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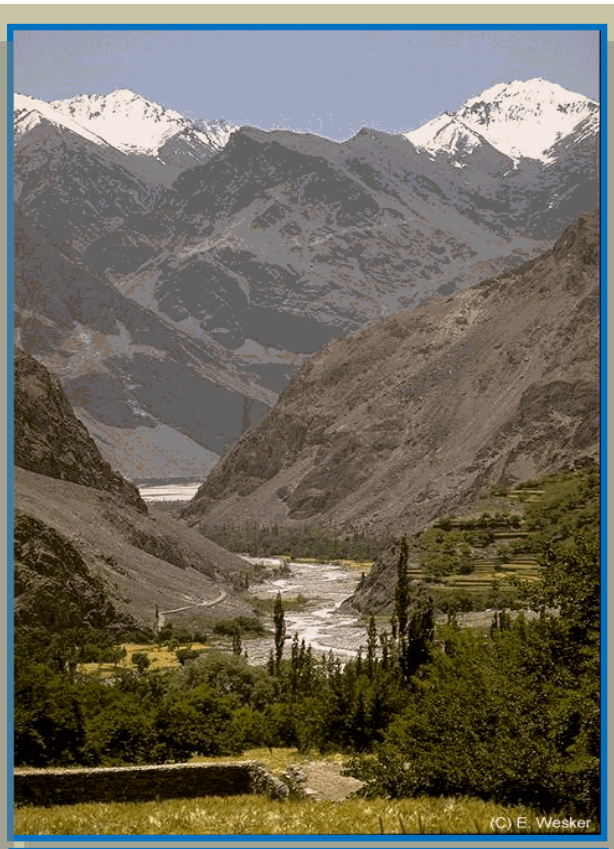
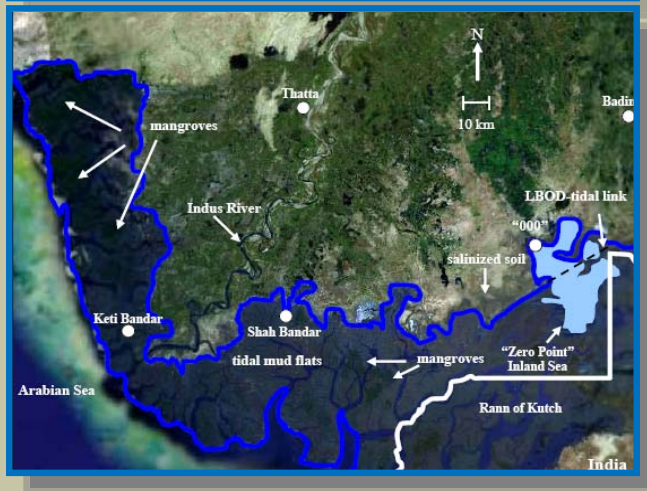
Pakistan Water Apportionment Accord for Resolving Inter-provincial Water Conflicts – Policy Issues and Options





BALOCHISTAN PARTNERSHIPS FOR SUSTAINABLE DEVELOPMENT

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PAKISTAN WATER APPORTIONMENT ACCORD FOR RESOLVING INTER-PROVINCIAL WATER CONFLICTS – POLICY ISSUES AND OPTIONS

1. THE CONTEXT

Key question is of ensuring equitable distribution of water among the provinces, AJK and Gilgit-Baltistan. This requires an integrated approach that would go far beyond the issue of how many large dams should be built in what order of priority and where they should be located. Indus and its tributaries enter the plains at locations known as '**rim stations**' where water is stored, measured and diverted into an extensive network of canals supplying water to Indus basin irrigated agriculture in the provinces (**Figure 1**). The major part of the system is in Punjab followed by Sindh, NWFP and Balochistan.

