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Water Conflicts and Hydroelectricity in South Asia

The Indus Water Treaty. A Review article

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Transboundary river water distribution agreements tethering neighboring countries are overstretched, at least between Pakistan and India. Tens of hydropower dam on the Western Indus Basin rivers have been transformed into a real threat to "lower riparian".

Industrial expansion, population growth, global warming, oil and gas depletion scenarios further worsen the water situation when the water flow declines 8-9 times below the minimum agreed limit.

Underground water pumping in excess of natural recharge rates has reached a stage of continued free fall in the Indus Basin.

The energy crisis, the economic meltdown, global warming and climate change scenarios require fine-tuned transboundary laws to share the international rivers.

This work points out dire need of new global water laws to sort out real transboundary river conflicts transforming into water wars. "A Business as usual approach" may transform water skirmishes into full fledged armed conflict.

Water is life affects the underlying geopolitical realities.

1. Water and Power Nexus

Hydroelectricity is the prevalent most economic source of white energy. There is little chance of inventing a genius innovatory energy source anytime soon that will not engage nations to water conflicts to produce electric power. Hydroelectricity is derived from gravitational force (potential energy) of the flowing or falling waters. A hydropower house may take the form of a run-of-river (flowing) or dam (falling). Hydroelectric power plants use water turbines instead of water wheel. The Water turbine has a swirling component for force to pass on kinetic energy to spinning rotor.

French engineer, Bernard Forest de Belidor, conceived the idea of water power in the 1770s. Different types of turbines such as Francis (1849), Pelton (1879) and Kaplan (1913) are considered suitable for10-350, 50-1300 and 2-40m heads whereas waterwheels are used for 0.2-4m falls. Typical capacities of pico, micro, small, medium and large dams are <5 kW, 5 to 100 kW, 100 to 10 MW, 10 to 10,000 MW and >10 GW. There only three large dams worldwide namely Three Gorges Dam (22.5 GW), Itaipu Dam (14 GW) and Guri Dam (10.2 GW). Global small scale hydropower capacity is 85 GW out of which 65 GW in China, 3.5 GW in Japan, 3 GW in USA and 2 GW in India. Norway, Brazil, Venezuela, Canada, and Sweden produce 98.25, 85.56, 67.17, 61.12 and 44.34% of their national power demands by hydro

power plants. Hydropower is considered the cleanest white energy.

The World's first DC hydropower house, Cragside in Northumberland, was operated in England (UK) in 1878. Thomas Edison invented the first long life incandescent lamp in 1879 before which carbon filament based short lived lamps were available. The first US Niagara hydropower station started delivering DC electricity in 1881.

Nicolas Tesla invented the first three phase AC generator used in the Niagara Falls hydro station. Most European countries got hydropower stations from 1880 to 1890 simultaneously. The British brought this technology to India in the early 1900s. The Water and Power Development Authority (WAPDA) was established in Pakistan in 1959.

The British government had already developed large barrages and canals systems for irrigation. WAPDA engineers constructed 1000 MW Mangla dam in 1867, 3500 MW Tarbella dam in 1976 and 2000 run-of-river Chashma power house in 2004. World's largest hydropower producers are China, Canada, USA, Brazil, Russia, India, Norway and Japan which have total installed capacities of 196.79, 88.974, 79.511, 69.08, 45.00, 33.60, 27.528 and 27.229GW. Famous Chinese three gorges dam since 1994 produces 22,500 MW electricity and proposed Congo Grand Inga dam will produce 39,000 MW by 2014.

A 50,000 MW dam is under proposal on the Red Sea. China's installed hydropower capacity is more than the total combined hydropower capacities of USA, Canada and Japan. Chinese hydropower generation capacity is about six times more than that of India and 33 times more than Pakistan's hydropower generation.

India's hydropower generation capacity is about 5-6 times more than Pakistan's, yet it is building dozens of dams on rivers which were given to Pakistan under the Indus Water Treaty in 1960. India had 300 dams in 1947. This number increased to 4000 by 2000. About 70% of new dams were built during the 1971-1989 period.

2. Transboundary Rivers Conflicts

In view of widespread water scarcity, due to climate change, it is time to fine tune the clauses of international rivers sharing laws. The United Nations adopted existing European and US agreements in light of Helsinki rules in 1997 as an international water law which has failed to protect downstream "riparian rights" (Pakistan) when the "upstream riparian" country (India) started building multiple dams on the Indus, Jhelum and Chenab without permission.

