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Environmental Impacts of Neelum Jhelum Hydropower Project

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Chapter # 1

Introduction

1.1) Background:

Neelum jhelum Hydropower plant is the part of a hydroelectric power scheme which is designed to divert water from Neelum river to a power station on Jhelum river. The Neelum river portion in Indian territory is known as the Kishan Ganga river and a similar power plant is located over there. The power plant is divided into three main parts C1, C2 and C3. C1 is the first stop and is the Nowsehri point. The water is accumulated and diverted from this point to the generation plant C3 through an underground tunnel. The tunnel is divided into two tunnels at C2 which is the main area of electricity generation.

For the protection of natural environment all the developmental projects need to be accessed in terms of environment. This study is known as Environmental Assessment for infrastructural and developmental projects and it is vital to achieve sustainable development goals. This can be achieved through good governance but this potential is scarcely subjugated in developing nations like Pakistan. En\vironment study for all private or public projects is obligatory under Pakistan Environmental Act 1997.

Tin 2000 a guideline was released for the for preparation and endorsement of Environmental Impact Assessment for different projects but the availability of guidelines does not mean the victory of Environment Impact Assessment until or unless they are practiced (Fuller, 1999). To achieve sustainable development EIA framework of any country should perform according to the requirement. People from rural areas were forced to migrate due to these ill-planned infrastructural projects. Such projects have also accelerated the decay in biodiversity. Construction of mega dams is a reason of changing the association of land and water that destroy the equilibrium of ecosystem, which sometimes create in hundreds of years.

There are around 40,000 large dams that barricade the World Rivers. They are changing the flowing system of the rivers. All these projects undoubtedly leave terrible impacts on environment. Many countries have stopped building these mega dams due there negative impacts in past few years. Rather they started spending more money in fixing these problems created by dams.

The modern world is strongly focusing on green development (Pervaz & Khan, 2014). Sustainability is the key element in Hydropower projects which are constructed by the proper research and planning. A recent book written in 2016 under the supervision of Zhiqun Daniel Deng "Environmental Issues Related to Conventional Hydropower" thoroughly discussed the impact of hydroelectric power generation on the environment. According to the writers "Hydropower facilities create an impact on the ability of aquatic organisms to move freely in any direction within the water. The hydroelectric power plant disturbs the flow and quality of passing through water. Government agencies put restrictions on the number of performance metrics. Before designing the hydropower systems the physical conditions of the marine life should be kept in mind. The better-designed turbines can minimize the risk of life faced by the aquatic organisms.

Construction of the dam does not necessarily only bring benefits, But on the other hand there are some social and environmental issues seen during the completion of such projects. Same case is seen in Neelum-Jhelum project. This project will divert water from Neelum River to Jehlum River where

power station is situated. It will generate 969MW of electricity in the system. This project started in 2008with the help of China. The first generator was scheduled to be commissioned in July 2017 and the \\entire project was expected to be complete in December 2017 which is in running position now.

This Project is situated near Muzaffarabad (capital of Azad Jammu and Kashmir). A tunnel is used to divert water of Neelum River. A Power plant situated in Chatter Kalas is one of the main part of the project which is located 22 Km in South of Muzaffarabad. Huge turbines will throw the water at a location, which is situated in South of Chatter Kalas. This power Project will produce estimated 969 MW of electricity per anum and its cost is 2.16 billion USD.

A former minister Omer ayub announced this hydroelectric project on 10 June 2007. MWH was selected by WAPDA which is working globally to provide environmental engineering, strategic and construction services. This project was a joint Venture of MWH, NESPAK, NDC, ACE and NORPLAN (Norwegian firm). MWH provided the project designsß, drawings and management construction services.

WAPDA then planned another project by diverting the river i.e. "Kohala Hydropower project" on Jhelum River near saran village 40km upstream from Muzaffarabad with an installed capacity of 1124 MW. It is connected by a 20km long tunnel located at Barsala 7km from Kohala Bridge. Its construction began in 2016 and it is expected to be operational up to 2021.

The aim of the study is to highlight the current condition of Environment after the completion of Neelum Jhelum Hydro power and to analyse what was predicted regarding the environmental disability and what is the on ground situation of the Environment.