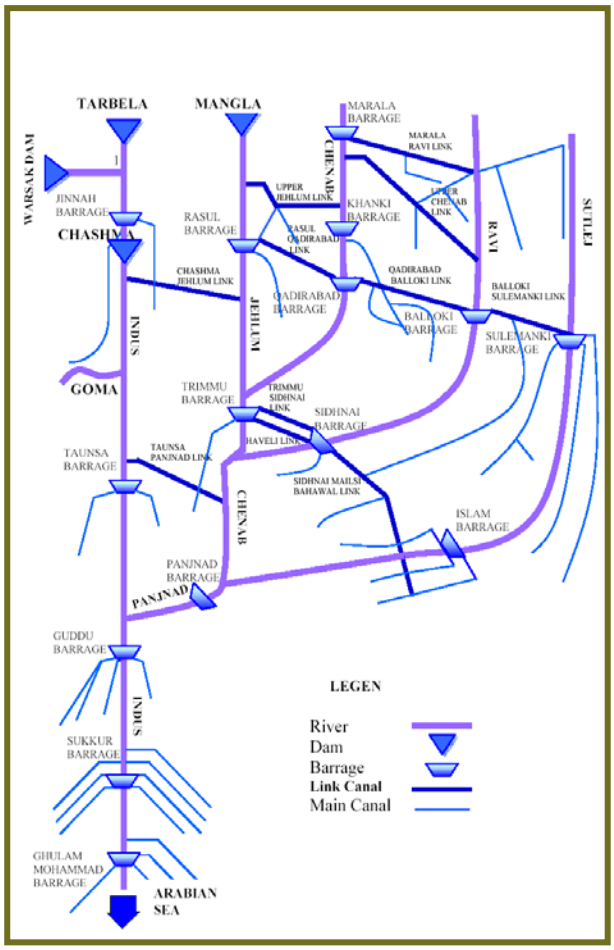

Figure 1. Indus Basin Irrigation System

Water conflicts between provinces date back a hundred years. They are an example of classic upstream-downstream rivalry. Water was allocated among provinces on an annual ad hoc basis until March 1991 when a final agreement was reached for Pakistan Water Apportionment Accord signed by the Chief Ministers of provinces. Despite this agreement, there have been growing conflicts between the provinces over the use of Indus-Pakistan waters during droughts, when provinces have to share shortages. The conflict arises on the interpretation of the clauses of the Accord between the provinces.

Major water conflicts are between Punjab and Sindh regarding the division of water and sharing of shortages as per water entitlements. Sindh as a lower riparian has historic conflicts with Punjab. There are water conflicts between Sindh and Balochistan regarding availability of water as per entitlements of Balochistan being the lower riparian of Sindh on Khirther and Pat Feeder Canals.

There is clear evidence that whatsoever is the situation and whosoever is located at the upstream, the upper riparian have the tendency to behave to take the larger share of water in times of shortage and have difficulty in accepting the rights of lower riparian in sharing the water shortages equitably.

One thing is very clear that water distribution is a concern during period of shortages, whereas during period of excess the lower riparian will receive most of the floodwater. Lower riparian is in fact a victim in both the extremes. Lower riparian also receive all sorts of effluents, which affect the bio-diversity and ecology of the area.

2. WATER ENTITLEMENTS AND WATER APPORTIONMENT ACCORD

2.1. Disputes on Water Entitlements

Inter-provincial disputes, particularly between Punjab and Sindh, considerably pre-date the creation of Pakistan. Pre-partition attempts by Punjab to construct irrigation infrastructure on the Indus were opposed by Sindh. In 1945 the British imposed a solution on the two provinces, which gave priority to Sindh's right to receive water from the Indus. No further sharing arrangement was made upon partition, so the British formula remained in force and was followed until 1970. Thereafter the federal government began allocating water on an adhoc basis: in the opinion of Sindh this decision favoured Punjab. Disputes between provinces continued because Sindh is of the opinion that the perceived pro-Punjab bias in allocations, and because of the impact of water infrastructure construction on the smaller provinces adversely affected the Sindh's rights on Indus water. Numerous commissions were formed to resolve these issues but failed to reach agreement – until 1991.

2.2. Water Apportionment Accord

Purpose of the Accord

Surface water and hydropower developments in the IBIS after commissioning the Tarbela Dam, under the Indus Basin Project in 1977, were almost ceased due to lack of resolution of the inter-provincial water disputes. The country has witnessed long crisis of canal water supplies and hydro-power generation before reaching any consensus.

Load-shedding and irregular canal water supplies due to variability in river flows were observed during the dispute period and even being witnessed today by the country. An inter-provincial agreement was essential to resolve the outstanding dispute of canal water entitlements, entitlements of future river supplies and distribution of surplus floodwater or additional supplies available from the construction of new storages.

Pakistan Water Apportionment Accord[1] was

1 The extract of the Pakistan Water Apportionment Accord signed during March 1991 by the Chief Ministers of the four provinces is reproduced as under:

