KEY RECOMMENDATIONS
by
PAKISTAN ENGINEERING CONGRESS
on
WORLD WATER DAY
HELD ON 22ND MARCH 2014

Pakistan Engineering Congress celebrated World Water Day on the theme of "WATER AND ENERGY" on 22nd March, 2014. Mian Muhammad Yawar Zaman, Minister for Irrigation, Government of the Punjab was the Chief Guest. Welcome Address was presented by Engr. Iftikhar Ahmad, President Pakistan Engineering Congress. Fourteen (14) papers were presented by eminent Water and Energy resources specialists covering aspects relating to multipurpose development of Surface Water Resources, arresting Global Water Deterioration, Impact of Global Warming on Flows in the Indus and Jhelum Rivers, Snowmelt Metamorphosis vis-à-vis Sediment Loading in Upper Catchment of Rivers, Irrigation-Drainage and Water Logging-Salinity issues etc. It was a very well attended event and was widely covered by News & Electronic Media.

Given below are the recommendations made by the Speakers:-

Recommendations:

Paper : Water Energy Nexus

Author : Dr. Izhar ul Haq

Recommendations:

- Pakistan has 145 MAF of average annual surface flows.
- After river diversions it has still 32 MAF annual flows for future development.
- Pakistan needs to build consensus for storage of water.
- It must store about 20 MAF by building 3 mega storage projects on river Indus.
- The three mega storage projects would help to produce cheap electricity, contain power tariff raise and have cascading effect on d/s projects.
- Pakistan has 60,000 MW of hydropower potential.
- In addition to storage projects, it must build run of the river projects as dozens of sites are available for these.
- Hydropower would be helpful for peaking and meeting daily load variations.

Paper : Water and Energy

Author : Engr. Muhammad Jabbar

Recommendations :

1. Thermal power support cannot entirely be done away with. However, the share of the thermal capacity, based on imported fuel should only be kept to a minimum for as long as practically possible.

2. Diamer-Basha Dam must be started immediately.

3. Immediate steps be taken up to develop a national consensus for the early construction of the Kalabagh dam project.

4. A broad based committee of professional engineers which may be headed by some eminent engineer with political prominence and may include, amongst others, all former WAPDA Chairmen with engineering background, eminent engineers from all the four provinces, particularly with relevant experience and some co-opted core professionals. The committee may take time for a dispassionate review of the whole scheme in a professional manner and convince itself before proceeding to develop a national consensus.

Paper : Water and Energy - Synergic Multi-Purpose Development of Surface Water Resources

Author : Engr. Riaz Nazir Tarar

Recommendations :

i. 'WAPDA's High Priority Hydropower Projects under Phase I' and aggregating to about 17,200 MW should be taken up during the next 2-3 years to enable their completion by 2025.

WAPDA'S HIGH PRIORITY HYDROPOWER PROJECTS (Phase I)

Sr. No.	Project	River	Location	Installed Capacity (MW)	Storage in MAF (Gross/live)	Earliest Initiation	Tentative Project Commissioning
1	Dasu (Stage I)	Indus	KPK	2,160	1.15/0.9	2014	2021
2	Kurram Tangi	Kurram	FATA / KPK	83	1.2/0.9	2014	2019
3	Golen Gol	Chitral	KPK	106	RoR	2011	2016
4	Tarbela 4th Extension	Indus	KPK	1,410	Existing Tarbela Storage	2013	2017
5	Munda	Swat	FATA/ KPK	740	1.3/0.7	2015	2021
6	Kohala	Jhelum	AJK	1,100	RoR	2016	2022
7	Bunji	Indus	GB	7,100	RoR	2018	2025
8	Diamer Basha	Indus	GB	4,500	8.1/6.4	2015	2024
Total				**17,199**	**11.75/8.9**		

ii. Engineering of Phase II hydropower development projects of about 2200 MW should be expedited by the concerned agencies for taking up construction by 2017 – 2018.