World Bank Vice president, Ismail Serageldin, said in 1995 that the next century wars would be fought over water and not over oil (World Bank, 1998).

If there has not been any exclusive war on waters in past that does not mean it can not be in future (Star, 1991). European countries share 4 river basins under 175 treaties, 4-5 African countries share 12 river basins under 34 treaties, 4-5 Asian countries share 5 river basins under 31 treaties. There are 48 joint river commissions in Europe, 23 in the Americas, 10 in Africa and 9 in Asia. European and American states had disagreements over water quality in Rhine and Colorado rivers but African, Middle East and Asian countries have water quantity disputes on Zambezi, Mekong, Nile, Euphrates, Tigris, Indus and Ganges. We love or hate each other we have to share the water, air and sun. Oil and water do not mix but can entangle to develop water, watts and war trinity. Some social scientists are covertly

producing amphoteric solutions of oil and water in blood geopolitically.

Upper riparian India has started diverting and holding off shared rivers waters under its innovatory dam policies which is starving lower riparian Pakistan (Ben and Sing, 2000).

India has embarked on diverting western rivers waters through connecting canals from Jehlum to Chenab through an 80km long tunnel, Chenab to Ravi through the Marhu tunnel, interconnection of Beas to Sutlej and Sutlej to the Ganges through a proposed express link canal which is in blatant violation of the Indus Water Teaty.

IPCC experts believe that global warming caused the August 2010 flash flood in Pakistan which affected 20-25 million people (IPCC, 2010). Climate change experts speculate that under rapidly rising global warming, water distribution conflicts could potentially lead to armed conflicts among nations in future (Clionadh, 2007). Transboundary river conflicts include water shortages as well as geopolitical issues (Nils, 2006).

Water conflict between Pakistan and India is building up due to the fast melting of the glaciers. Middle Eastern countries take water availability as a strategic weapon (Alees, 1994). Palestinians per capita water consumption is 60 liters per day in the West Bank whereas Israelis use 330 liters per day (5 times more) (Stephen, 2008).

Fair water distribution is one of the key issues in Israel-Palestinian agreement today (David and Julie, 2010). Arab-Israel conflict is getting aggravated by water conflicts (Mustafa, 1994). Israel is also trying to secure access to Nile, Euphrates and Ceyhan in Turkey. Global research observers blame Israel for stealing Arab waters (Sawsan, 2010). People have been occupying waters since antiquity but the water flows today and they have gone the same is going to happen with present and future generations.

Historic wrecks are often the source of conflict as well as consensus (Paul and Craig, 2000). Transboundary water conflicts cannot be resolved using game theory geopolitics bearing undercurrents (Kaveh, 2010). Fair rules must be developed by United Nations in the name of International Rivers Water Sharing Laws. Shared river waters conflicts are both of the inter and intra state types (Hans et al, 2000) that require global laws to safeguard lower riparian (Paul et al, 2006). Without UN backed water laws, the long held agreements may break leading to political confrontations (Eran, 2000).

Water distribution experts have already proposed several models (Irene et al, 1986; Marc et al, 1987; Giordano et al, 2007, Joseph et al, 2004) that facilitate the UN to formulate transboundary water sharing and conflict resolution laws. Mass migrations and water conflicts intensification has been noted in Tanzania since last one decade (Milline, 2005) and Pakistan during August 2010 floods. The developed countries sustain dilemmas in developing countries that lead to talent migration causing serious blows to economies of developing countries (Schon and Ian, 2009).

The Water situation is getting worse in the USA and China. It is extremely critical in Brazil, and in India and Pakistan where the underground water table is falling at rate of 3-5cm per year.

India is building several dozen dams and diversion canals on shared rivers; Indian hydro tactics have caused droughts and flash floods horrors in Pakistan. India is constructing 24-25 dams on river Chenab that feeds to central Punjab housing 90-100 million people. India

relates it to her growing power needs but Pakistan takes it aqua bomb capable of causing droughts and flash floods. The Recent flash flood due to monsoons rains and timed injection of Indian dam waters has inflicted 25000 lives, 1-2 billion crops and 5-7 billion property losses.

The United Nations have no global law on transboundary water distribution. Due to natural scarcity of freshwaters, concerned experts have long been warning of water wars (Swain, 2001; Richard and Robert, 1996; Grayling, 2008; Michael and Glen, 2008, Kay, 2009).

