	-
12' Ceiling	96.5	94.0	84.0	89.5	93.0	96.0	-	89.0	86.0	91.5	83.0	88.5	89.5	-	94.0	95.0	96.5	98.0	-	-	-	97.0	98.5	93.5	97.0	98.0	101	-	94.5	85.5	-
July																															
9' Ceiling	90.0	93.5	96.5	98.0	-	98.0	96.5	92.0	89.0	85.0	84.0	-	92.0	88.5	84.5	85.5	86.0	80.5	-	80.0	-	87.0	86.0	88.5	86.5	-	80.5	86.0	90.0	-	83.0
10' Ceiling	90.5	93.0	96.0	98.0	-	98.0	96.0	92.0	89.0	85.5	83.0	-	92.0	88.0	85.0	85.5	86.0	80.0	-	80.0	-	87.0	86.0	90.5	86.5	-	80.5	86.0	90.0	-	83.0
12' Ceiling	90.5	93.0	95.0	97.0	-	97.5	95.0	92.0	89.0	85.5	84.5	-	92.5	88.0	85.0	86.0	86.0	80.0	-	80.0	-	87.5	86.5	90.5	86.0	-	80.5	86.0	90.0	-	83.0
August																															
9' Ceiling	81.5	-	83.0	84.0	80.5	77.5	79.0	83.0	-	88.0	86.5	86.5	88.0	-	91.5	-	91.0	91.0	93.0	91.5	90.5	90.0	-	91.0	90.0	-	-	-	91.5	-	94.0
10' Ceiling	81.5	-	82.5	84.0	80.5	77.5	79.0	83.0	-	88.0	86.5	86.5	89.0	-	91.0	-	91.0	91.0	92.5	91.0	90.5	89.5	-	90.5	90.0	-	-	-	91.0	-	93.5
12' Ceiling	82.0	-	82.0	84.0	80.0	77.0	78.5	83.0	-	88.0	87.0	87.0	89.0	-	91.5	-	91.5	91.5	93.0	91.5	91.0	90.0	-	91.5	91.0	-	-	-	91.0	-	94.0

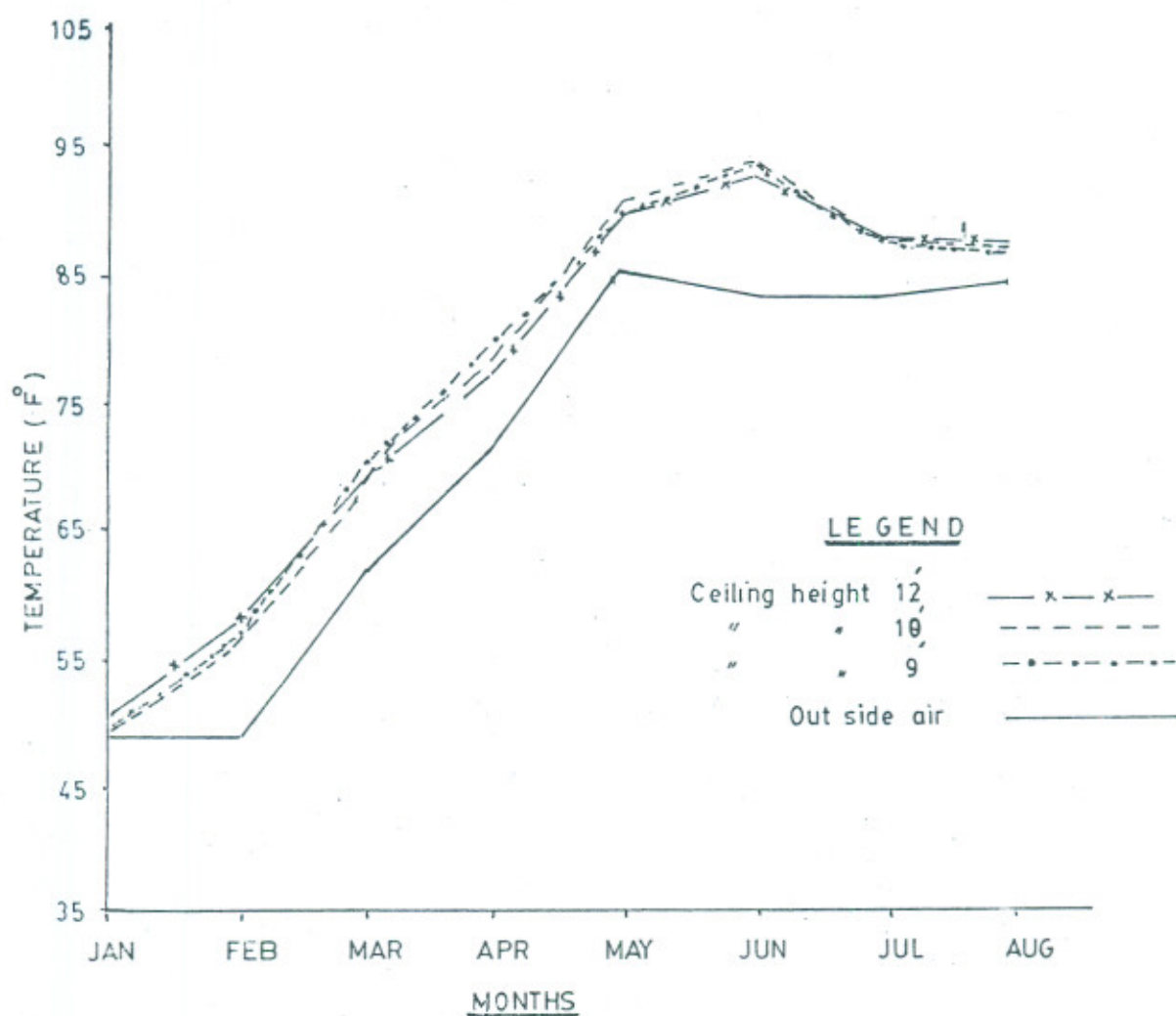
MONTHLY MEAN MAXIMUM TEMPERATURES

(FIG.1)



MONTHLY MEAN MINIMUM TEMPERATURES

(FIG. 2)



PRIVATIZATION OF GROUNDWATER DEVELOPMENT IN PUNJAB

Engr. Mian Hafiz-Ullah*

The use of ground water has been a major factor in the growth of agricultural production in Pakistan especially in Punjab, for the past 20 years. Initially its use was restricted to open dug wells in non-command area. Extensive use of groundwater started after 1960 with the demonstrative effect of tubewells introduced through Salinity Control and Reclamation Projects (SCARPS). The primary purpose of Scarps was to tackle the menace of water logging and salinity. But the additional supply of water provided a flexibility to canal water supply. Under the Scarp projects about 13,500 publicly owned and operated tubewells were installed. As a result private tubewells grew rapidly and there are now more than 300,000 private tubewells in Pakistan, 80 % of which are located in Punjab. Scarp area alone has about 60,000 private tubewells. Rapidly declining performance of Scarp Tubewells in public sector requires redefining the role of Government in the groundwater development.

Initially a part of Scarp-I was run as Pilot project under the name of Scarp Transition Pilot Project wherein about 213 Scarp Tubewells were transitioned to private tubewells in about 5 years. The policy was to encourage individual farmers to own Scarp tubewell and or a new private tubewell, which would be subsidized through non-refundable subsidy from the Government. After that Scarp

Transition Project was launched to transition whole of remaining Scarp-I Tubewells about 1346 STWs. The Scarp transition project started in 1992 and it will be completed in December 31st, 1997 wherein 1346 fresh groundwater tubewells are transitioned. Initially Second Scarp Transition Project was to be launched on experience of Scarp Transition Project. The approach was later modified to convert the Scarp Tubewells to Community Tubewells instead of individually owned private tubewells.

Punjab Private Sector Groundwater Development Project builds on the experiences of SCARP Transition, ISRP and on Farm Water Management Programs to encourage the private tubewell development.

PRESENT CONDITION OF SCARP TUBEWELLS

At present the Scarp Tubewells have mostly outlived their life. It is estimated that about 15% of the Scarp Tubewells are working to 80% or above of their original capacity, 25% are 50 to 80% of capacity and 40% to less than 50% of their original capacity. 8% are totally closed and about 9%, the data is not available; probably they have been closed and abandoned. The present pumpage capacity is estimated to 9597 Cs., which is 50% of the installed capacity.



Although there are about 60,000 PTWs in Scarp area, their operation factor is only 10%, which means there is re-charge in the Scarp area and resultantly water table is rising. Such condition cannot be sustained and hence the necessity of Punjab Private Sector Groundwater Development Project was felt.