PHASE II HYDROPOWER PROJECTS IN PIPELINE

Sr. No.	Hydropower Project	Implementing Agency	Capacity (MW)	Tentative Commissioning
1	Patrind	IPP	147	Apr. 2017
2	Phandar	WAPDA	80	May. 2017
3	Harpo	WAPDA	35	May. 2017
4	Shushghai-Zendoli	SHYDO	144	Nov. 2017
5	Sharmai	SHYDO	150	Nov. 2017
6	Matlitan	SHYDO	84	Dec. 2017
7	Shogo-sin	SHYDO	132	Dec. 2017
8	Gulpur (Poonch River)	PPIB	100	Dec. 2017
9	Keyal Khwar	WAPDA	122	May. 2018
10	Lower Palas Valley	WAPDA	665	May. 2018
11	Basho	WAPDA	28	May. 2018
12	Lower Spat Gah	WAPDA	496	Jun. 2018
13	**Total (1 to 12)**		**2183**	

iii. IPPs with aggregate capacity of over 3,800 MW, under tariff negotiations and processing with PPIB, be expedited with aim of their completion by 2025.

iv. Fully engineered and approved Diamer Basha Dam Project should be immediately launched for completion before 2025. As interim, due to non-commitment of foreign funding, core project launching be initiated by starting construction of 'Dams and Appurtenants' through own resources. This will convey firm commitment of GoP towards project implementation and attract interested international donors for funding hydropower generation facilities.

Paper : Studies on Snowmelt Metamorphosis vis-a-vis Sediment Loading in Upper Catchments

Author : Engr. Usman-e-Ghani

Recommendations :

The recent trends of variation in flows in the Indus Basin, particularly in the basin tributaries, indicate wide inconsistencies in contrast to the predicted forecasts by the various agencies. This has necessitated the possibility of review in the operational criteria for operations at various controls downstream, and also for the further fine-tunings of such operations, so as to ultimately develop still a better premise of operation for effective sediment load management at all the projects / works.

It would also be important to bear that our current major reservoirs, i.e. Tarbela, Mangla and Chasma, the lives of which stand as our important concern, were built as a matter of fact as a replacement work to augment the flows of Eastern Rivers, i.e. Ravi, Sutlej and Beas, which were lost by Pakistan on signing of Indus Waters Treaty in 1960. Hence the significance of these projects for the national economy of Pakistan, and also for the food security, simply cannot be overemphasized. Their vitality is not pertinent only for the rivers upon which they have been built but also for agriculture in the basin with the command areas spreading over several millions of acres.

The optimum project management, therefore, runs as essential requirement in overall national water resource management scenario asking for the level of expertise, analyses and operation higher than the usual so as to add more lives to the projects instead, particularly when the three western basins now also have an additional role to support the three Eastern Basins which have been lost.

The subject of this paper, i.e. Studies on Snowmelt Metamorphosis vis-a-vis Sediment Loading in Upper Catchments, is thus a critical one. The sediment that gets entered into the reservoirs has a direct relation with rain-fed and snow-fed part of the incoming water and would certainly be more and more understandable with the deeper insight to their respective shares of total sediment load. The results of such studies could then be used for objective planning by running the detailed analyses of the sediment load that enters the reservoir each year. With the reliability of forecast once established, the required assessment would not be much difficult to continue.

Conjunct with the flow analyses as has been highlighted above, the modeling of the load pattern would give the operators of the projects an additional aid to endeavour for more proficient reservoir management. The impact would not just be limited to reservoir management aspects of the projects but would also be extended for the prolonged life of power turbines in view of the available forecast of the loading patterns. A well-conceived/developed set of the studies or the analyses by the relevant experts, which are required to be undertaken to this effect, would remain to be the most significant part in the whole effort.

The discussion above could be taken as indicative of some possible reliance upon the currently available tools and models in this particular field of analyses and management. However, the necessity of a lot more in the same line should be taken as obvious too.