A report published by SHERPA stated about the hydropower projects that "A successful hydropower project is not only produced by ingenious management within the organization, but it's a multidisciplinary piece of work, varying from preserving fauna and flora to deciding technical features such as the selection of materials in the plant. The integration of knowledge acquired from different special fields in all phases of planning and accomplishment will increase the probability of taking care of everything. This is why a full functional framework and excellent practice guidelines are vital to assure maintainable hydropower projects and as a result help in water management"

1.2) Losses in Neelum Jhelum Hydropower project:

The rock structure and geology was not studied thoroughly and the construction of 58Km tunnel was started which ultimately resulted in rock bursting and some human lives were also lost. Zafar Mehmood (ex-WAPDA chairman) provided this information to the P.A.C. (Public Accounts Committee) in 2015. Expensive tunnel boring machines were installed which costed of Rs19.5 billion.

"Full capacity of Neelum-Jhelum project i.e. 969MW will be affected in coming few months as unit-4 has virtually been disassembled to remove the damaged rotor",(Statement published in the newspaper).The contract of the project won by a Chinese construction company CGGC-CMEC in Dec 2007.

1.3) Why Environment is need to be studied:

The building of mega Dams create a severe effect on the life of human beings it can be really harmful to local human populations in different ways. Same situation is seen in AJK after the completion of this Hydropower project. Following changes have seen by the Locals and experts.

- Human farmland submerged in the reservoir wipes out the sources of revenue and destroys their commonly used cultivation methods.
- The construction of reservoirs in tropical regions create "vector threats" that means they provide safe grounds for mosquitoes, parasites and other harmful bacteria.
- Creating reservoir, digging, mining and cutting the lands results in increasing natural tragedies like earthquakes and floods due to changing river geography and heavy constructions as Muzaffarabad is already located at fault line for earthquakes.
- Fishing industries and tourism that depend on natural environment gets disturbed because the water level of the river decreases and the garbage at the sides of water leads to waste dunks.
- Turbines installation and changing flow of the river disturbs the marine life. So the Flora and Fauna of the locality got badly affected by the construction of this mega Hydropower project.
- The adverse effects of dam is seen on drinking water quality , Spring water is decreasing day by day and it affected the nearby communities that are using spring water.
- Migration of people whom lands are used by the Government for the project along with this those people who are somehow affected by the project decrease human resource of the area and this scattering of families weakened those tribes who were already in minority.

The aim of this study is to analyze that either the above identified issues practically exist in the locality or these are just the rumors created by a certain group of people.

1.4) Hypothesis:

- It is greatly observed that environment changed massively during and after the construction of Neelum Jhelum Hydropower project, which is a serious threat to the people and other living creatures.
- The behavior and implementation of relevant Environmental departments in order to preserve the nature is not upto the mark.

1.5) Research Gap:

Many studies are conducted around the globe in terms of environmental change after the major projects but there are few researches in Pakistan in this context. Specifically Neelum Jhelum

Hydropower project is not studied yet in terms of Environmental changes which the area is facing after the mega projects of Neelum Jhelum and kohala Hydropower plants. In addition most of the related work to other projects was focused on the quantitative approach in understanding the after impacts of mega projects on environment but these issues are widely addressed at policy and legal level.This study identifies the research gap in the form of qualitative understanding of the issue and behaviours as well as perceptions of public about the after impacts of Neelum Jhelum Hydropower project. In addition this study follows the qualitative style to comprehend and analyse the issue widely by focusing on the native opinions. Moreover the data is analysed by following the thematic approach. The qualitative approach gives an intensive and comprehensive understanding about the issue and it plays its part to fill up the gap which was missing by the previous literature.

Chapter # 2

Literature Review

Studied all the available literature related to "Neelum Jhelum Hydropower project" from books and articles in soft and hard form.

Gone through the book "The Limits of Growth" written by Donella H. Meadows and Dennis L. Meadows titled. A book "Green development, Environment and sustainability in the third world" written by W.M Adams beautifully depicts the need of sustainability in the development projects especially when it comes to developing and third world countries.