1. There was an agreement that the issue relating to Apportionment of the Waters of the Indus River System should be settled as quickly as possible;
2. In the light of the accepted water distributional principles the following apportionment was agreed to 55.94, 48.76, 5.78 and 3.87 MAF for Punjab, Sindh, NWFP and Balochistan, respectively. In addition to the 3.0 MAF are allocated for civil canal in upstream areas of the rim stations in NWFP.
3. NWFP/Balochistan Projects which are under execution have been provided their authorised quota of water as existing uses;
4. Balance river supplies (including flood supplies and future storages) shall be distributed as per agreed distribution formula of 37% each for Punjab and Sindh, 14% for NWFP and 12% for Balochistan.
5. Industrial and Urban Water supplies for Metropolitan city, for which there were sanctioned allocations will be accorded priority;
6. The need for storages, wherever feasible on the Indus and other rivers was admitted and recognised by the participants for planned future agricultural development;
7. The need for certain minimum escapage to sea, below Korti, to check sea intrusion was recognised. Sindh held the view, that the optimum level was 10 MAF (1.2 km^3), which was discussed at length, while other studies indicated lower/higher figures. It was, therefore, decided that further studies would be undertaken to establish the minimal escapage needs downstream Kotri. These studies were undertaken during the current decade by the previous government on all Pakistan basis including the below Kotri requirements;
8. There would be no restrictions on the provinces to undertake new projects within their agreed shares;
9. No restrictions are placed on small schemes not exceeding 5000 acres (2000 ha) above elevation of 1200 ft;
10. No restrictions are placed on developing irrigation uses in the Kurram/Gomal/Kohat basins, so long as these do not adversely affect the existing uses on these rivers;
11. There are no restrictions on Balochistan, to develop the water resources of the Indus right bank tributaries, flowing through its area;

signed in 1991 (GOP 1991) for the distribution of water of the IBIS as Canal Water Entitlements between the provinces. The important features of the Accord are that it: a) protects the existing uses of canal water in each of the province; and b) apportions the balance of river supplies, including flood surpluses and additional supplies from the future storages among the provinces.

Limitations of the Accord

Accord allowed for a minimum flow of water into the sea, and shared the remainder between provinces. In this way, the Accord allowed for erratic flow of water in the Indus, and ensured that all provinces gained from surpluses or lost from shortages in supply. The distribution of water agreed for different provinces includes: a) Punjab 69.03 km^3 (55.94 MAF); b) Sindh 60.17 km^3 (48.76 MAF); NWFP 7.13 km^3 (5.78 MAF) (+ 3.00 MAF from un-gauged canals above the rim stations); and d) Balochistan 4.78 km^3 (3.87 MAF). The balance river supplies (including flood waters and future storage) were to be distributed as per formulae of: a) Punjab and Sindh each of 37%; b) NWFP 14%; and c) Balochistan 12%. Total water allocations made to the provinces are 141.11 km^3 (114.35 MAF) (+ 3.00 MAF above the rim stations). The issues related to the Accord are:

- Annual river flows of the western rivers vary from 112.5 to 231.6 km^3 (91.2 to 187.7 MAF) during 1937-07. Mean annual river flows at 50% probability comes to 168 km^3 (136.1 MAF). When the river flows are less than water allocations based on canal diversions as given in the Accord of 141.11 km^3 (114.35 MAF) by about 17% of probability of exceedence.
- All river flows can't be diverted to the canals because there are minimum flows to be delivered below Kotri of 12.34 km^3 (10 MAF). There is only 50% probability that allocated waters can be diverted to canals if flows are uniformly distributed. In reality there is 50% probability to divert 130 km^3 (105 MAF) to the canals. Thus in most of the years, provinces will be receiving less than allocated water. This has created problems among the lower riparian when they have to share shortages because there is general feeling that they are not receiving their due share as per Accord.
- Accord allocations will not be available to the provinces and they should be mentally ready to share the shortages in almost every year.

In May 1994, the Punjab government again proposed a revision of the ten-daily figures to base this on historical use. An Inter-Ministerial Committee reached consensus on this arrangement, but decision was challenged in the courts which upheld the arrangement as per Accord. In practice, however, the smaller provinces especially Sindh accuse Punjab of using its 'upstream' position and control of water infrastructure to implement sharing on the basis of historic uses.

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12. The requirement of LBOD will be met out of the flood supplies in accordance with the agreed sharing formula;
13. For the implementation of this accord, the need to establish an Indus River System Authority (IRSA) was recognised and accepted. It would have headquarters at Lahore and would have representation from all the four provinces. The headquarters were later on shifted to Islamabad;
    a) The system-wise allocation will be worked out separately, on ten daily basis and will be attached with this agreement as part and parcel of it;
    b) The record of actual average system uses for the period 1977-82, would form the guideline for developing a future regulation pattern. These ten daily uses would be adjusted pro-rata to correspond to the indicated seasonal allocations of the different canal systems and would form the basis for sharing shortages and surpluses on all Pakistan basis;
    c) The existing reservoirs would be operated with priority for the irrigation uses of the provinces;
    d) The provinces will have the freedom within their allocations to modify system-wise and period-wise uses; and
    e) All efforts would be made to avoid wastages. Any surpluses may be used by another province, but this would not establish any rights to such uses. This is one of the issues, which needs further analysis considering water as a finite and limiting resource.