European and Americans water agreements under Helsinki Rules and the International Law Commission Convention on Law of the Non-Navigational Uses of International Water courses have been universalized for global water treaties which have no consensus across the board. Despite 2 dams on Beas, 4 on Sutlej, 6 on Ravi, 7 on Indus, 8 on Jhelum and 24 on Chenab India assumes full right on all six rivers falling down to Pakistan and blames colonial period water laws creating schism that locks the water sector into a developmental catharsis (Radha, 2002).

In response to a satellite research on ground water depletion in Punjab (Matthew and Isabella et al, 2009) reporting underground water table declining rate of 3-5cm/yr, an Indian water expert tried to justify multiple dams policy on western Pakistani rivers as a sensible measure to mitigate their water depletion crisis (Saumitra, 2009). Pakistan, being downstream riparian, supports Radha's demand for international legislature on transboundary water sharing laws to avoid water conflicts but does not support Saumitra's innovatory policy to steal others waters to solve own problems. Pakistan proposes United Nations to frame laws governing distribution of international river waters including construction of dams in high hazards seismic areas. In view of multiple river basins shared by two or more countries it has become imperative to formulate global river water distribution laws acceptable to upper and lower riparian, déjà vu, water fracas and frays might escalate to dismal water wars in forthcoming decades. Several water experts have pointed out Indian ingenuity based maneuvers to hoodwink lower riparian (Swain, 2001).

3. Breach of Indus Water Treaty

India and Pakistan used to share the River Indus and its five contributories Jhelum, Chenab, Ravi, Beas and Sutlej under British rule. The Pakistani areas had no dam to store water, therefore 80% of the water from six rivers would eventually fall into the Arabian Sea. When water conflicts started intensifying after the division of British India in 1948, the World Bank's President Eugene Black acted in an arbitration procedure between Pakistan and India which resulted in 1960 in the Indus Water Treaty. Under this agreement three eastern rivers Ravi, Beas and Sutlej were given to India and three western rivers the Indus, Chenab and Jhelum were given to Pakistan. It was "water division" rather than 'water sharing". Pakistan also agreed to allow India to use some of western rivers' waters for local agriculture around rivers in India and produce run-of-river style hydroelectricity provided tyhe water flow did not fall below 55,000 cusecs at Marala and other interface barrages that went below 20,000 in 2009.

The Indus Water Treaty worked well up to the 1980s before the Indian Government decided to build dams in Shiwaliks (Himalchal, Punjab, Jammu & Kashmir) on the western rivers (Jindal, 1990). Geotechnical studies were carried out in Ballowal, Takarla and Karoan areas from 1984 to 1995. Generally pre-monsoon, monsoon and post-monsoon rain fall in Kashmir

valley (Handwara) used to be 305, 161.8 and 89mm from 1903 to 1982 (Kumar, 2010) which increased to 1117 to 1249mm in 1990s (Jindal, 1990) that prompted India to go for multiple dams on western rivers without seeking permission of lower river riparian.

Building dams on active faults in Zone-V (<7<Meq<9) was in violation of the Indus Water Treaty.

The Indian Government conducted several more studies on geotechnical and hydrological parameters for the design of small earth filled dams in the 1990s (Sur, 1999).

Initially, the small dams construction experience using local expertise led to micro-earthquakes around Thien Dam in Himalayas in 1980s (Bhattacharya et al, 1986) which forced them to seek international assistance on dams. Feasibility studies on 400 MW Hasti Dul (400 MW) and other dams were carried out in Kashmir valley and the adjacent provinces of Himachal and Punjab in the 1990s (Winter et al, 1994).

Uri-I (240 MW) dam on river Jhelum and Nathpa (1650 MW) dam on river Sutlej were carried out to test geological and geotechnical responses which hardly complied (Behrestaghi et al, 1996). If the Indian dams were to fail for technical reasons or as a result of earthquakes the people who would suffer would be Kashmiri or Pakistanis.

Building tens of dams without consulting lower riparian renders the Indus Water Treaty virtually defunct. Under the Indus Treaty of 1960, India is supposed to inform at least six months before launching any hydropower project. India did not comply in this regard.