OBJECTIVES

1. Redefine government's role in groundwater development and provide assistance to facilitate change.
2. Develop a monitoring program and regulatory framework to ensure sustainable use of the groundwater resources.
3. Develop sustainable farmers' organizations (FOs) which can efficiently operate and maintain groundwater irrigation, improve surface irrigation and establish a base for participation in the management of the canal systems.
4. Increase beneficiary's incomes and alleviate poverty.
5. Rationalize public expenditure on O & M of the irrigation and drainage systems as well as increase the recovery of public

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expenditures on irrigation infrastructure.

- 6 Avoid environmental hazard of saline water intrusion into fresh groundwater aquifers.

PROJECT DESCRIPTION

The Proposed project, covering a large part of fresh groundwater SCARP areas in Punjab, would be implemented over a period of five years. The project is designed to meet the above objectives. The major project components are: -

- a) Disinvestment of Scarp tubewells.
- b) Development of a groundwater monitoring and regulatory framework.
- c) Improvement of irrigation conveyance facilities.
- d) Prevention of saline groundwater intrusion in fresh aquifers.
- e) Monitoring and evaluation of the project impact and
- f) Project management and technical assistance and training.

DISINVESTMENT OF SCARP TUBEWELLS

a) Strategy of Transfer

Government has been investing heavily to keep Scarp Tubewells in working order. 85% of the O&M expenditure of Scarps is reserved for the electricity consumption and the balance 15% is for O&M. It has been very difficult to maintain the Scarp Tubewells which have already outlived their life.

Normally life of a Scarp Tubewell is 10 to 12 years. With the increase in electricity tariff, O&M cost of tubewells have been rising rapidly. During 1995-96 O&M allocation for Scarps were more than the M&R allocation for Canal System. Whereas Scarp area is only 25% of the total command area. It has been estimated that annual expenditure per Scarp Tubewell is Rs.1.50 Lac. Whereas the recovery from the Scarp area have been through water rates which were charged as twice the canal water rate. The yawning gap of 76% between expenditure and recovery has now made it impossible for the Government to maintain the Scarp Tubewells, therefore it has been suggested to organize the farmers into Water User Association at the watercourse level and transfer the Scarp Tubewells through disinvestment to the Farmers Organizations (FOs).

The Scarp Tubewells will be disinvested in the following three modes: -

1. If the farmers opt to take over the Scarp Tubewell as such it would be transferred to them at the cost of Rs.10,000/-
2. If the Farmer Organizations want to modify the existing Scarp Tubewell, they would be allowed to do so. To facilitate non-refundable subsidy of Rs. 20,000/- will be paid to the F.O.
3. If the farmer do not want to take over or modify the

Scarp Tubewell then they will be allowed CTWs.

- They will be paid subsidy of Rs. 30,000/- per Community Tubewell (CTW).
- The limit of membership for a Tubewell Group is 30% of the members of the watercourse.
- No limit of area has been specified for the CTW.
- The existing staff working on Scarp Tubewells would be allowed 5 years service benefit for retirement. 3 months pay, as compensation will be given to employees having less than 10 years service.

A provision exists for training of the redundant staff to pursue higher qualification if they opt to. We are taking options for training so as to equip them with skills and knowledge for making them useful citizens.

b) Development of Groundwater Monitoring and Regulatory Framework

In Punjab, groundwater extraction have been increasing consistently, as a result the falling water table in some fresh groundwater areas is a matter of considerable concern. Over exploitation threatens the quality of the resource--lower level aquifers are generally more saline and significant differences between fresh and saline areas induce intrusion of saline water.

As the rate of groundwater use is approaching its potential availability, determination of groundwater rights (at individual and community level) and regulation of its use are essential for sustainable and equitable use of this common resource.

We are developing groundwater mathematical model for the Scarp area to develop regulatory framework. This would require intensive monitoring in critical areas for determining safe yields of aquifers and allocation of groundwater rights. An institutional support will have to be developed for implementing groundwater regulations in critical areas.

Presently Scarp Monitoring Organization (SMO) WAPDA monitors the groundwater aquifers, especially in the Scarp areas. We are trying to evolve an institutional set up with detailed rules for control and licensing, as well as to develop the methodology of groundwater monitoring. It is hoped that it will take first 3 years of the project to collect data and develop the methodology, which would be tested in the remaining two years. Testing and development is a continuo process and would remain even after the completion of the Project. We are planning to assess the roles of the regulating and monitoring surface water and drainage agencies, farmers and their organizations, local government and NGOs etc.

c) **Improvement of Irrigation Facilities in Project Areas.**

i) Farmers need be encouraged and their confidence built upon providing their share of canal water in addition to CTW. For this farmers have to be trained on conjunctive use of water when the CTWs become operational. Therefore it has been provided to include repair of distributor gates, rehabilitation of diversion structures, desalting and improving critical sections of the canals and other adjustments to enable critical sections of the canals and other adjustments to enable delivery of authorized discharge. These works would not cover complete remodeling of the distributaries. This work should be identified and proposed by Social Mobilization Field Teams and the PID during their implementation of the Project. Critical area with excessive seepage will be provided with lining but cost of lining will have to be shared by the Farmer Organizations. The channels on which farmers agree to pay at least 5 percent of the capital costs of works up front and 50% of the capital cost would be considered for lining. These improvements would reduce the losses significantly and where the area is underlain by saline groundwater would conserve valuable surface water. Improvement in

water control and remodeling of moghas would result in an overall increase in water use efficiency an equitable water delivery to watercourses especially towards the tail end reaches of the canals.

ii) **Water Courses improvement.**

Overall package includes 100 watercourses in the saline pockets and 400 in saline areas adjoining the fresh groundwater aquifers would be improved under a voluntary and participatory programs. 1500 watercourses would be lined and improved in the fresh groundwater areas. In saline Groundwater area up to 30 percent of the length of communal watercourse would be provided with lining. In FGW zone 15% of communal watercourse would be lined.

Farmers would share the cost of lining and improvement of the watercourses. 30% of the cost of materials would be paid up front and 45% would be payable in six installments in 3 years period. This measures would also prevent saline intrusion in the fresh groundwater aquifers. Farmers would be consulted about these improvements at the start of the Project.

d) **Improvement of Drainage Facilities.**

A total of 821 drainage tubewells have been installed in Scarp-II saline zone, many of these are not working. Project provides of 35 saline tubewells to be installed as replacement to lost pumpage of the existing drainage tubewell, which have either deteriorated to a very low

capacity or have been closed. These drainage tubewells would be installed in the vicinity of Shah Jiwana and Ara units of Scarp-II and effluent would be pumped into existing surface drains. Bordering Shah Jiwana unit, the replacement tubewells would be provided along Faqarian-Sillanwali drain (8 tubewells) and Sobagha drain (12 tubewells) and in Ara unit along lower Raniwear drain (15 tubewells). It is hoped that this capacity together with proposed preventive measures, would be sufficient to balance recharge and extractions and maintain the groundwater tables at an appropriate level in the saline areas bordering with FGW area.

O&M of Scarp Tubewells have generally been plagued by problems arising from poor management and budgetary shortfalls. The saline STWs are the worst hit, primarily because, unlike the fresh groundwater STWs, farmers are not interested in their O&M. Most of the saline tubewells are either permanently closed or in highly deteriorated condition. To avoid a similar fate of the saline STWs proposed to be rehabilitated or replaced in Scarp-II area, the O&M of these saline STWs would be contracted out to the private sector under "performance contracts".

PROJECT MANAGEMENT

The project would be managed by PMU consisting of a Project Director and two ex-office Members (one each from the Irrigation Department and the Directorate General of Water Management). The PMU has

employed consultancy, one for Project Implementation and other for Impact Evaluation of the Project.

The PMU is responsible for:

- a) Overall project management and coordination.
- b) Development of groundwater regulatory framework.
- c) Community development for formation of FOs and establishment of CTWs, including processing and disbursement of financial assistance to FOs.
- d) M&E, including development of an MIS system for the project.
- e) Impact evaluation studies.
- f) Planning, budgeting, maintenance of consolidated project accounts, including the IDA Special Account, and ensuring timely submission of audit reports.
- g) Procurement of vehicles and all consulting services required for the project.