Issues in Implementation of the Accord

Formula for water distribution as per Accord was based on ten-daily average use, system-wise and seasonally (Kharif and Rabi) adjusted figures provided by the provinces. The Council of Common Interests (CCI) met in September 1991, six months after the Accord was signed, to agree the ten-daily average water use. Punjab was of the opinion to use the figures of 'historic use' during 1977-82, the period during which adhoc allocations by the federal government had favoured Punjab as per opinion of the Sindh. This proposal was opposed by the smaller provinces, and rejected by the CCI.

In May 1994, the Punjab Government again proposed a revision of the ten-daily figures to be based on historical use. The smaller provinces accuse Punjab of using its upstream position and control of water infrastructure to implement sharing on the basis of historic use. Sindh in particular contends that it has received less water than its entitlement under the 1991 Accord. It says that the reduced flow is insufficient to meet minimum requirement for inflow to the sea; seawater now comes up to 100 km inland. This resulted into increased salinization of agricultural lands in lower Sindh, with subsequent adverse effects on ecosystems, soil quality and deterioration in the quality of water supply to Karachi (both due to increased salinity and increased concentrations of pollutants) causing health problems. Another problem is the shrinking of mangrove forest, which is dependent on fresh water supplies. Once the sixth largest in the world, this has reduced in size by 38% between 1977 to 1990 due to water issues and excessive cutting. The livelihood of thousands of people who depend on the mangrove forests is threatened.

In short, despite the Accord, there are significant disputes between the provinces over the current distribution of water.

2.3. Pakistan's Water Crisis

Inter-provincial disputes are taking place against a backdrop of severe water crisis for the country. Pakistan is predominantly an arid country, receiving an average rainfall of 278 mm per annum. The rising population means per capita water availability has fallen dramatically: from 5,000 m^3 per person in 1947, to 1,080 m^3 per person during 2010. This makes Pakistan as water-stressed country. Pakistan's dependence on IBIS makes it particularly vulnerable. Unlike other countries with multiple river systems, Pakistan has no alternatives to draw on if Indus supplies fall short. There are no new water sources that can be mobilized to meet increasing demands. Increasing abstractions of groundwater by around 1.0 million tubewells, has depleted fresh groundwater supplies and now abstractions are being made in marginal to brackish zones. Balochistan farmers are now drilling tubewells beyond 250 m to access water. The quality of Indus water supply is also deteriorating: salinity is a major problem, as 12 million tons of salts are being added to the IBIS per annum. Excessive and indiscriminate use of chemicals (fertilizers and pesticides) is also affected surface and groundwater. Urban and industrial effluents are being discharged into freshwater. Sedimentation in the IBIS means rising water levels in rivers and canals, leading to the danger of floods.

While there have been huge investments in new water infrastructure, the deferred maintenance of assets means that much of this is in very poor condition, especially the secondary level canal irrigation system. The quality of new project implementation has fallen. Irrigation efficiency is

Already, millions of people in urban centres like Karachi, and in large parts of provinces, suffer from severe water shortages. As Pakistan's population, particularly in urban areas, expands there will be more demand for water for non-agricultural purposes. This raises genuine danger of extreme water scarcity. It is estimated that Quetta will run out of potable water within next 15 years and water conflicts will be on the rise. Pakistan needs to act quickly to avert its severe water crisis.

41.5% that means 58.5% of water is being lost in the transit but it recharge the aquifer. The loss although is recovered from groundwater abstractions but energy is also a concern in irrigated agriculture, which poses serious concerns on the profitability of agriculture. Furthermore, loss of surface water to the aquifer in poor quality zone can't be retrieved in the quality context and also causing waterlogging and salinity.

The Dam Debate

The Government of Pakistan argues that it has to increase the country's water storage capacity, through the construction of large dams to tackle the water crisis. These would have the added benefit of generating electric power thereby helping meet country's expanding power needs. Among the dams being planned by the government as part of its strategy of dam construction to address water shortages and generate power are: Diamer-Basha, Akhori, Kuram Tangi and Munda. There is considerable opposition to the government's dam construction strategy, and specifically to the proposal to construct the Kalabagh Dam.

The Kalabagh Dam is to be built on Indus Main at Kalabagh in Mianwali district, on the border between NWFP and Punjab. The Government estimates that construction will take 10-12 years, and will generate 35,000 jobs as well as 3,600 MW of hydro-electric power. Punjab sees the dam as vital to increase agricultural and industrial productivity, and argues that it would prevent 'wastage' of water flowing into the Arabian Sea. According to WAPDA, total cultivable land to be permanently submerged by the dam will be 14,000 ha. Independent estimates put the figure as high as 74,000 ha. Note that neither figure takes into account lands that would be inundated in a flood, or from rising river levels above the dam. There are also differences between WAPDA and other sources' estimates about the number of people who will be displaced by the dam: 83,000 versus over 100,000, respectively.