India has several dam projects including water diversion tunnels and canals. India had allocated RS.33 billion for the 330 MW Krishanganga project and Rs. 18 billion for the 240 MW Uri-II hydropower dam on River Jhelum, Rs.51 billion for 1000 MW Pak Dul and 1200 MW Sawalkot dams projects on Chenab. The Sawalkot dam is 646-feet height which is more than the 485-feet height Tarbela and 453 feet height Mangla in Pakistan. These dams are 160 km away from Kangra where a 8.0 Richter scale earthquake occurred in 1905 on record (Kiani, 2010).

India has already built 60 MW Madekheda dam on Indus river and is constructing 130 MW Chuttak, 600 MW Monpreet n Randeep, 44 MW Dumkhar and 60 MW Nimo Bazgo dams on river Indus. After completion of 330 MW Wular barrage and 240 MW Uri-I dam India is further constructing 330 MW Krishanganga and 240 MW Uri-II dams on the river Jhelum.

India completed 450 MW Baglihar, 345 MW Salal-I and 345 MW Salal-II on river Chenab on which Pakistan objected seriously. India has diverted Jhelum river water to Chenab through a 80km long tunnel which is clear breach of Indus Water Treaty. India is constructing another 1200 MW Bursar dam on this tunnel. Instead of respecting Indus Water Treaty India has started construction of 400 MW Hasti Dul, 460 MW Rattle, 400 MW Gyspa, 100 MW Pakdul, 800 MW Karthai, 180 MW Raoli, 725 MW Seli, 1200 MW Sawalkot, 90 MW Tangat, 50 MW Pattan, 50 MW Teling, 100 MW Tandi, 180 MW Sach Khas, 300 MW Dueli/Dugli, 100 MW Rashal, 100 MW Myar, 190 MW Gondhala, 240 MW Dogar, 100 MW Shatru, 110 MW Dang, 20 MW Thai Rot and Chenai dams (Wikipedia, 2010; Arashad, 2010). After completion of so many dams all the western rivers will become dry. Bhutan has a hydropower potential of 23,000 MW out of which 4,484 MW is expected to be harnessed by constructing six dams by 2024. Pakistan has 50,000 MW hydro potential which is under threat due to 39,000 MW power Indian dams on western rivers. Pakistan is generating 71.9% thermal, 25.2% hydel

and 2.9% nuclear power. Our energy mix consists of 43.5% oil, 41.5% gas, 0.3% LPG, 4.5% coal, 9.2% hydropower and 1.1% nuclear electricity (Nayyer, 2004). Pakistan has over 40,000 MW wind, 30,000 MW solar and 800 MW geothermal potential.

India has already contributed to the drying up of the eastern rivers Ravi, Sulej and Beas. Water only flows in these rivers when India has significant dam overflows. India is digging a Sulej-Ganges Link canal to divert waters to the southern Indian states on which Indian riparian have taken stay from the Indian court.

India has built 390 MW Pong, 360 MW Pandoh and 126 MW Larji dams on river Beas, 1000 MW Bhakra, 1650 MW Nathpa and 800 MW Kol, 1000 MW Karcham Wang and 77 MW Nangal dams on river Sutlej, 1200 MW Baira Siul, 540 MW Chamera and 600 MW Ranjeet Agar, 120 MW Sewa-II and 70 MW Budhil dams on river Ravi. Indian dam mania is causing drought to both eastern and western riparian farmers. Pakistan has only two dams which usually stay partially filled throughout the year except monsoon months Wikipedia, 2010). Unfortunately, 95% Indian dams in Himachal, Jammu and Kashmir regions are located on dangerous earthquake faults zones. Recently India has launched another dams construction drive in Himachal Pardesh (En.Wikipedia, 2010) to build 300 MW Baspa, 231 MW Holi, 70 MW Dhamwar, 2050 MW Parbati, 192 MW Allian, 162 MW Swara, 370 MW Sham Not, 560 MW Rattle, 430 MW Kiru, 320 MW Kawar and 35 MW Bichlari dams (Ramanathan, 2007). United Nations water experts must formulate global water legislation to avoid water wars especially between India and Pakistan which may engulf many others. When Pakistan came to know of water shortages in rivers India had completed 70% of 48 dams. Indus river system is spread over 944,473 km2 out of which 553,416 km2 lies in Pakistan. Pakistan declared failure of Indus Commission in 2005 referring the case to neutral expert. India has 34 large dams out of which 10 are in Kashmir. Indian links between Neelum, Jhelum, Chenab through Tavi river uplift canal, Ravi, Beas, Sutlej and Yamana transfer western rivers water to Indian highlands as shown in Fig.1

There is no dam on Chenab, Ravi, Beas and Sutlej rivers on the Pakistani side. However,

India is building over three dozens dams on Western rivers which are viewed as a matter of grave concern by Pakistan.