Monitoring and Evaluation

Local consultancy services in project monitoring and evaluation will be required to study and assess the success of the project in meeting the objectives and to assess the

physical, social and economic impact of the project on the project area and its inhabitants. The Project Implementations and Evaluation consultants will assess: -

- i) Impact of the project on water use and equity in the distribution of water resources.
- ii) Performance and likely sustainability of FOs.
- iii) Performance of technical assistance consultants in supporting the management and implementation of all project initiatives.
- iv) Changes in cropping patterns including a shift towards production of higher value crops.

The Project Concept & Discussion

The Project provides to disinvest the Scarp Tubewell to private sector as CTW without allowing the Ground Water Table to rise. This has been provided by CTW which will be beefed up through Water Course improvement & lining;

- Improvements in surface supply systems
- Improvement in drainage TWs and
- Improvement of drainage's three N.D.P.

There are various options available for CTW and it needs further discussion for future viability of Project Objectives.

CTWs can be: -

- Diesel Operated.
- Electrically driven.
- Flat Rate option or Metered supplies.

Pumping Costs have been worked out for these alternatives and are given below for various operation factors.

Operation and Maintenance Cost of CTWs

Operation Factor	C&M Cost (Rs)		
	Diesel TW	Electric TW	
		Meter Con.	Flat Rate
	Per hour	Per Hour	Per Hour
0	52.17	63.26	89.80
20	36.73	44.63	45.10
30	31.51	38.42	30.20
40	29.01	35.49	22.75
50	27.47	33.46	18.28
60	26.47	32.28	15.37
70	25.76	31.44	13.29
80	25.22	30.81	11.73

It is seen that running cost reduces to almost 50% at Operations Factors 40-50% and above. Thus indicating the optimum OPERATION FACTOR for Diesel T/Ws, which are most popular among the farmers at present.

For Electrically driven Pumps 57% of the Capital Cost is the cost of getting an Electric Connection. Flat rate seems

cheaper than diesel but the reliability of the arrangement and supply is questionable. Metered supply is most unaffordable.

Discussion

Result of Impact Evaluation studies for Scarp Transition Pilot Project and Second Scarp Transition Project have demonstrated that development of groundwater has continued

equally in both Porject & non-project areas. So have been the effects on agriculture productivity. So why have another Project of similar nature. A closer look at project documents would reveal that main stress in Punjab Private Sector Groundwater Development Project is on viable Farmers Organizations. All other project elements of subsidy improvement of existing facilities

(Irrigation & Drainage) are a catalyst. profitability, which need be insured through Project implementation operations. Cs. capacity and quantity of water pumped by a CTW at various Operation Factors is as under: -

An essential condition to the viability of social institutions is CTWs are generally of 1

Quantity of Water

A.F %	Qty. AFT/Month	OF %	Qty. AFT/Month
10	5.95	50	29.75
20	11.9	60	35.7
30	17.85	70	41.65
40	23.8	80	47.6

Operation Factor is dependent on No. of TWs and demand. If more TWs are installed than required, these will be operated on low Operation Factor. Consequently raising cost of water as indicated in the table 1. Then the farmers will be disheartened due to lack of profits and are likely to loose interest.

If the No of TWs is less, Operation Factor will be very high, may be beyond practical limits.

Farmers will not pay the social and time costs of joining groups unless they see real benefits such as increase in incomes.

As indicated before, the costs are 50% reduced at Operations Factors 40-50%, indicating the

optimum utilization factor for CTWs for sustainability.

So fixing of No. of TWs for optimum operation is critical to success of the project. Demand of TWs water varies with: -

Level of canal supply.

Stage in cropping period.

Type of crop.

Rainfall.

The demand is high in peak demand periods, when crops are near maturity and low in slack demand period.

An Operation Factor of 50% has been selected to cover both the peak demand and slack period demand.

Position of Irrigation water supply in the FGW Project Area shows that canal supplies (3.51 MAF) are 40% of total supply (8.84 MAF) and PTWs supply is 34% (3.01 MAF) whereas share of STWs is 26% (2.32 MAF).

FGW Project area is 26.5 Lac acres, therefore number of CTWs required would be: -

On replaced pumpage basis 6500 Nos.

On area basis 106 acres/CTW.

Conclusions

For sustainability and cost effectiveness of the Project CTWs be given for an average area of 100 Acres.

SELF-RELIANCE THROUGH SCIENCE AND TECHNOLOGY

**Engr. Colonel (R) Mumtaz Hussain, FIE (Pak)*

Abstract:

Science and Technology (S&T) plays a pivotal role in the social development, progress and prosperity of a society. A country can only maintain its sovereignty, integrity and national cohesion if it is self sufficient in its scientific, technological, engineering and industrial needs. Advanced countries owe their success to massive Research and Development (R&D) initiatives whereas this aspect has largely remained ignored in the Third World countries. The countries can learn to develop this S&T sector through one another's experiences at international and regional levels. The developing countries ought to reshuffle the national priorities and strengthen their S&T base. Pakistan has tremendous potential in terms of dedicated and industrious man-power and huge reserves of natural resources which can optimally be exploited by application of S&T mechanisms and tools.

PRELUDE

EMERGENCE OF SCIENCE AND TECHNOLOGY

Science is the fundamental knowledge based on natural phenomena, human observation and logical approach. Science and religion are not two separate entities but complimentary to each other. In fact all the divine religions advocate the seeking of knowledge and deplore illiteracy and scientific darkness. The world societies have witnessed the unabated proliferation of science since the 17th Century.

Science is the mother of invention and technology. Without the achievement of advancements in the scientific sector the technology would remain ill developed. Technology is the application of scientific knowledge in practice. A deep rooted inter-relationship exists between science and technology. Science consumes resources whereas technology generates resources. The technology had not only led to emergence of Industrial

Revolution but also transformed the very fabric of human civilizations thereafter.

SIGNIFICANCE OF SCIENCE AND TECHNOLOGY

On importance of technology a Chinese philosopher once remarked, "If you give a fish to a man, you will feed him for a day;" if you give a fishing rod to him, you will feed him a life time; if you teach him how to make a fishing rod, you feed him and his whole village.

Science and technology (S&T) play a pivotal role in bringing positive changes in the developmental process. This is the single most significant factor affecting the social uplift of a society. These are the essential instrument by which a nation can achieve self-reliance in every walk of life.

The pinnacle of achievements in S&T sector means the reduction of technological dependence on other nations.

OPTIMAL HARNESSING OF NATURAL RESOURCES.

A country may be blessed with vast reserves of natural resources, both renewable and non renewable. However these are of little significance unless tapped optimally. It is the S&T which comes to the rescue at this juncture and assists in obtaining the useful manufactured and finished products.

MARKET COMPETITIVENESS

Present era is characterized by global openness. The world markets are being contested by all and sundry. Only those countries can compete which possess sound scientific and technological footings.

S&T is the prime mover of economic growth.

INDUSTRIALIZATION

A country can not achieve economic survival if it depends

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on export of the raw material and import of the finished goods. There is dire need of establishing primary and secondary industries. This is only possible if technological skills exist to install light and heavy industries and subsequently to operate them also. Sectors like agriculture, construction and transport hitherto have not been run as industries thus letting their respective contribution towards national development marred by the manufacturing units.

PRESERVATION OF NATIONAL SOVEREIGNTY AND PRESTIGE.

Without achieving self-reliance in science and technology a country is unable to maintain its honour and integrity among the comity of the nations. It is difficult for a nation to preserve its geographical and ideological frontiers if it relies on the borrowed technology. A technologically starved nation is liable to invite economic, political and military interference.

GLOBAL SCENARIO ADVANCED COUNTRIES

JAPAN. The Japanese Nation had to face humiliating defeat at the hands of the Allies consequent to World War II. Instead of strengthening the military might they embarked upon a pragmatic approach to develop the S&T infrastructure. They paid huge sums of money to borrow, hire and transfer of technology from abroad. However, the Japanese people, through innovations and modifications adopted the imported technology

commensurate with the local component and indigenous wisdom. Today, on the development scene, Japan is second to none and is one of the seven most industrialized countries of the world. Like other advanced countries it has developed endogenous S&T base closely associated with the advances in productive techniques. Japan invests an amount of 80 billion dollars per annum on S&T research programmes.

SOUTH KOREA. It is one of the Asian Tigers with respect to the recognized development standards. This country is the distinguished example of achieving the highest levels of self sufficiency, prosperity and progress in a short span of two decades. The Koreans owe their success to the researches of Korean Advanced Institute of S&T (KAIST).