In a system with variable water supply such as the Indus, storage capacity is needed to regulate water supply ensuring that surpluses are not wasted and there is sufficient water to meet needs in times of shortage. Pakistan's water storage capacity is currently very limited. Both USA and Australia have over 5,000 m^3 of storage capacity per person; China has 2,200 m^3; Pakistan is way behind with just 137 m^3 of storage capacity per person. Even the dams that have been built in Pakistan are dwarfed by those in other semi-arid countries. In the US, dam on the Colorado River can hold 900 days of average flows. India can store between 120 and 220 days river flow, but Pakistan can store only 30 days of river flows.

Provincial Opposition for Construction of Dams

The proposal to construct Kalabagh dam was first put forward by General Zia-ul-Haq in 1984. Since then it has been the subject of almost continuous inter-provincial dispute, with Punjab on one side supporting construction and rest of the provinces on the other side, vehemently opposed. In NWFP the fear is not of diminished water supply, since the dam will be downstream, but of the environmental and physical impact of the dam itself on the surrounding areas. The permanently submerged cultivable land and displaced people was given the estimate of 100,000 displaced is endorsed by the NWFP Government. There is considerable skepticism about federal promises to recompense those affected and resettle them. The threat of flooding of the fertile Nowshera Valley and city (with a population of 200,000) is also taken very seriously in NWFP. Should this happen it would destroy the economic backbone of the province.

The Kalabagh Dam will generate hydro-electric power. The normal procedure is for royalties for power generation to go to the province where they originated. In NWFP there are concerns that the province will be denied royalties because of the dam's location on the Punjab-NWFP border and because of plans to position the dam's turbines in Punjab. Both the Punjab and federal governments have given assurances this will not happen.

Three smaller provinces have been unequivocal in voicing their opposition to the Kalabagh Dam proposal. All three Provincial Assemblies have passed resolutions rejecting Kalabagh Dam. There have been numerous demonstrations against the government's plans. Sindh former Chief Minister described the dam project as 'technically unviable and politically impossible'. Interestingly, the mainstream parties have been more reticent on the issue, no doubt concerned about losing support in pro-dam Punjab. Government attempts to promote dialogue and consensus-building on the dam's construction appear to have had the opposite effect of catalyzing opposition to it. The current government also maintained the policy of not constructing any dam without national consensus.

In Balochistan opposition stems from the fear that the province's water supply will be diminished by construction of Kalabagh Dam, but even more from the perception that it favours Punjab. In other words, the dam is seen in the wider context of Balochi resentment at their treatment by the federal government, which they equate with Punjab. In Sindh, by contrast, the opposition is very much focused on the direct impact of the dam's construction. The fear is that the detrimental consequences of diminished water supply already experienced by the province inflow of seawater, loss of agricultural land to desertification, loss of livelihoods, shrinking of the mangrove forests, deterioration in water quality and health problems will be exacerbated. The proposed construction of a new canal on the left bank of the Indus, to take water to the Rasul-Qadirabad area of Punjab and increase its agricultural potential, is seen by Sindhis as a further indication that they will get less water if the dam goes ahead. Assurances by former President, Prime Minister and other national leaders that Sindh will get its fair share of water after Kalabagh Dam were not accepted. Sindh is of the view that the federal government failed to give them their due share under the Accord. As in Balochistan, the dam issue is also viewed in Sindh through the wider lens of minority province resentment at federal-Punjab domination.

Current Status of Basha Dam

In December 2005, former President General (Rtd) Pervaiz Musharraf made 'unilateral' announcement that construction of Kalabagh Dam would go ahead. However, following strong opposition from Sindh, NWFP and Balochistan, the plan has been postponed. Instead the government has initiated construction of the Diamer-Basha Dam in Gilgit-Baltistan. The site for the Basha Dam is in Diamer, some 314 kms upstream of Tarbela. With an estimated capacity of 9.0 km^3 (7.3 MAF), it is expected to generate 3,360 MW of power. In April 2006, former President General (Rtd) Pervaiz Musharraf laid the foundation for what the government hopes will be the first of five dams to be built in the next decade.