Science news and global warming observations conclude that the Himalaya region will be affected in the near future. Dams worth 150,000 MW have been proposed in India, Nepal, Bhutan and Pakistan. International Rivers point it out that these projects are environmentally determinental (ie from a global warming perspective). Melting glaciers, like Dig Tsho Glof in Nepal in 1985, may lead to glacial lake bursts causing flash floods. Bhutan noted 25 dangerous glacial lakes in 2009.

Over one billion people rely on Himalaya waters. Upstream countries should not store waters in dams to starve lower riparian. India must focus on other sources of energy instead of blocking the flow of water to Pakistan.

United Nations and Indian scientists and engineers must advise the Indian Government to curtail dam construction in fault zones on western rivers under 1960 Indus Treaty to discourage water war for long term regional security. We have long history of using waters amicably but energy crisis is driving the conflicts. Global irrigation potentials exists 68% in Asia, 17% in Americas, 9% in Europe and 1% in Oceania. Indus Basin western rivers contribute to 15-20% of Asian food cycle. Transboundary rivers are not local rather global

assets which need due attention on merits. Indus water treaty went well for last 50 years but recent Indian dam drive is worsening the scenario.

Salaman's (Salman, 2010) claim the lower riparian (Pakistan) can harm upper riparian (India) is not a valid argument as Pakistan and India have divided rivers instead of sharing them.

Eastern rivers Sutlej, Beas and Ravi were chosen by India and Western rivers Indus, Jhelum and Chenab were left for Pakistan due to geographical locations. Eastern rivers had annual water capacity of 41 billion cubic meters (33 MAF) whereas western rivers had capacity of 188 billion cubic meters (135 MAF). Uri dams have storage capacity of 3.07 MAF in 1999 which increased to 6.37 MAF in 2002. Sutlej-Yamana (SYL) can transfer 3.5MAF water. India is transferring this water from western rivers into eastern rivers through Tavi-Ravi 31 meter high uplift link canal. India stopped Neelum River to divert water to Wular Barrage through 27 km long tunnel which is further diverted from Jhelum to Chenab through 77 km long tunnel. Asia Times called it race to death over Kashmir waters (Asia Times, 2009).

The Indus Waters Treaty 1960 Annexure D Part 2 (8, 9, 13, 15, 16 and 18) allows India to build even new run-of-river power plants without interfering with the water flow and diversion. The Indian decision to build large dams instead of run-of-river power stations is clear violation of above subsections.

Part 2 section 15 restricts India to deliver volume of water varying from 30% to 130% of river water. India can divert water from one to other tributary of the same river but not the other rivers like Jhelum to Chenab and build 1200 MW dam on the tunnel. It must be run-of-river design not the dam capable holding waters for months. India has the right to stop water flow to Pakistan when dead storage of run-of-river powerhouse is being filled not several MAF dam which exceeds her permitted 3.6 MAF limit. Treaty section 18 (a, c) permit India to use 300 cusecs discharge turbines along with storage capacity 20 feet above mean bed level of tributary but the new 33 dams have been raised up to several tens of meters which contradicts the agreement. Part 4 (24) also allows India to build hydropower plants on any irrigation channel taking off western rivers without storage other than the poundage but is required under Part 5 (1-3) to supply location, hydrodynamic, design details such as spill ways, head tail etc to Pakistan 6 moths before starting construction work that has been covertly violated in last two decades. Indus Waters Treaty 1960 Annexure E related to water reservoir, dead, live, flood, surcharge, conservation and power storage capacities restricts India to values shown in Table 2.

The Indus Water Treaty Annexure E allows India to enjoy general, power and flood storage limits of 1.25, 1.60 and 0.75 MAF which is consistent with 3.6 MAF restriction of Part 2 section 15 as discussed above. Ground reality is the India has already build 14 power houses and working on the construction of another 33 medium size dams with storage capacities exceeding several tens of MAF instead of allowed 3.6 MAF. Pakistan used to get over 156 MAF earlier which despite fast snowmelts and monsoon runoff has reduced to just 134 MAF per year. Indus Waters Treaty 1960 Annex E (10) restricts India to not exceed storage beyond 10,000 acre feet above 3.6 MAF during even emergency and do not release it all of sudden to cause difficulty for Pakistan. Annexure E (18) restricts India to not let the water flow go bellow 55,000 cusecs it has been going bellow 20,000 in routine since many years.