Muhammad Aslam Uqaili's book "Energy, environment and sustainable development" based on the facts that what environmental hazards so far have arisen due to mega constructions and what are the possible ways toward sustainability of the environment.

Karl Popper's book "Poverty of Historicism" helped to establish a framework model for the study. He concluded that decision making is a step by step process in which we try any error elimination policy and analyze the results and the process continues because in any environmental or social construction the results are not always up to the mark due to external factors and changing conditions.

Elements of earthquake engineering and structural dynamics written by Andre Filiatrault, Robert trembley, Bryan Folz and Didier Petting concluded that along with other reasons mining and digging is the major cause of Earthquake in red zones.

All the primary data available on Internet has been studied so far for a clear vision of my study. Therefore, this study will be a healthy addition in the literature.

2.1) Global Literature:

"Union of scientists" published a report, which concluded the following impacts of hydropower power projects and mega dams on the environment.

2.1.1) Wildlife Effects:

Hydroelectric systems have a major influence on marine ecosystems. The blades attached with the turbines can damage marine life and fish. Storage of excess water can dry the reservoir. So most hydroelectric operators throw a minimum quantity of water at different time of year. If the water is not released downstream rightly it can harm the surrounding animal and plant life. Along with this the oxygen level in reservoir water is low and it's usually colder than normal river water, thus when the water is released it effects negatively on plants and animals. These impacts can be minimized with aerating turbines that are mounted to increase dissolved oxygen and that helps to ensure the water discharged from the reservoir should come from all levels of the reservoir.

2.1.2) Global Warming

Global warming rises due to the installation of hydroelectric power plants. Emission of different gases for hydro generation plants is hazardous for ozone layer, outer space and surroundings. Lot of relevant online literature was studied among them the most relevant was the blog written by Peter Bosshard on "Hydropower Environment". He discussed about major hydropower projects and their impacts on the environment.

Hoover Dam is one of the world's highest dams, built in 1936. It catalyzed the industrial and agricultural growth of the US but on the other hand ruined the Colorado River's fisheries. Change in Climate creates a major impact on the dam's capacity of water supply and power generation.

The Kariba Dam was completed in the 1950s to power Zambia's copper belt. The Dam was sponsored by the World Bank. Kariba was built with the concept of regulating nature for quick economic progress. On the other hand, 57,000 people were misplaced by the dam and underwent famine.

In 1960s, India constructed Bhakra Dam which was considered as the figure of green revolution in India. It was named by the Prime Minister Pandit Jawaharlal Nehru as a "Temple of Modern India". Later on poorly handled irrigation schemes resulted in water logged brackish soils and weakening harvests.

Dams can even break if not built technically and maintained accordingly. World's biggest disaster of Dams happened in 1975 and approximately 171,000 people were killed in it. Disaster took place with Banqiao Dam of china. More than 100 cases are studied by scientists and they also linked dam building to earthquakes. The most important example is that of China's Sichuan earthquake in which took the lives of 80,000 people in 2008, researchers concluded that it was triggered by the Zipingpu Dam.

Sardar Sarovar Dam was constructed on India's Narmada River and it resulted in the displacement of more than 250,000 native people. World Bank with draw from the project in 1994 because of an autonomous review found systematic violations of the Dam's social and environmental policies. After this degrading experience the bank remained out of mega dams for more than a decade.

World's largest hydropower project was built in China in 2008 on Three gorges Dam. The power generation from the project is estimated as eight large nuclear power plants. The Dam exiled more than 1.2 million people, and destroyed the ecosystem of the Yangtze River. Despite of the major environmental issues caused by the project Chinese Government continues to export the technology abroad.

Dams create serious impacts on environment. United States addressed this issue in 1930 and removed more than 1,150 dams to reinstate ecosystem of the rivers particularly fish habitats. The Dam named Glines Canyo in the Pacific Northwest was ruptured which was 64 meter high, this is the world's biggest removal of dam so far.

According to the blog published by the website of "International Rivers" titled "Problems with Big Dams". By 2015 the dams have disturbed the flow of half of the world's rivers. These large dams are approximately 57,000 in number around the globe. The world's large dams have affected different species, turned areas into wetlands through flooding and millions of people were forced to leave their homes.