Initiation of work on the Basha Dam has, not surprisingly, caused the focus of opposition to shift away from Kalabagh to it. The issues involved are remarkably similar. In the region where the dam will be located, the Gilgit-Baltistan, there is alarm about its environmental and physical impact. The Basha dam will cover an area of about 110 kms displacing some 100,000 people; there is nowhere in the Gilgit-Baltistan for these people to be resettled, and their unique culture means it will be hard for them to adjust to a new, distant locality. There are also fears that Chilas could be flooded.

Given this potentially huge price, the Gilgit-Baltistan could well end up paying for the new dam, the people there are demanding compensation and that they receive royalties from generation of hydro-power at Basha. But plans for the dam indicate its power-generating turbines will be located in NWFP; that province is already laying claims to the revenue from power generation. Should this happen, there will be great anger in the Gilgit-Baltistan at what they perceive as a denial of justice.

Pakistan's water crisis is something that will affect everyone in all provinces. The key to addressing this water crisis, and averting the very real danger of extreme water scarcity within just a few decades, is collective action. The CCI and the Accord were supposed to provide the foundation for collective inter-provincial action on water issues. Unfortunately, various factors prevented this happening, and the situation today is that there is a wide gulf between Punjab and the three provinces. If Pakistan is to meet the challenges ahead, this gulf has to be bridged. Possible steps to achieve and prepare Pakistan to deal with future water issues include: a) implement the Accord in full, ensuring all provinces get their fair share of water; b) reconstitute the CCI and give it the power to make decisions on water disputes; c) carryout feasibility studies to obtain an accurate assessment of the impact of constructing various dams; d) consider alternatives to controversial dams projects such as Kalabagh, e.g. an increased number of smaller dams although small dams are not the alternative to large dams on the Indus Main, therefore sites have to be selected on Indus Main; e) seek consensus from all stakeholders through open and informed policy dialogue before making decisions to construct new dams: avoid imposed decisions; f) ensure that plans for new dam construction include compensation and resettlement provisions for affected communities; and g) allocate more resources for water infrastructure and strengthen water management so that optimal use is made of available supplies.

In NWFP opposition to Basha Dam is muted if not absent. This is not surprising, given that NWFP will be saved from the environmental and physical disruption and damage caused by dam construction, and could well profit from power generation at the new dam. But in Sindh, Basha is opposed as vehemently as Kalabagh. There the worry is that Basha will lead to diminished water supply and all its consequent negative effects. An additional 'international' dimension to opposition to the Basha Dam comes from India, which asserts that parts of Indian Kashmir will be submerged by it. Despite all the opposition, work on the Basha Dam has started.

3. KEY ISSUES AND CHALLENGES

Pakistan Water Apportionment Accord was signed during 1991 by the Chief Ministers of the four provinces regarding sharing of canal water supplies. The Accord although resolved the issues of apportionment of water between the provinces but the real issue of sharing water shortages caused conflicts between the upper and lower riparian and these conflicts are getting deepen due to water scarcity caused by climate change. This is also the root cause of not having new water development

projects on the Indus Main. The key issues related to inter-provincial waters have been identified and are:

3.1. Inter-provincial Disputes

- **Inter-provincial water conflicts are now severe on the division of water as per entitlements and sharing of shortages** proportionately as per Accord between the provinces. Punjab and Sindh are facing conflicts since pre-partition. Sindh and Balochistan are also facing similar conflicts as Balochistan (Khirther and Pat Feeder Canals) is a lower riparian of Sindh and not using its due share of allocated water due to inadequate irrigation infrastructure. Who is using the share of Balochistan is a question to be addressed?
- **Provinces are not entitled to market their unutilized share of water** as per Water Accord, which is a weakness of the Accord and may be rectified in future.
- **Transport of effluents to the downstream areas and impacts of pollutants on the bio-diversity and ecology** of lower riparian and delta ecosystem is now a serious concern, especially during the floods, when all the pollution is washed to the downstream.

3.2. Water Apportionment Accord and Water Entitlements

- **Lack of enforcement of the formula for water distribution as per Accord** based on ten-daily average use, system-wise and seasonally adjusted figures are still an unresolved issue. Punjab is still of the opinion to use the figures of 'historic use' during 1977-82, the period in which adhoc allocations by the federal government had favoured Punjab as per opinion of the Sindh.
- **Lack of trust of lower riparian (Sindh) on equitable distribution of water is an issue which needs to be resolved**, as Sindh is of the opinion that it has received less water than its entitlement and is facing serious impacts on the delta ecosystems.
- **Impact of reduced flows below Kotri barrage on the livelihood of downstream people** dependent on the delta ecosystems including the livelihood sources of fisheries, mangrove forests, livestock and delta farming are now visible and significant.