KAIST was established in the year 1996 with the strategy of undertaking mostly industrial oriented research and development programmes (R&D). This Institute employs a nucleus of about 1500 motivated and highly qualified scientists and engineers and is largely funded by the private sector. South Korea launched a two phased action plan for industrialization. In First Phase (1970s) they laid more stress on S&T education, researches for development of indigenous technology, transfer of foreign technology and attracting capital investments from foreign industrialists and businessmen. In the Second Phase the application of technology for the

enhancement of productivity led to transformation of Korea into one of the highly industrialized country of the world which is capable of manufacturing the wide range of products from micro electronic chip to the gigantic ship. Its annual expenditure on R&D is 9 billion dollars.

SINGAPORE Singapore is the real Asian economic giant. It enjoys the status and strength of one of the leading technological country of the world.

Its entire adult populace is technology oriented and is committed to value addition.

This country had spent an amount of 2 billion dollars on R&D during the five year plan (1991-95). For the next 5 year plan it has made allocation of 2.8 billion dollars.

Theme of technology development is the shift from low value assembly operations to high technology precision engineering and industrialization.

North has abundance of scientists. 92% of the total number of scientists reside in the North. Similarly these countries afford 97% of the world expenditure on the R&D. This is why the nations in the North are reluctant to transfer the latest technologies to those in the South.

ISLAMIC WORLD OVERALL APATHY

General apathy prevails in the Ummah about the S & T discipline both in public and

private sectors. Budget allocation is not enough to support the routine research programmes. Huge fundings are diverted for the defence and non developmental sectors and the education field remains neglected.

Quality institutions are a few. The number of scientists and technologists produced is too small to meet the ever-growing technological needs. The standard of education is also below the desired mark.

LACK OF COLLABORATION

There is lack of mutual cooperation among the Muslim countries towards the goal of achieving self-reliance in the fields of scientific education and practice. Moreover interaction between educational institutions and industries is glaringly limited in scope.

DEPENDENCE ON WEST.

On account of non-existence of the modern and research facilities there is heavy dependence on the West for training and literature. In this way huge sums of hard earned foreign exchange are unnecessarily spent. The scientists trained in the western countries do not fit suitably under the local sociocultural conditions and resource-starved academic institutions. Borrowing of the alien technology without incorporating the local component can not contribute usefully.

PRODUCTION OF ACADEMICIANS.

Most of the educational institutions produce theory biased scientists. Such scientists contribute a little in the productivity chain and seek refuge in the government offices where these are generally employed on administrative rather than technical jobs.

ABSENCE OF INNOVATIONS AND INVENTIONS.

There is vivid absence of any significant advancement in evolving technologies and innovatory practices for solving the local engineering issues. Simplistic approach is avoided and cost heavy complex designs are suggested. Designers prefer to serve rich clientele over the rural based customers.

RUDIMENTARY NON-FORMAL EDUCATION

Generally the Muslim countries have not promoted non-formal S&T educational systems.

There is general slackness regarding adaptation of the latest communication technology. The Muslim nations are not making use of the fruits of the electronic information networking.

MEAGRE CONTRIBUTION TOWARDS SCIENTIFIC LITERATURE

The contribution of the Muslims towards production of scientific and engineering literature is hardly worth their population in the world. Out of one hundred thousands technical books and two million research papers the share of the Muslims is only one thousand.

The Muslims, being the torch bearers of knowledge, are not even keeping pace with their great traditions.

HEAVY EXPENDITURE ON FOREIGN CONSULTANCY.

The Muslim countries allocate negligible portion of the budget for the development of S & T sector. Out of the available budget significant amount is wasted on import of costly foreign consultancy. This implies the lack of confidence in local expertise. Own designers and technologists are downgraded and heavy fees are paid to the foreigners.

DISMAL SUPPORT FROM INDUSTRY.

For better and effective grooming of the tomorrow's professionals the industry neither bears the financial burden nor provides facilities for the workplace training. As compared to the advanced countries role of the Muslim industrialists is depressing. The industrialists barely render any notable services towards non-campus/hands-on training of students and young engineers.

LIMITED INCENTIVES FROM S&T COMMUNITY.

The scientists, engineers and technologists are normally not given due incentives and encouragement they deserve. Instead they are kept subjugated by the administrators. The technical tops slots are filled by the non-technical management. Under such an environment the scientists are not able to produce positive results.

PAKISTAN

S&T Sector has been utterly neglected in Pakistan since its inception. It has not been popularized. The academic institutions do teach the age old scientific disciplines without seeing glimpses of modern knowledge. Irony is that technology is not at all being developed and effort is made on import of the same without knowing its viability under the local conditions.

Institutional environment is not conducive for the academic pursuits. Political parties show their strength through the auxiliary student wings. The political leaders avail the support of the so called student leaders during political crises with a view to achieve their nefarious objectives. The professional institutions are littered with "Kalashnikov Culture" and "Drug Mafia" which are the main impediments in the path of academic pursuits.

Pakistan spends about 0.2% of GNP on S&T sector which comes to about 75 million dollars per year. This figure is rated to be the lowest in the world.

Of the total technical strength of 32,000 persons only 10,000 scientists and

technologists are engaged in research work.

Pakistan produced 468 Ph.Ds in science, engineering and technology till the year 1980 which depicts a dismal state of affairs.

A vast but futile S&T infrastructure exists in Pakistan. Public sector has failed to develop indigenous technology. Private sector has contributed a little to get certain technologies transferred from foreign patent holders.

Ironically more emphasis has been given to popularization of science and in the process technology and vocations continue to be downgraded. Resultantly, the orientation of the scientists is mainly focussed on age old non-productive theoretical knowledge. The technologists are graded inferior to the "bookish engineers" and are not served with equal opportunities. Therefore only those persons take up the technological learning who are comparatively lesser educated and have missed the boat to become the "engineers".

State of education is alarming. It shows the declining trend. National literacy rate is 36%. Women literacy level is only 24%. 17 million children do not join the formal schooling. Half of

the school going children are drop-outs during the primary stage. Due to higher drop-out rates and poor standards of education, the dream of achieving honourable position at the global level can not be realized.

Teachers are not accorded respectful status in the society. Only those persons enter the profession of teaching who are unable to make fortune elsewhere.

Political leadership in Pakistan is prejudiced against S&T. Our godfathers are not familiar with the fruits of industrialization as most of them belong to feudal class. For minor benefits they prefer imports over the local manufacturing. Although our economy is agro-based yet there is burning need of establishing sound industrial network with the ultimate aim of getting freed from the foreign wicked clutches.

Our S&T problems are undoubtedly multifaceted and multidimensional requiring ruthless surgery. The national priorities are ill-defined. S&T affairs are being run on adhocism even after 50 years of independence. The sad state of affairs as compared to certain Asian countries is indicated by the table given below:-

	S. KOREA	SINGAPORE	MALAYSIA	PAKISTAN
Adult Literacy Rate (%) 1992	74	93	80	36
Primary Enrolment Ratio 1990	107	108	93	42

Secondary Enrolment Ratio 1990	87	70	56	21
Tertiary Enrolment Ratio 1990	38	26	-	3
Mean Year of Schooling 1992 (index North 100)	90	39	54	18
R&D Scientist and Technicians-1986-91 (per 1000 peoples)	46	23	-	4
Science Graduates (as percentage of total graduates) 1988-90	29	53	28	10
Pupil-Teacher Ratio- 1990	34(P);25(s)	26(P);19(S)	20(P); 19(S)	43(P);19(S)
Public Expenditure	4.5	4.5.	5.	0.3

(as % age of GNP) - 1990 on Science Education

Source: UNDP Human Development Report 1994 (P-Primary, S-Secondary)

AGENDA FOR ACHIEVING SELF-RELIANCE

SCIENCE CULTURE

The scientific gap between the advanced countries and the developing nations is on the rapid increase. This gap can be minimised by developing "Science culture in the developing countries especially in the Muslim Umma. The cordinal aim is to foster thinking of the common masses, bureaucrats, public representatives, private sector etc. in the scientific terms.

Scientific knowledge must be applied at all levels in order to solve the day to day issues. New technologies continue to be evolved on the basis of rationale, economic needs and spirit of competitiveness. The Society as a whole must accept the global challenges and keep the wheel

of creativity and productivity moving in positive direction. The Muslim Umma ought to revive its glorious past and usher a new era of pioneering the S&T activities.