Paper : Impact of Global Warming on Flows in the River Indus and the River Jhelum in Pakistan

Author : Ishtiaq Hassan, Abdul Razzaq Ghumman, Hashim Nisar Hashmi

Recommendations :

The time series analysis of the two important rivers (Indus, and Jhelum) of Pakistan indicates that the inflows have increased overall during the base period. The pattern of hydrograph for river inflows has remained almost the same in time series analysis. It is also concluded that the increase is not continuous but there do occur increases as well as decreases in the inflows. It means that effects of changes in global warming have experienced more increases at one time and less increases at other time. The flow modeling of the river Indus at Tarbela and the river Jhelum at Mangla by using IHACRES modeling software has shown average increases of approximately 21.07% in river Indus at Tarbela and 22.50% in river Jhelum at Mangla by the end of 21st century. These increases are positive signs of increases in water resources of Pakistan. There is need to develop more water storage reservoirs at various locations on the courses of these rivers to fulfill irrigation and power demands of the country.

Paper : Irrigation-Drainage and Waterlogging-Salinity Issues in Lower Indus and the Possible Solutions

Author : Dr. Muhammad Basharat, Dilbar Hassan, Engr. Akbar Ali Bajkani and S. Javed Sultan

Recommendations :

- For the assessment of optimum groundwater development potential for different areas in Lower Indus, a fresh survey of depth wise groundwater quality is urgently needed to ascertain and enact conjunctive water management potential.

- Rethink on drainage coefficient/requirement for different areas and redesign/rehabilitate drainage system to provide 8-10 ft cushion for avoiding waterlogging and providing excess rainfall storage, to avoid rainfall flooding, as observed in 2011.

- Fresh assessment of crop water demand, simultaneously keeping in view the drainage quantum and groundwater use potential needs to be accomplished for each canal command, as the groundwater quality varies drastically in different areas. This would help in developing 8-10 ft cushion for avoiding waterlogging and providing excess rainfall storage and avoid flooding. For promoting conjunctive use of canal and groundwater, further needed steps will be as under:
    - Reallocation/Rationalization of canal water supplies
    - In irrigated areas with deep fresh groundwater-canal supplies be reduced;
    - In areas with shallow fresh groundwater, skimming wells need to be promoted;

- Practical demonstration to the farmers regarding possibility of growing paddy with less water and thereby provide optimum moisture content for Rabi crops, especially the wheat crop is the need of the hour. This will help in changing the mindset of the farmer regarding misconception of over irrigation;

- Irrigation and drainage infrastructure improvement is urgently needed, including rehabilitation of irrigation channels profile and sections according to the design.

- Eradication of corruption in operation and maintenance of the irrigation and drainage system and thereby improve the equity of water distribution to the farmers; and

- For achieving the last two objectives, capacity building of the irrigation department, both technical and managerial, along with feeling the responsibility of the job is necessary. For this, overall improvement in governance in the province is a first and foremost requirement. Otherwise achieving the end goal cannot even be imagined.

Paper : Last Opportunity to protect Groundwater Deterioration in Lower Bari Doab Canal

Author : Dr. Muhammad Nawaz Bhutta

Recommendations :

The way forward to continue to address groundwater deterioration in LBDC in particular and in Punjab in general is to:

i. Take the opportunity to introduce groundwater management to avoid the catastrophic collapse of LDBC's agricultural economy.

ii. Canal water supplies should be ensured to design level and groundwater pumpage should be restricted.

iii. Establish a Groundwater Cell to work with the LBDC Area Water Board (AWB).

iv. Continue to develop the groundwater capability of PID and PIDA staff

v. Utilize the database/GIS/modeling tools to upgrade groundwater monitoring and evaluation.

vi. Adopt rules and regulations to protect groundwater from deterioration.