3.3. Water Entitlements and Availability

- **Water availability in the post-Accord period was much less than the water entitlements** as per Accord. Accord distributes 141.1 km^3 of canal water supplies among provinces. Maximum amount of water diverted to canals during post-Tarbela period was 137.15 km^3 with mean supplies of 122.2 km^3, which is 13.4% less than Accord entitlements. Variability in canal water supplies during post-Tarbela period ranges between 98.3 to 137.15 km^3, which is 30.4 and 13.4% less than Accord entitlements and is a major issue creating water conflicts among provinces.
- **How to share water shortages among the provinces**, when they feel that their entitlements are as per Accord. Another issue is that why water entitlements are higher than availability of water for diversion to canals. The reason is that these entitlements are based on the fact that additional storages will be constructed to transfer water of a wet year to the dry year, which are still not available.

3.4. Need for Storages and Opposition from Provinces

- **Storage is needed on the Indus Main to regulate water supply** ensuring that surpluses are not wasted and there is sufficient water to meet needs in times of shortage. Pakistan's water storage capacity is only 30 days of river flows. The GoP has planned to increase the water storage capacity through construction of large dams – Basha, Kalabagh and others. These would have the added benefit of generating hydro-power thereby helping meet country's expanding power needs.
- **Serious inter-provincial disputes on the construction of Kalabagh dam have been observed since last 25 years**, with Punjab on one side supporting construction and rest of the provinces on the other side, vehemently opposed. The Kalabagh Dam will generate hydro-power. The normal procedure is for royalties for power generation to go to the province where they originated. In NWFP there are concerns that the province will be denied royalties because of the dam's location on the Punjab-NWFP border and because of plans to position the dam's turbines in Punjab. Both the Punjab and federal governments have given assurances that this will not happen.
- **Former President of Pakistan laid the foundation in April 2006, for what the government hopes will be the first of five dams to be built in the next decade – the Basha Dam**. Initiation of work on the Basha Dam has, not surprisingly, caused the focus of opposition to shift away from Kalabagh to it. The issues involved are remarkably similar. In NWFP opposition to Basha Dam is muted if not absent. This is not surprising, given that NWFP will be saved, the environmental and physical disruption and damage caused by dam construction, and could well profit from power generation at the new dam. But in Sindh, Basha is opposed as vehemently as Kalabagh. There the worry is that Basha will lead to diminished water supply and all its consequent negative effects. An additional 'international' dimension to opposition to the Basha Dam comes from India, which asserts that parts of Indian Kashmir will be submerged by it. Despite all the opposition, work on the Basha Dam has started.

4. POTENTIAL OPTIONS

4.1. Resolving Inter-provincial Water Conflicts

- **Make an amendment in the Water Apportionment Accord and allowing provinces to market their excess water** especially Balochistan so that on one side the province is not deprived from their entitlement and at the same time it will result in efficient use of water through selling of extra water and maintaining transparency in distribution of water. Balochistan is not using its due share of allocated water due to inadequate irrigation infrastructure.
- **Develop state-of-the-art and reliable system of water measurement to provide reliable information for making rationalized decisions to resolve inter-provincial disputes**. The culture of "water measurement" has to be adopted as a tool for water management by all the provinces to rebuild trust among the provinces. This will also help to distribute water in both the extremes of water shortages and water excess. Once this system is established and transparent only then Pakistan is in a position to ask India to provide flow data through telemetric system.
- **Build consensus for construction of carryover dams to ensure availability of water as per Accord entitlement to various provinces**. The Accord entitlements are based on additional storages to be constructed to transfer water of a wet year to dry year, which are still

not available. The current dams are meant for transfer water of the Kharif season to the Rabi season in a normal year. In the wet years, the available storage can't store the excess water during the Kharif season. The trust building measure would depend how transparently allocations below Kotri are provided from the new storages.

- **Utilize available potential sites** (Diamer-Basha, Akhori, Kuram Tangi and Munda) **for construction of carry-over dams to address water shortages and generate low-cost hydro-power**. Consensus can be built for the construction of these dams through a transparent system of water distribution. These dams would have the added benefits of generating hydro-power thereby helping meet country's expanding power needs.
- **Bridge the gulf between Punjab and other three provinces to meet the challenges of water scarcity and shortage of energy** through: a) implementing the Accord in full, ensuring all provinces get their fair share of water; b) giving power to the CCI to make decisions on water disputes; c) carryout feasibility studies to obtain an accurate assessment of impact of constructing dams; d) consider alternatives to controversial dams projects such as Kalabagh, e.g. an increased number of smaller dams although small dams are not the alternative to large dams on the Indus Main, therefore sites have to be selected on Indus Main; e) seek consensus from all stakeholders through open and informed policy dialogue before making decisions to construct new dams: avoid imposed decisions; f) ensure that plans for new dam construction include compensation and resettlement provisions for affected communities; and g) allocate more resources for water infrastructure and strengthen water management so that optimal use is made of available supplies.