S&T MOVEMENT

The developing world should learn from own failure of the past and the rich experiences gained by the technology leading nations. This is possible by launching S&T movement in all tiers and spheres of society. The foremost goal is inculcate awareness at varying levels that the very survival of the nation depends on achieving self sufficiency in S&T sector. The movement should not be allowed to remain subservient to time framework and should continue till we come at par with the advanced nations of the world. The bureaucratic red tapism must not hamper the progressive

outlook of the movement. The educational institutions, the vocational centers, centers of excellence, research centres and chambers of commerce and industries should work in unison for national goals. The support may be sought from foreign expertise, donor agencies and media (both electronic and print). The media can play an effective role by popularising the scientific pursuits.

COOPERATIVE SPIRIT

In the first place the advanced countries should render cooperation to the developing nations by transfer of scientific information and craftsmanship. For the sake of humanity the rich countries need to extend liberal financial assistance to the poor countries for carrying out R&D programmes. The expertise

ought to be provided at nominal costs so that the developing countries may also see the dawn of progress and prosperity. The rich countries must exhibit goodwill and shun the element of misersness regarding dissemination of knowledge. It is the foremost duty of the United Nations to help the down trodden peoples of the world to develop sound S&T footings. Its agencies like UNESCO can help the developing nations to strengthen multisectoral and intersectoral cooperation with the ultimate aim of achievement sustainable growth.

The Muslim Umma should accept the challenges of the modern world by excelling in the fields of S&T. They should realize the nefarious designs of the anti-Islamic forces and learn to develop strong rather than depending on the foreign research works. It is the "Muslim Brotherhood" which helps the Muslims to pool up their resources for the establishment of S&T universities, research centers and industries. They are required to avail the latest information's and share developmental ideas, management skills, engineering knowledge, industrial expertise and technologies among themselves. Like the advanced nations, the developing countries should endeavour to seek the active cooperation of industrial sector through sponsorship of the problem oriented research works and S&T education. The skilled manpower can be produced in the vocational and technical trade centers which are managed by the respective industries.

Frequent exchange of industrialist, scientists technologists and engineers among the Islamic countries in order to benefit from one another's, experience. Seminars, symposia, workshops and on-site visit programmes may be arranged on national as well as regional issues.

ENHANCEMENT OF FINANCIAL SUPPORT

The developing countries can not provide adequate funds to the professional institutions. The engineering universities can generate financial resources by conducting research projects as required by the industries. This process will help the industrialist to get the indigenous solution to their issues and the institutions will receive money for making up the needs.

For on-the-job training of both the teachers and students the universities seek the assistance of industry. The industries may spend some money on provision of such training but in turn they may get real engineers and technologists who will be of immense help in increasing quality production.

ACTIVE PARTICIPATION OF WOMEN

Women constitute about half population of the world. It is criminal to keep them away from the mainstream of national development process. It is high time that they are given equal opportunities in the technical fields. By nature they are better suited for the engineering and other technical disciplines. Different attitude should be

adopted for the women while granting admission to the women in the professional universities. Technically trained mother certainly help in guiding their children to become capable scientists and technologists of tomorrow.

The women must not be downgraded while awarding the employments. Like industrial countries they must be treated at par with the, of course, keeping in view the peculiar nature of jobs.

There is dire necessity of giving representation to the women in the policy making bodies of the technical organizations. This action will remove existing nations regarding gender discrimination. Examples of such ladies will attract the other women to join the technical fields and ultimately contributing towards national development. The fact of matter is that women are especially good at disciplines like engineering, medical/teaching designing, banking, sales and fine arts.

REGIONAL ALLIANCES

There exists strong alliances among the industrially advanced countries in the world either on regional basis like European Union (EU) or otherwise like Group of Seven (G7). Through such hands they control and regulate the economics and production of the manufacturing units for mutual benefit. However, the developing countries do not

expect to be exploited on the basis of technical advancement and resource superiority on part of the industrialized nation. In actual practice there are serious differences between the North and South on trading commercial, industrial, imports/export and host of other issues.

It is encouraging to note that the developing countries are also entering into regional partnerships for the economic well being in their respective peoples. In this context Developing 8 (D8), Economic Cooperation Organization (ECO) and Oil Producing and Exporting Countries (OPEC) are cited as examples. SAARC can also play a viable role for the S&T uplift in the member states. Subsequently by dint of self reliance in S&T, the regional group may share in the game of international power brokerage.

The allies should support one another in terms of encouraging fellowships, scholarships and job opportunities for the young scientists and engineers. Seminars and symposia be arranged on the regional level in which the potential inventors and discoverers are lured to present their treatises.

RECOMMENDATIONS AND CONCLUSION

RECOMMENDATIONS

- * Develop science culture.
- * Launch S&T movement.
- * Popularize S&T education.
- * Foster cooperation at international, Muslim Umma and regional levels for strengthening of S&T Sector.
- * Enhancement of financial support from industrial establishments and donor agencies for R&D.
- * Seeking active participation of women in developmental activities.
- * Acceleration of industrialization process in developing countries.
- * Judicious combination of foreign technology with the local technical know-how.

CONCLUSION

There is "Now or Never" situation for the aspiring nations to achieve self reliance through S&T failing which they may face national catastrophes. Professor Alfred North Whitehead has very rightly warned, "In the conditions of modern life/the rule is absolute: the race which does not value trained intelligence is doomed. Today we maintain ourselves, tomorrow science will have moved over yet one more step and there will be no appeal against the judgements which will

be pronounced on the uneducated."

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SILT CLEARANCE ON SELF HELP BASIS

* *Engr. Nazir Ahmed Sheikh*

Instructions about Annual Canal Closures issued vide Secretary, Government of the Punjab, Irrigation & Power Department letter No. SO (OP) 2-1/80/83, dated November 07, 1983 contain a very serious message because of the facts that.

In the Martial Law Regime this campaign of silt clearance on self help basis had been launched, for the sake of alleged economy and ensuring better supply at tails. The instructions on Annual Canal Closure do not accommodate silt clearance as a full time job, rather its account under works has not been even highlighted as a mentionable activity. But practically silt clearance on self help basis reached its culmination such that the rest of the activities contemplated did not find a place to the degree of sanctity and recognition aimed at by the Engineers.

The campaign of silt clearance on self help basis and the package of instruction about Annual Canal Closure were negating each other. The later were backed by the Engineers but the former by the Administration at whose beck and call was everything. Balanced approach was not devised. Commensurate importance should have been worked out for each work. The Engineers could not succeed in this regard.

Democratic era of a couple of years when Mr. Ghulam Hyder Wayen, as Chief Minister Punjab, dreamt of green revolution completely smashed the package of instructions of Annual Canal Closures which were practically reduced to:

- a) Tempering most of the distributories and even some branches in respect of their regime as no such work was based on survey. It was based on visual observations. The field staff was acting as a group of experts when prescribed the works. At places the will of the mob prevailed and excavation was done beyond the healthy limits.

- b) Inescapable works at Barrages.

The situation which prevailed in respect of the staff appeared as under:-

- a) Every officer up to the level of Executive Engineer was worried about being present at the site of silt clearance and show face daily to the Assistant Commissioners lest he should be marked absent. Even the Superintending Engineer had to accompany Commissioners and Deputy Commissioners to motivate the public and reap fruit to be communicated to the higher. Special formats engaged the entire department in filling data

and communicating up on war footings. The figures were swollen to maintain the level of appreciation. It is very fruitful for the civil authorities to meet the public but such calls by the Engineers during a limited period of closure results in wastage of time which cannot be recompensed.

- b) Chief Minister Punjab and Secretary, Government of the Punjab, Irrigation & Power Department alongwith the local Administration did their best engaging a dozen of agencies for collecting data and highlighting for the improvement of the lot of the common man.

- c) Checking of important hydraulic structures was completely given up. The basic tiers i.e. Sub Engineers remained bogged in arrangements for silt clearance.

About a decade is over and the neglect has entered the stage of infancy recording tangible effects like:-

- i) Washing away of X-Regulator at Raib on L.J.C. (For Shahpur Branch). Its revival cost over Rs. one crore.
- ii) Washing away right flared wall of head main line lower in Thal Canal Circle, Mianwali.

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- iii) Washing away of outfall of B.S. Link I.

May more collapses are likely to become known in view of the magnitude of neglect having gone in due to helplessness on the part of the Engineers. It may be noted that green revolution did not even germinate. Our deficit in all productions went on increasing. We are importing sugar, wheat, potatoes and onions.

Still it is the moment, under the changed circumstances, when the staff has lost their political anchorage and are ready to lend ears to revive the Departmental working. perhaps the higher ups will also prove receptive as luckily we have our Secretary from the Administration.