World's large dams affect rivers in certain ways but not all of the dams cause such problems. They disturbed the planets freshwater in worst ways than other ecosystems. As a result, these dams disturbed different communities of the world. These ill-planned dams are the greatest issue of present era.

Boulder Colo wrote that Dams represents of human's ingenuity and skills. This is not an easy job to control flow of water, but now people are asking whether generating a little electricity at the cost of environmental de stability is worth doing? this is due to environmental awareness.

A consortium of 150 groups was signed about the Hydropower Reform Coalition (HRC) who worked on the effects of dams and poor quality of water. It was found that the organic materials, outside as well as inside the river that normally washed away towards downstream creating dumps which will consume oxygen for decomposing. It also results in activating algae blooms, which in turn result in "dead zones" (oxygen deprived zone), this phenomenon effect river life. The difference in temperature of the surface as compare to the depths in dams is also threatening for the survival of marine life. This type of water lacking oxygen when released into river effects environment of downstream due to unstable temperate.

Environment related literature on mega hydroelectric power projects in Pakistan are discussed in a journal written by Rabia Azhar as "Resettlement in new environments and its impacts on Socio cultural values of the effectors, Case study of Terbela Dam". She found that Dislocation of affected has adversely affected their social and cultural fabric and values and they are not satisfied.

According to the environmental study of 3 major Dams when Tarbela dam and Aswan dam were built there was no such focus towards sustainable development. The main purpose of these dams was controlling floods and electricity generation. The environmental concerns were totally ignored.

All 3 dams helped in controlling floods, which were one of their main purposes. The situation of Kalabagh dam is not dissimilar from those of Aswan, Tarbela and Three Gorges. As Kalabagh is at the downstream of Tarbela so sedimentation deposit rate will be higher in Kalabagh. The forecasted value of deposition of sediments in case of Tarbela is higher than real deposition, so it means sediments flowing towards Kalabagh dam will also be less in real time scenario.

Another scenario was that of Aswan Dam, it was concluded that predicted deposition of sediments is different in this case. River Nile was carrying load of sediment to Aswan for long period of time, which resulted in effecting the capabilities of Aswan dam, but on the other hand it improved the life of the dam. While the sedimentation rates were different at Three Gorges Dam.

Aswan and Tarbela dam contributed very less amount of negative effects on natural environment. One of the important reasons is that sustainable development was not taken into account, which results in less effect on environment.

She concluded in her journal that if Kalabagh dam is not built the problems of power shortage continued to devastate the present economic conditions of the country. The proclaimed environmental hazards are not that dangerous in nature to stop the construction of dam. Few of the effects are very dangerous in nature but their chances are very rare.

Though Kalabagh dam was not the only answer to the economic incapacities, there are many alternatives to the dam, which should be considered by government. Solar energy could be an enhanced option since it has no negative impact on the environment but it is very expensive practice, as its cost will recover in 7 years for installing solar voltaic cell. Along with this the power generation by gas, nuclear power and coal are not cost effective and they also result in damaging environment by releasing carbon dioxide which is a dangerous pollutant. Coal and Gas are also non-renewable means of energy so excess utilization of these resources can result in reduction of natural resources.

It can be concluded from the above analysis that the environmentalists, politicians, engineers and other stakeholders related to building dams should contemplate the consequences of construction of such big hydroelectric projects. They should consider environmental and socio-economic concerns on first priority while building such mega projects. This will help in better decision making for construction of dams in future.

A report published by star hydropower limited for the Asian Development Bank as "The Patrind hydropower project, environmental impact assessment". The reports clearly depicted the following problems faced in terms of environmental disability and other related issues.

Land and soil erosion, Water resources level, disturbance of air Quality, noise pollution, Spoil Material, Waste Management, Explosive storage and Handling Temporary structures and facilities, disturbance of flora, terrestrial Fauna, disturbance of houses construction, Commercial Assets, Infrastructure, Cultural and Archaeological Sites, Vulnerable groups, Health and Safety, traffic management.