4.2. Developing Water Storages

Storages in the Indus Basin

Build new carry-over storage dams for adaptation against expected shrinkage of glaciers and changing precipitation patterns due to the climate change, if happened. In a system with variable water supply such as the Indus Basin River System, storage is needed to regulate water supply ensuring that surpluses are not wasted and there is sufficient water to meet the needs in times of shortage. Pakistan's water storage capacity is currently only 30 days of river flows. The GoP argues that it has to increase the country's water storage capacity, through construction of large dams. These would have the added benefit of generating hydro-power thereby helping meet country's expanding power needs. The potential dams to be constructed to address water shortages and generate power are: Diamer-Basha, Akhori, Kuram Tangi and Munda. Consensus can be built for the construction of these dams, if trust is built through a transparent system of water measurement and distribution.

Storages Outside the Indus Basin

Livelihood for the stakeholders in areas outside the Indus Basin is very much needed especially in Northern Punjab, Balochistan, NWFP, FATA and AJK. The conflict areas in NWFP, FATA and Balochistan demand livelihoods, which can be provided by developing small dams and developing irrigation schemes for agriculture, watershed management and reservoir management for poly-aquaculture. Currently, small dams are largely in Punjab and NWFP. Generally, the command area of these dams is less than 1000 ha, with an average of around 400 ha. The small dams constructed in Balochistan are also having command area of over 2500 ha for the two small dams (Sabakzai and Mirani) and rest are too small and may be regarded as mini dams or delay action dams. The current government has developed an integrated strategy for drought mitigation where watershed-reservoir-command area-downstream ecosystems will be managed in an integrated fashion. In the 1st phase 12 medium size dams and in second phase 20 medium size dams will be constructed. The actual implementation of this initiative would depend on the allocation of resources to these projects as the

country is facing economic crises. These developments should also include full package for irrigation and agricultural development so that high value crops can be grown using high efficiency irrigation systems and production practices.

Can Storages Outside the Indus Basin Solve Water Shortages

The storages on Indus Main are large hydro-power dams having minimum storage of over 7.5 km^3 for the potential sites identified for these large dams. The small dams outside the Indus basin are having very little storage of 0.030 to 0.060 km^3, thus 125 small dams would provide storage equivalent to the Kalabagh dam. Further, the expected effective life of small dams is not more than 20 years rather less and command area is not easily available at sites where water can be stored. This fact has to be understood; as there are mis-perceptions regarding small dams and number of people does talk that small dams should be built instead of large dams. We have to keep in mind that life of small dams is 15-20 years, as siltation process is rather rapid and thus it will not be economical to build small dams even potential sites are available. Further generation of hydel-power is hardly possible in small dams. Therefore, large dams on Indus Main can't be replaced by any number of small dams. These are two different things. For food security, large dams on Indus Main are essential. For equitable distribution of resources to the deprived people in fragile ecologies small dams have to be built but these dams will not solve Pakistan problem of food security and export requirement.

How Conflicts on Storages Can be Resolved

The conflict on the construction of large storage dams on Indus Main is largely due to two reasons. Firstly, the lower riparian especially Sindh province does not have any trust on Punjab regarding availability of their share of water if it is stored in reservoirs. Therefore, it is the responsibility of IRSA and Punjab Government to demonstrate transparency in operation and management of river flows in the upper Indus basin so that trust is built and Sindh is ready to accept construction of large dams on Indus Main.

The other aspect which is needed to resolve the conflict that income from hydro-power generation instead of giving to the province where dam or power houses are located, it may be distributed to all the provinces as per their rights under the Award. This is important because most of the dams will be built either in G-B, NWFP, AJK and Northern Punjab, therefore, Sindh will never get any share from the royalty of hydro-power. When water belongs to all provinces, then why royalty is given to the province where the dam is located. It is not fare.

The above-mentioned two aspects are essential to create an environment conducive to build consensus among the provinces for the construction of the large dams on Indus Main.

4.3. Building New Irrigation Facility

Diversion of Glacier and Snowmelt in Mountains

In areas where glacier- and snowmelt contributes to the Indus River system is having steep mountainous system and any amount of water used other than the evaporative demand is received back in the river. Therefore, development of small scale mountain irrigation systems in G-B, NWFP, AJK and Northern Punjab can help to develop new livelihoods, if innovative and high tech agricultural systems are developed. There has been allocation of 3.7 km^3 made in the Accord for these areas above the rim stations for NWFP but it is expected that this allocation is not fully utilized.

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