Paper : Minimum Flows for Hydropower and Dam Projects

Author : Engr. Kamran Yousaf Kazi, (NESPAK)

Co-Authors : Imran-ul-Haq, Prinicpal Engineer (NESPAK) & Fatima Hashmi, Environmentalist (NESPAK)

Recommendations :
The Alborz dam (Iran) will alter the natural flow regime of Babol River. One of the greatest benefits of the dam and the required $1m^3$/sec minimum flow is that zero flow days or months will cease to exist, which were otherwise part of the natural flow regime of Babol River. Continuous flow of water will ensure that some measure of ecological integrity will remain downstream of the dam.

Water quality in the river is largely a function of human development in the Alborz Basin as the modeled results indicated. Even with the dam and its subsequent reduced flows, the model showed normal DO values except in the reach that is subjected to industrial effluents.

Modeling the impact of minimum flows in this study is a first step in the direction of sustainable engineering. While the larger question of whether this minimum flow is '*suitable'* for maintaining ecological integrity still remains to be studied, as a first step this study was imperative towards quantitatively understanding how changes in the natural flow regime affect river morphology and water quality. The next step would be to assess how the riverine and flood plain ecosystem would react and respond to such a minimum flow and subsequent changes in channel morphology and water quality.

Paper : Water Resources Development in Pakistan – A Revisit of Past Studies

Author : Engr. Abdul Khaliq Khan

Recommendations :
- Pakistan should be building at least one reservoir for storage of about 6 MAF of water every decade to maintain its carry over storage capability and regain the storage lost to sedimentation.

- The priority should be given to the construction of Diamer Basha, Kurram Tangi and Munda dams as well as Dasu Hydropower Project.

- Planning should start to build carry over reservoirs. A revised scheme of dam on Soan River with its reservoir to be fed from Akhori Dam should be considered.

- During canal closure months of December and January the Mangla and Tarbela dams are not allowed to produce power to their capacities. Re-regulating storage projects should be studied to be constructed at Jhelum and Indus rivers downstream of these two dams.

- Criteria of selection for ranking of hydropower projects should be developed which could consider factors like urgency of need, national demand, provincial preferences, capital

cost, economic analysis of the project and remoteness of the site. The Planning Commission of Pakistan should prepare standard criteria in consultation with all provincial governments.

- Water conservation measures need to be adopted through the use of high efficiency irrigation systems.

- Using improved agricultural practices increase the rate of agricultural produce which should outrun the growth of population.

- Country-wide studies to define the specific crop water requirements of lands in various districts in the country should be carried out.

- Judicious use of groundwater should be ensured by urgently adopting strict regulation measures.

- A spinal drain to dispose-off saline effluent of southern areas of Punjab into the Arabian Sea should be planned.

Paper : Nuclear Desalination Demonstration Plant (Nddp) at Kanupp Co-Production of Water and Energy – A Dual Purpose Nuclear Power Plant

Author : Engr. Ahsan Ullah Khan.

Recommendations :
The milestone achieved in producing fresh, clean and drinking water using nuclear energy source has been doable through indigenous efforts of Pakistan Atomic Energy Commission engineers. PAEC has again taken the lead in another specific areas i.e., sea water desalination.

Benefiting the people of Pakistan in various fields has always been motive of PAEC engineers and scientist not only in the energy sector but it is also pursuing numerous programs in the field of Basic and Applied Sciences, Food, Agriculture and Biotechnology and Human Health.

In forthcoming era the visions of using nuclear energy for dual purpose and producing potable water on large-scale have become priority since it is the need of time, attractive, technically feasible, economical and safe alternative to fossil energy options. Nuclear desalination is generally very cost-competitive with using fossil fuels.

Paper : Water Footprints of Bottled Water in Pakistan

Author : Asad Sarwar Qureshi, Atif Nawaz

Recommendations :
In Pakistan, bottled water industries are growing rapidly in current years and would follow the same trend in future. It is estimated that to produce one litre of bottled water, we need 15.44 litres of water. The most of the water is consumed in material production and processes whereas only 6.5 percent goes to actual water. More than 90% of the cost paid by the consumers actually goes to material manufacturing and processes involved in bottle making. It is estimated that the bottled water consumption in Pakistan will increase to 500 million litres (7.7 million cubic meters) by 2025. Most of the water used in this industry comes from groundwater. With the declining groundwater tables and deteriorating groundwater quality, it can be a serious challenge to meet this demand. Energy required to pump this much groundwater would be another problem in future.