It is pointed out that silt clearance on self help basis was claimed to be economical although no benefit cost ratio was ever worked out. Instead it embraced such vivid setbacks to some irrigators/participants which fact ultimately proved cause for the failure of the campaign i.e.

- i) Irrigators buy the canal water. Any work on such system in such a manner was counted as Begaar.
- ii) Water level in the channel rises as a result of siltation and upper outlets draw more reflecting shortage at Tail. Irrigators from the upper reach counted it a setback for themselves and avoided participation. Many

occasions arose where nobody other than the Tail Irrigators came forward for silt clearance. Children from schools and gangs of corporations/town committees were called for filling such gaps.

Many other complications arose as under:-

- i) The claims of the public in respect of P.O.L. for local machinery could not be settled by the administration.
- ii) Claim of Agriculture Department who spared machinery for silt clearance could not be settled for years to come. Many claims may be pending as yet.
- iii) Silt clearance through non-technical approach caused set back to the regime of the channels; it further aggravated equitable distribution of water.
- iv) Outlets could not be checked/adjusted.
- v) No progress could be made towards achievement of equitable distribution of water which is supposed to be the essence of the entire activity.
- vi) A situation of Ghadar (Chaos) cropped up and the corrupt elements started playing with the outlets round the year resulting in dry tail reaches of certain channels.

Political intervention helped such elements and promotion of

the chaotic situation when nobody was rendered accountable.

A careful scrutiny of the instructions would reveal that the entire field staff has to be mobilized and redistributed according to work load and importance of work rather than putting everyone under the command of Tehsildars/Magistrates and Assistant Commissioners.

This is a debatable point and may be discussed in a special meeting of the Chief Engineers.

Immediate attention is required so that this issue could be settled during September to better prepare for next Annual Closure.

However my personal views are as under:-

1. Silt clearance should be envisaged after exhausting technical recipe and that too on surveys of September/October. Regarding/remodelling should be preferred over restoration of last designed bed levels.
2. Inescapable participatory silt clearance may be welcome subject to that technical standards are not allowed to eclipse and the out-turn is recorded in the Measure Books alongwith suitable note of non-payment to any contractor.

TRANSMISSION CABLE GOAL: INCREASE CAPACITY

To meet ever-growing challenges of planning, installing, and expanding transmission lines, cable technologists seek better conducting and insulating materials to pass more current at higher voltage

By: Cate Jones, T&D Editor

Solutions explored here for getting more electricity out of equivalent transmission distances include: (1) increasing carrying capacity of existing lines by substituting upgraded cables using newly available materials, (2) using cross-linked polyethylene (XLPE) cables for underground transmission lines, now being qualified at higher and higher voltages, and (3) researching gas-insulated and superconducting technologies for future application.

GOING UNDERGROUND

For applications above 50 kV, overhead transmission lines cost much less to install than underground cables, but are increasingly difficult to site and permit. Consequently, considerable research work is being devoted to finding more cost-effective and efficient concepts. Today, three cable systems are under development as alternatives to overhead lines: synthetic or XLPE-insulated cables, gas-insulated cables, and superconducting cables. As these technologies develop, the likely result will be a range of complementary technologies each suited for a specific set of condition. According to experts in this area, hybrid systems incorporating all or some of these technologies will provide network planner with a greater degree of design flexibility.

QUALIFYING XLPE CABLES

XLPE-insulated cables were introduced in the early 1980s' replacing oil-filled cable of up to 150-kV capacity. Lower costs were the big benefit, but oil-leakage problems were reduced as well. Although oil-filled cable systems have long demonstrated enviable safety and reliability records and extremely low failure rates, designers and selecting XLPE insulation more frequently for high-voltage cables.

There are several advantages to the XLPE cable, compared to oil-filled, including:

- Easy installation on routes with varying altitude.
- Much lower dielectric losses (by a factor of 20).
- Less environmental impact in the event of mechanical damage.

Voltages up to 220 kV are state of the art with XLPE insulated cables. Recently, 400-kV XLPE cables have been developed and have been qualified by several utilities. More recently Siemens Power Cables, Berlin, has received an order for 6.5 km of 400 kV XLPE underground transmission cable that is installed in Berlin in 1997.

In readiness for new underground circuits to be installed in Montreal, Que, Canada, over the next few years, Hydro-Quebec, Montreal, along with three international cable manufacturers Alcatel, Toronto, Ont, Canada, Fujikura, and Pirelli Cables SpA, Milan, Italy have completed a prequalification program on extruded XLPE 345-kV, cables and premolded joints. Proponents claim this technology is simpler to install and operate than the oil/paper-insulation system currently used. Hydro-Quebec has been using polymeric extruded insulation at the 120-kV level since 1989.

An extruded 315-kV cable system that consists of premolded joints is no yet commercially available. Therefore, Hydro-Quebec conducted a series of prequalification tests designed to assess the reliability of the elements of such a system and to verify the cable and junction installation method in manholes. Each of the three manufacturers provided its own cables for the tests and was responsible for installing them at the designated location in the high-voltage laboratory at Institute de Recherche d'Hydro-Quebec (IREQ), Montreal. Three cable loops approximately 150-m long, premolded joints, outdoor terminations, and SF₆

terminations were successfully tested.

Similarly, Centro Electrotecnico Sperimentale Italiano (CESI), Milan, Italy has completed long-term prequalification tests for Bewag, the electric utility for Berlin, Germany, on all components of a 500-kV cable system including cable, sealing ends, and joints developed by Siemens High Voltage Cable System, Berlin.

Application of high-voltage XLPE insulated cables is now being considered in Japan and Canada as a result of the successful qualification of this technology. However, because of the capacitance of the cable, distances of only 20 to 30 km are possible. The high linear capacity of cables with solid insulation limits the distances covered to sections of critical lengths 15 to 20 km at 400 kV above which it is necessary to place reactive power compensator stations. For maximum currents above 2000/amp, the cost of manufacturing cable becomes quite expensive.

FIBEROPTIC MONITORING

Long term reliability of XLPE cables requires that they be operated within the design parameters over the entire length of the cable. Temperature excursions, for example, can result in premature aging of the cable. Both the level of the heat-generating current and the conditions for heat dissipation around the cable are subject to alterations over time.

Temperature is typically measured by the thermocouples

attached at previously selected locations outside the cable, resulting in imprecise temperature data. Errors were inherent in this approach because the measurements were taken in areas where the heat flow was no longer concentrated and where heat dissipation might be uneven as a result of changing levels of moisture in the ground. The hottest point along the cable route could not be identified accurately.

By introducing optical fibres into the shielding of the high-voltage XLPE cable and by using special measuring techniques, Siemens reportedly has developed a way to precisely measure temperature over the entire length of the cable. The temperature-measuring instrument uses optical reflectometry and is controlled by a PC. Both normal and overstressed operating states of the cable can be measured.

Because of the availability of the accurate temperature data, the fiberoptic system can be used to monitor high levels in current transfer, thus allowing the cable to be used to its maximum capacity in the event of an emergency. Temperature distribution measurement over time and place ensures that the critical temperature along the cable route is identified. In this way, a precise computer calculation based on currents and temperatures can be carried out at any time to determine the power reserves available. The temperature and location data can be tracked on screen using a temperature "fingerprint" where

the maximum temperature values and changes over time can be easily recognized.

Temperature measurement using fiber optics may also help locate ground faults quickly. If the optical fiber survives the ground fault and is still functioning, the position of the fault may be identified by the higher temperature at that point. If the optical fiber is destroyed, then the temperature-measuring instrument may establish the point in interruption using reflectometry.

In addition to testing the 400-kV XLPE cable and accessories for Bewag, CESI also confirmed the proper functioning of this innovative temperature monitoring system. Siemens has already installed in Berlin 30 km of 100-kV XLPE cable and accessories with fiber optics. The optical fibers are connected in the joints using readily adapted standard accessories. According to Siemens, the technology can also be applied to gas-insulated, oil-filled, and paper-insulated cables.

GAS-INSULATED LINES

Another alternative that is emerging for high-voltage underground transmission is gas-insulated cable (GIC), especially for power transmission above 2000 MW, voltages ranging upwards of 400 kV, and distances of up to 100 km.