4. Water, Power and Energy Confluence

Population growth, industrial expansion and the consumer economy have increased electricity demand from 17PWh in 2000 to 20PWh in 2010. Demand is esitamted to increase to 24 PWH by 2020 and 30PWh by 2030.

About 2.5 billion people out of global 6.8 billion population lived with severe water conditions in 2005 which are likely to increase to 3.95 billions out of 8.5 billions population by 2030.

The IEEE believes trading water for watts is start of hard choices era. Hydroelectric, solar, nuclear and wind power plants consume 5.4, 2.5-2.8, 1.5 and 0 liters water per kWh but produce no carbon.

Coal and gas fired power plants consume 1.1-1.8 and 0.5-1.8 liters per kWh energy producing 0.43 to 0.96 kg/kWh carbon. P

hotovoltaic power generation uses 0.1 liter/kWh water producing 0.02 kg/kWh carbon. Wind power is the cleanest form energy which neither uses water nor produces carbon (IEEE Staff, 2010). Pakistan is among least coal burning countries but global warming is hitting hard on it since 1998. A recent temperature rise to 54°C in Mohenjo Daru followed by 1200,000 cusecs flash floods has affected over 2 to 2.5 million people across Pakistan. The climatologists say it makes no difference whether a single country increases or decreases greenhouse gases emissions at global scale. A country injecting thousands miles away can affect you through the common atmosphere. Recent industrialization in China and India has led to accumulation of green gases over Pakistan that has changed monsoon flow patterns from Bangladesh to India to Southern Punjab to northern mountains exacerbating glacier melting.

World power demand is 17 PWh whereas thousands of dams installed electric power capacity is 777 GWe that supplies just 2.9 PWh which is 18% of total demand. The remaining 82% demand is met with fossil fuels which are likely to be deplete after 2050.

5. Dams Hazards & Drawbacks

A large dam may fail during earthquake and flash flood. Dam failures may lead to serious consequences. It causes flash flood causing catastrophes. The Chinese Banqiao dam failure killed 26,000 by drowning in flood water and 145,000 people by subsequent epidemics in addition to billions dollars property losses.

Vajont Dam failure by geological reasons killed 2000 people in Italy in 1963.

Kelly Barnes Dam failed due to flash flood killing 27 people in 1957.

It is very dangerous to construct dams on geological fault lines.

Dam construction devastates lots of fertile land and causes the evacuation of rural populations. It is estimated that 50-80 million peoples have been displaced worldwide due to dam construction.

7. Concluding Remarks

Freshwater drives irrigation and industrial processes which support life. Even if natural freshwater does not decline significantly due to global warming, the pressure of growing population and industrial production are important factors to bear in mind in relaiton to the debate on “Peak Water”. (Peak water, 2010)

To prevent water conflicts between nations, it is necessary to develop under international auspices, workable global laws which govern international rivers.

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Table 1 Historic floods induced losses in Pakistan

Year	Deaths	Losses (RS)	Affected (Homes/crops/cattle)
1950	2209	10 millions	100s/100s Acres/dozens
1973	900	12.27 billion	500,000/10,350,000/dozens
1976	2600	15 billion	

600,000/556,000/70,000

1977

100s

Few billions

330,000/100,000/dozens

1978

100s

Few billions

1500,000/600,000/dozens

1988

529

5 billion

400,000/150,000/33,000

1992

Few dozens

Few billions

250,000/1300,000/dozens

1995

511

Few billions

250,000/600,000/dozens

1996

118

Few billions

20,00,000/80,000/95,000

1998

Few dozens

85 billion

70,000/70,000/20,000

2005

80,000

280 billion

150,000 homes ruined

2010

>2,000

850 billion

2,500,000/8,000,000/100,000

Table 2 Indus Water Treaty 1960 water allocations (IWT, 1960)

Western rivers

Storage capacities (MAF)

Name

Location

General

Power

Flood

Indus

Jhelum

Jhelum

Chenab

Chenab

Main

Tributary

Main

Tributary

Main

0.25

0.50

Nil

0.50

Nil

0.15

0.25

Nil

0.6

0.6

Nil

0.75

X*

Nil

Nil

X* limited to 300 acre feet including agriculture and power use

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