Like any other industrial activity, bottled water is not completely innocuous to the environment. On the one hand, quality standards and controls as well as spring protection could help better

protecting water quality at a larger scale. The choice of packaging materials should increasingly consider environmental parameters. The manufacturing, recycling or incinerating bottles of water implies energy needs and some outlets in air and water of polluting particles. Transporting bottled water throughout the world also implies energy needs as well as fuel combustion. Therefore government should promote safe drinking water through taps to discourage the use of bottled water

Paper : Solar Energy in Pakistan – Potential, Current Status and Future Prospects

Author : Irfan Yousuf and Syed Aqeel Hussain Jafri

Recommendations :
Solar energy is one of the most promising renewable energy resources in Pakistan. Its abundant availability and country being blessed with such a huge resource give an opportunity to tap this energy resource to meet energy needs of the country. Solar energy has wider applications which are required to be promoted in different traits of life. Pakistan being energy deficit and energy starved must have to look for alternate solutions for meeting energy needs and solar energy applications come out to be potentially and technically viable for that purpose. The barriers identified in this paper are required to be addressed enabling the sector flourished and solar energy applications being deployed for various uses

Paper : Water and Energy Efficiency Potential in the Textile sector with Best Water Management Practices (BWMPs) in Pakistan

Author : Mr. Sohail Ali Naqvi, Mr. Ali Hasnain Sayed and Ms. Saba Dar

Recommendations :
There is much potential in the textile sector for the water and energy conservation. From the above discussion, it is concluded that the major portion of the water is wasted by the ignorance and unawareness of the workers. The summary of the above techniques is as under:

- The industry usually uses around 5% of total water consumption for showering in cyclones to capture fly ash from the exhaust flue gases. This water could be conserved by reusing of Reverse Osmosis (RO) rejected water.

- The progressive Industry uses around 1.5—1.8% of fresh ground water in thermal oil recirculation pump cooling. Industry should store this water in a pit and reuse in utility area.

- Properly handling the chemicals could save the chemical consumption as well as the water consumption by separating the chemical drains from the other drains.

- By the installation of counter current flow washing, industry can save about 50-60 % of water used in the conventional system.

- By the installation of heat exchangers and reuse of heat recovered in different processes.

- Reuse of Mercerization 2nd and 3rd Wash Water Streams for Preparing Scouring Bath could save 8-10% of the caustic soda consumption as well as reduction of the water and energy.

If we implement all the above techniques for water saving, so roughly about 30% water could be saved in each industry by only small amount of capital cost.

There are many other BWMPs (Best Water Management Practices) which could be adopted by the industry and it could save its water and energy by simple techniques. Some of these techniques are as below:

- Installation of water dye tray in the printing table

- Use of soft water in the dyeing
- Use of Hydrogen Peroxide for Bleaching instead of Sodium Hypochlorite
- Reuse of Jigger Dyeing Last Rinse Water for Makeup of Dye Bath
- Use of Solomatic Bleaching

Paper : An Overview of Ground Water Recharge Potential in Irrigated Areas of Punjab and Khyber PakhtoonKhwah

Author : Engr. Muhammad Saeed, Engr. Syed Javed Sultan, Engr. Asim Saeed Malik, Muhammad Mumtaz

Recommendations :
To meet the challenge of irrigation water shortage, suitable surface and groundwater management techniques should be adopted by the farmers.

Programmes of artificial recharge to groundwater are immediately required to undertake the highly depleted areas throughout the country and it should be managed during the flood season. In shallow groundwater areas, surface irrigation water allowance may be decreased to compensate the highly depleted areas by increasing surface water allowance.

An integrated programme should be formulated and implemented in depleted command areas for effective utilization of available water as well as developed infrastructure to recharge to groundwater.