The basic gas-insulated technology has been in use for over 25 years in switchgear, sometimes with long bus ducts. The performance of gas-insulated bus ducts has been

demonstrated up to 550-kV rated voltages and 8000/amp rated current. GEC Alsthom T&D, Villeurbanne, France, for example, installed two 420-kV gas-insulated cables in the Loire Valley in 1981 for Electricité de France (EdF), a utility among those involved in investigating the feasibility of this technology. The three phases used separate ducts with each duct approximately 500 m long. The length of the three phases end-to-end is more than 3 km. Siemens has installed a double 420-kV system with separate ducts for each phase at 600 m in length. These were installed in 1975 at the Cavern powerplant, Wehr, Germany. Both steel and aluminium alloys are used for enclosures. Welding and molding techniques were developed for making appropriate connections.

However, the cost for implementing long runs of GIC is currently prohibitive estimated to be about 15 times that of an overhead transmission line on a per-kilometer basis. Several companies are involved in research aimed at reducing costs for this technology down three to five times that of an overhead line transmitting 2000 MW. Concepts being explored include:

- On-site assembly of modules in mobile, dust-proof workshops.
- Mechanical burying using a digging machine in conjunction with the mobile workshop to minimize the civil works.
- Use of a pipeline-type welded steel tube and related technologies.

- Use of simple subassemblies welded on-site and flexibility to make section of any desired length; however, to minimize the size of the part that may need repair or replacement, the length of these sections has been deliberately limited to 100m.

- Investigating lower-cost gas than SF₆, including gas mixtures.

In the cable design developed by GEC/Alsthom, the conductors of the three phases have cross-sectional areas that are adapted to the current being carried. Conductors are supported inside a steel tube. With such a short space separating them from the steel tube, the magnetic field is strong. To avoid eddy-current losses, the conductors are placed inside an aluminium tube, which acts as a shield. The conductors are held in place by epoxy-resin support insulators. Each support insulator rests on an arm of a non-magnetic metal part at ground potential, integral with the shielding tube. The insulating medium is nitrogen at 12 bar.

THINK HIGH CURRENT, LOW VOLTAGE

Superconductor technology is to electricity transmission as fiber optics are to communications, say some experts. The technology will lead network planners to non-traditional approaches, because it required you to think in terms of current, not voltage, says Mujibar Rahman, chief engineer and vice president of research and development at Pirelli Cables North America, Lexington, SC (USA). Superconductivity promises a reduction in size and weight of cables, and lower electrical losses. A cable carrying more current lower operating costs, provides greater flexibility in system planning, and enables utilities to optimize existing infrastructure and peripheral

components, such as transformers and circuit breakers, states Rahman.

"Conventional copper cables were to be replaced with high-temperature superconductivity (HTSC) power cables, it would be possible, under the same spatial condition, to transmit two to five times the power while reducing electrical losses. In some isolated cases, it would allow system designers to omit the 400-kV transmission level, as a mere 110-kV- would suffice to transmit power of up to 1000 MVA, reports Dr. Heinrich Schindler, Siemens Corporate Research & Development, Erlangen, Germany.

A consortium comprised of Pirelli Cables SpA, Milan, Italy; HTSC supplier American Superconductor Corp (ASC), Westborough, Mass (USA); the Electric Power Research Institute (EPRI), Palo Alto, Calif (USA); and the US Dept of Energy is developing underground HTSC cable technology. The consortium recently developed a record-length HTSC assembly. Pirelli engineer built the flexible 50-m conductor with 5 km of lead-stabilized bismuth strontium calcium copper oxide (or BSCCO) tape supplied by ASC using standard industrial stranding equipment. The tape was wound around a hollow core designed to carry liquid nitrogen.

The conductor met its design target, demonstrating a maximum critical direct current of 1800 amp at 1 microvolt/cm at 77K over its entire length. Field trials of the technology are expected to be conducted in 1999. Rahman predicts a commercial product will be available between 2000 and 2002.

In the Siemens concept,

each of three cores contains coaxially arranged outward and return lines to insure that no

alternating magnetic fields occur in the area surrounding the cable route. Siemens is testing a conductor made with an in-house-developed HTSC material measuring approximately 2 m in length and with a current carrying-capacity of 2000 amp. A field test is planned for 2000, using a prototype cable for 400 MVA at 110-kV.

In Japan, Tokyo Electric Power Co. (Tepco) is heading two separate collaborations to develop cables—one with sumitomo Electric Industries, Osaka, Japan, and one with Furukawa Electric, Chiba, Japan.

Tests on prototype cable systems have been conducted. Because the current capacity of the HTSC cables is much greater, Tepco plans to replace conventional cable up to 500 -kV

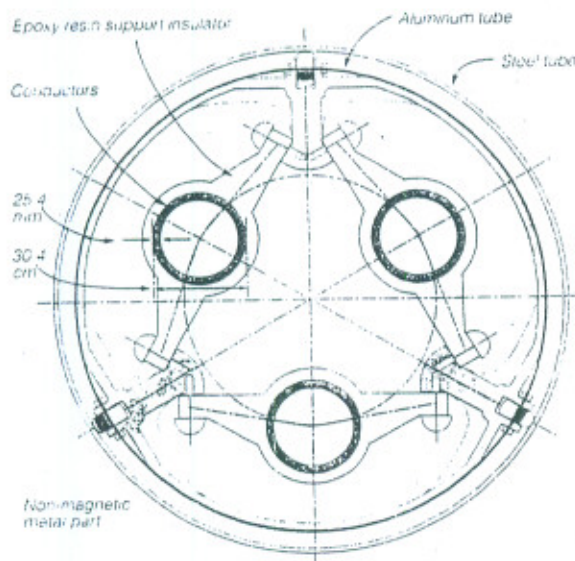
HTSC cables representing transmission capacity of 0.5 to 1 GW.

HIGHER-CAPACITY UNDERSEA CABLES

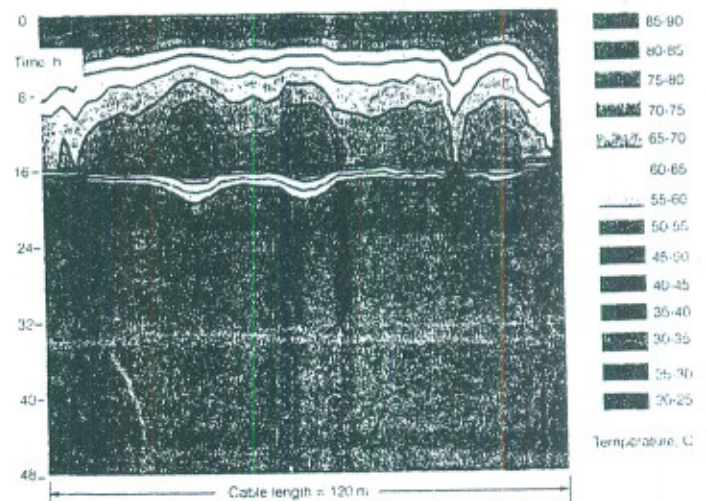
Increasingly ambitious HVDC links are resulting in the cables are based on conventional mass-impregnated or oil-filled cable technologies, ongoing development of

undersea cables. The submarine Record setting cables have been developed and installed over the past few years in the Baltic Cable and Kontek links (Electric Power International, December 1995, p35). The upper limits of mass-impregnated technology has yet to be reached, according to ABB High Voltage Cables, Karlskrona, Sweden. Mass-impregnated cables were used in the record-breaking Baltic Cable. The next record setting project is the Bakun HVDC link.

(Courtesy Electric Power International USA)



Gas-insulated cable is being explored for transmitting power above 2000 MW at 400 kV



Fiber optics integrated into underground cables can provide a way to fingerprint temperature changes over the length of the cable

REGIONAL PROFILE

PACIFIC RIM: AMBITIOUS T&D PROJECTS INCLUDE TWO WORLD RECORD SETTERS

The countries of the Pacific Rim are expanding their electric systems at a furious pace. Much of the work involves getting the power from newly built stations to the load centers, interconnecting with neighbours for economies and flexibility, and pursuing what amounts to rural electrification for far-flung inhabitants. Two projects in Malaysia and Indonesia have world record setting design features.

The government of Malaysia recently announced that an international consortium, ABCCBPO, Kuching, Sarawak, Malaysia, was awarded the contract to build the 2400-MW Bakun hydroelectric project in Sarawak, including the associated 1300-km, high-voltage direct-current (HVDC) transmission facilities to peninsular Malaysia. Most of Bakun's capacity will be transmitted by the HVDC across Sarawak and the South China Sea to peninsular Malaysia. The 670-km sea crossing, when completed, reportedly will be the longest in the world. Three dc peoples, each rated to carry 710 MW, will be used for power transmission at 500 kV. This exceeds the world power and voltages records for HVDC cables currently held by the Baltic Cable transmission link between Germany and Sweden.