The above issues were predicted and precautionary measures were taken to minimize them. According to the report published by Pakistan Water and Power Development Authority on the feasibility and environmental study of Kohala Hydropower project AJK "The major adverse impact of the project will be on the downstream section of the river Jhelum due to less availability of water for most of the time. The other significant adverse impacts arising from this are, deterioration of water quality downstream to some extent reducing in the aesthetic value of Jhelum river downstream reservoir, increased flood level and frequency during head pond flushing, some minor impacts on flora or wild life are likely to occur. Some productive area will come under reservoir, residential colonies, are likely to occur. Some productive area will come under reservoir, residential colonies, power house and contractor camps, so there will be loss of livelihood of the land owners and relocation of houses, school, mosques and suspension bridge etc. will be needed.

2.2) Literature Related to Neelum Jhelum Hydro power project:

"Pakistan and India did not agree on bilateral solution over the use of Neelum River's water so they took this matter in International arbitration court. This process is lengthy as well as costly.no matter what will be the outcome of this process but will surely spoil bilateral relationship between these two neighbouring countries." expressed by Dr Shabir choudhary in July 2010.

Main purpose of this project is to generate electricity by diverting its water, which belongs to Kashmiris. Neelam Jhelum Hydroelectric Project was started by Pakistan from Muzaffarabad by diverting water with the help of a tunnel from Nauseri to Jehlum near Chatar Kalas, which is located 22 km in south of Muzafarabad.

It will generate 969 MW of electricity after its completion. While on the other hand Kishanganga Hydro Electrical Project was started by India at Gurez by using 22 km tunnel to divert Neelam's water. This tunnel will end at a jhelum river tributary near Bonar. This tunnel will disturb the water flow in Azad Kashmir.

This shows the location of two projects i.e. Baghliar Dam on River Chenab and Neelum Jhelum project on River Neelum. The Pakistani Government states that the changing the course of water to Wullar Lake violate Indus Water Treaty because it decreases power generation up to 16% due to decreased flow of water, as a result loss in energy sector estimated up to 6 billion rupees per year. Mutual Talks between India and Pakistan on this dispute have suffered failure and Pakistani side wanted to undertake this dispute through the arbitration process protected by the Indus Water Treaty of 1960. One of the vital dams in Pakistan, Mangla dam is generating about 1000 megawatt since 1967 without paying anything to Azad Kashmir.

Pakistan is generating 1720 billion rupees from Mangla Dam Power generation. Researcher claims that Pakistan is in debt of 2580 billion rupees in terms of value of all the hydroelectric projects in Azad Kashmir excluding the profit earned from irrigation and fishery.

Since 2003, Pakistan has started paying 15 Paisa per unit as a royalty for Mangla Dam to government of Azad Kashmir. On the other hand, Pakistani government pays 70 Paisa per unit in terms of royalty to other provinces. Regardless of this inequality and exploitation, Kashmiri leaders are happy to receive this amount for Mangla Dam from their political masters.

The Court of Arbitration contains of 7 prominent experts. Both Pakistan and India were supposed to nominate 2 members from their side and they have to agree on the remaining 3 experts in law, water disputes and engineering. In addition to that these experts must either belong to the Massachusetts Institute of Technology, the World Bank or the International Court of Justice. Both Pakistan and India conducted a meeting for the selection of members for the arbitration court.

Indus Water Treaty 1960 is a peaceful resolution of water dispute between India and Pakistan. To resolve such issues a commission was created but if commission fail to resolve it then it became the duty of both governments to resolve it amicably and if both scenarios fail to deliver then it will be send to International Court of Arbitration.

The Court of Arbitration is supposed to investigate about the planned diversion along with the possibility to divert the water from the Jhelum River protected by the Treaty. This changing of natural course of water reduces the water flow in River of Neelum but on whole it will not disturb the flow of water entering in Pakistan. This diverted water is then discharged into the river of Jhelum.