In Indonesia, the newest link being planned between Java

and Bali will be a 500-kV overhead power line across the Straits of Bali. Part of the project reportedly will be the design and construction of the tallest transmission tower lines in the world.

The towers will be 295 m tall and weigh 920 t each. The towers will take power to Bali over a 2.5-km-wide shipping lane. In addition to the strain of the cables, the towers must be able to withstand heavy seismic activity and powerful winds from tropical storms.

The crossing will be a single circuit and transfer 200 MVA when operating at 150 kV, rising to 700 MVA when upgraded to 500 kV.

OTHER NOTABLE ACTIVITIES.

YTL Power Generation, one of the newly established private utilities in Malaysia, and Siemens AG's High-Power Transmission & Distribution Group, Erlangen, Germany, supplied the 275-kV switchgear for the Paka and Pasir Gudang projects. Power from these two new combined-cycle plants are fed into national utility Tenaga Nasional Berhad's (TNB) grid through three 275-kV switchgear stations at Paka New, which comprises 13 bays with 13 circuit breakers; Paka Extension, which comprises four bays with two circuit breakers; and Pasir

Gudang, which consists of six bays with three circuit breakers.

The three stations have twin busbars, a type of construction especially suitable for power stations because the generator incoming feeders and the corresponding outgoing feeders occupy only one bay width. Thus, the overall length of the outdoor switchyard is restricted to the length of the power line supported on four 60-t towers to link Paka New to the Paka Extension.

Siemens is also setting up two 500-kV outdoor substations on the west coast of the Malay peninsula. TNB plans to superimpose the 500-kV level over the existing 275-kV transmission system.

System studies for a proposed HVDC link between Malaysia and Thailand have been completed by Teshmont Consultants Inc, Winnipeg, Man, Canada.

Recommendations have been made regarding the converter terminal equipment in each country, telecommunications equipment, and HVDC transmission line. A decision on the project, which is being funded by TNB and the Electricity Generating Authority of Thailand (EGAT), is imminent, according to Teshmont.

An enormous archipelago stretching 5100 km over three time zones, less than half of Indonesia's 13000 islands are inhabited. However, some of the main islands are among the most densely populated locales in the region in particular, the main island Java, where over 60% of all Indonesians live.

In the 1980s, a new 500-kV system was installed in Java linking the west, central, and managed by Merz & McLellan, Newcastle upon Tyne, UK, includes some 700-kV switchgear, and civil works for four 500-kV/150-kV substation, together with a new national control center for the interconnected networks.

To meet the increasing demand for power in Jakarta and West Java, PT. PLN Persero, the national electric utility, has begun implementing several projects to reinforce the transmission and substation network. One of these projects is the Jakarta and West Java Substation and Transmission Lines Project. This project included work on gas-insulated substations (GIS), 150-kV underground cabling, and a total of 20 km of 500-kV and transmission lines. New overhead transmission lines will be constructed in West Java which required obtaining new rights of way (ROWs).

However, no new ROWs for overhead transmission lines are being permitted in Jakarta. Most of the 150-kV lines in Jakarta pass through heavily built-up urban environments, creating survey-access and clearance problems.

Consequently, 5 km of the 150-kV lines will be supported by steel poles instead of the normal lattice-type towers to minimize the land area needed.

PT Multi Fabrindo Gemilang (Multifab), a multi-disciplinary

Indonesian company, won part of this major project. The company selected Australian company Optimal Pacific's (Brisbane, Australia) survey and design software to address critical project requirements, including survey and design through highly congested urban areas, and to provide fast turnaround between design revisions and actual line modifications.

The "point-and-shoot" and data-recording capabilities allow large amounts of data to be gathered very quickly. The data collected are immediately available for overhead line design following data downloading and modelling. The system allowed Multifab to design in three dimensions (3D), essential for this project, with many elevated and off-line obstacles that can violate clearance checks.

Such checks were made interactively in the CAD environment by simply clicking in the conductor and obstacle in question. The 3D modelling capability proved to be an asset for laying out terminal towers and substation entries, and to check conductor mid-span clearance in the slack condition.

Design modifications were made quickly and accurately through the use of electronic data bases, and interactive tools for manipulating structures and testing multiple "what-if" scenarios. Revised drawings were available almost immediately. Data for clearances, sagging, deviation angle, design tension, incline angle, incoming conductor angle, span, wind span, weight span, total chainage, and loading cases with differing temperatures and wind pressure were available for reports as required.

A reliable supply of electricity is essential to Bali to support its main industry, tourism. The first interconnection was

completed in the early 1990s by Persero. The 150-kV undersea cable circuits between Java and Bali were designed to provide a power tensor of 120 MVA each and a secure power supply to Bali from the East Java grid. Because of operational constraints of long transmission lines and voltages stability conditions, the full potential of the cable interconnection could not be realized, thus limiting the circuits to a power transfer of only 65 MW. Also, strong undersea currents and damage caused by ships' anchors have rendered only one cable operational.

Work continues at the precedent-setting Paiton coal-fired power station, where two units began operating in 1994 and several more are being built as independent power stations. Ultimately, eight coal-fired steam units for a total capacity of 4000 MW are planned at paiton. Part of this project required construction of a 500-kV substation, supplied by Cegelec, paris, France and a 150-kV substation supplied by ABB Power T&D Co, Jakarta.

Plans to add up to 840 km of new transmission lines on the island of Sumatra were recently reported. PT PLN Persero and the National Grid Co, Surrey, UK, have agreed to form a joint venture to build, own and operate the new lines. Sumatra, which has a population of 20-million about 10% of Indonesia's total population has a generating capacity of less than 1000 MW, but demand has been growing about 15% annually. The grid additions will include about 540 km of 275-kV lines and 300 km of 150-kV lines and 300 km of 150-kV lines. PLN's existing system of substations will be expanded and several more will be added as part of the joint venture.

(Courtesy Electric Power International USA)

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- Irrigation and hydraulics
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- Geo-technical investigations
- Physical modelling of hydraulic structures
- Dams and hydropower
- Forestry and rural sociology
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- Operation and Maintenance
 - preparation of operation manuals

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62-M Gulberg-III, Lahore. Phones: (042) 5862033, 5837824, 852412, 5860044, 5860055, FAX (042) 5862033.

26-K-II, Model Town, Lahore. Phones: (042) 5867773, 5860870, 5869287, FAX (042) 5869287

PROJECTS

NDC is substantially contributing individually and with Joint Ventures towards economic uplift of the Nation through the following major Projects :

- Marala Ravi Link Canal System Restoration and Improvement Project, 82/2 Block-A Model Town, Lahore, Phones : (042) 5864554-55, FAX (042) 5880289.
- Chashma Right Bank Irrigation Project Stage-III, WAPDA Staff Colony D.I. Khan, Phones : (0529) 740402, 740248, FAX (0529) 740401.
- Swabi SCARP, WAPDA SCARP Colony, Charsadda Road, Mardan, Phones : (0531) 4973, 65827, 83089, FAX (0531) 65890.
- Peshur High Level Canal Project, 2nd Floor Commercial Complex Block-II, Phase V, Hayatabad, Peshawar, Phones : (0521) 812049, FAX (0521) 812164.
- Fordwah Eastern Sadiqia (South) Phase-I Irrigation and Drainage Project Drainage Component, 146-A-1 Township, Lahore, Phones : (042) 5112882, 5116634 FAX (042) 5116635
- Post Flood Rehabilitation and Protection Project, House No.271, St. No.8 Cavalry Ground (Extension), Lahore Cantt. Phones : (042) 6667264, 6669012, FAX (042) 6669013.
- Study for Development of Irrigation Uses in Punjab due to Water Accord, 147-M Gulberg-III, Lahore, Phones: (042) 856288, FAX (042) 5862033
- Zaibi Dam Project, Mitha Khel, District Karak (NWFP), Phone: (05244) 210520 Ext.58.
- Punjab Private Sector Groundwater Development Project, 89/A-1 Township.

CLIENTS

Some of the major Clients are listed below ;

- Ministry of Water and Power, Government of Pakistan, Islamabad.
- Ministry of Defence, Government of Pakistan, Islamabad.
- Pakistan Water and Power Development Authority, Lahore.
- Federal Flood Commission, Government of Pakistan, Islamabad.
- Government of Punjab, Irrigation and Power Department, Lahore.
- Government of NWFP, Irrigation Department, Peshawar.
- Government of Balochistan, Irrigation and Power Department, Quetta.
- Government of Sindh, Irrigation and Power Department, Karachi.