Court of Arbitration will decide among the three possible outcomes

1. The diversion of water is not allowed.
2. Diversion is allowed without violation of Treaty.
3. Mixed findings.

According to the 1st finding India will have to stop the project, which will result in loss of billions of Indian Rupees. Pakistani project will be affected according to the second finding. There is a possibility that the Court of Arbitration may give a mixed finding that the course water can be diverted while considering downstream impacts. This process of Arbitration is very lengthy and expensive. There may be a possibility that verdict will be announced after years. While both states

will be speeding to complete their respective Projects, as the understanding is if a project is near to completion then it will be very tough for the Court to announce a totally negative verdict.

Indian Federal Minister of Power Jairam Ramesh said that Kishenganga project has strategic importance to India. He added, "This is a dispute with geo-strategic and foreign policy implications".

Though Pakistan has started the negotiation but legal team of Pakistan is still not ready and there are rumours of controversies about selection of the members of the legal team because of potential favouritism and rewards. Both Pakistan and India are exploiting the natural resources of Kashmir. No matter what will be the decision of court people of Kashmir on both side will lose in this power game.

Chapter # 3

Detailed description of Neelum Jhelum Hydropower Plant

At Nauseri, on Neelam River 125m long and 60m high concrete gravity dam is constructed. Over-topping was reason to design dam. Head pound of 8 million cubic meters will be created by dam and a reservoir with capacity of 2.08 million cubic meters will help in fulfilling daily power needs. 280 cubic capacity, 6 gated tunnel intake structure is attached with 3 conventional flushing surface basins which are installed at their respective ends for flowing sediment back into the river. Total length of head race tunnel is 28.5 Km along with a 15.1 Km stretch of the tunnel from the Nauseri constructed as a twin tunnel system each with cross section of 42 Sq.m. single tunnel having cross section of 82 sq.m will be remaining head race tunnel down to surge chamber. Concrete invert is used to line tunnel. Jhelum River almost 380 meters below its bed is crossed by tunnel.

340m high riser spillway and 820 m long surge tunnel, four steel lined 150m long penstock tunnels and having 3.8m internal diameter and surge chamber is constructed. There lies 4 units with total capacity of 969 MW are there in the underground power station. Through 500 KV double circuit transmission line, power station is attached with Rawat grid station (in Pakistan).

3.1) Prominent features of this project:

Project Cost	Rs. 130 Billion
Installed Capacity	969 MW
Type of Dam	Concrete Gravity
Height / Length	47 / 135 Meters
Annual Energy	5.150 Billion Units
Average Head	420 Meters
Design Discharge rate	280 Cumecs
Tunneling	Two tunnels, each diameter 7.3 meter - 15 km, 9.6 meter-17Km (Total 47 KM).
EIRR	26%
Completion Period	8 Years

A concrete gravity dam with a volume of 156,000 cubic metre was proposed on Jhelum river where it flows in the direction of west close to 'Saran'. At this location the valley comprises a steep side with significant rock outcrops of both banks with the proposed full supply level of the reservoir at EI 905m submerges about 0.8 square kilometres area and a small storage volume of about 15 million cubic meters is created. On this elevation the right bank of the valley opens out into a wide terrace of scattered houses and agricultural area. An elevation of 900 m extended on 6.4km upstream of the Dam to Hatian village.

Along with the main Dam and reservoir the other major components are decanters, connection tunnels, surge tunnel, headrace tunnel, concrete lined pressure shaft, power house, high pressure tunnel, tail race tunnel, transformer hall and hydro mechanical and electrical equipment. The power house and switchyard are located at Barsala 34km downstream of Muzaffarabad. About 17km long tunnel is proposed to short circuit the bend of Jhelum River from Saran to Barsala.

3.2) Land Acquisition:

- Acquirement of approximately 2400 Kanal state's and private land for the project Muzaffarabad District.
- For the provisional cost of notified land for the project, WAPDA has provided Rs. 705 million to the Government.
- Possession of 80% land has been taken by WAPDA and for remaining land, arrangements are being made to acquire. 15

3.3) Financing:

Government of Pakistan has approved financial arrangement for the project:

- For project execution, Neelum Jhelum Hydropower Company was initiated.
- Providing for 50% fund requirement, surcharge of 10 Pisa/unit on power traffic for Neelum Jhelum hydroelectric power was imposed.
- Through loans and bonds etc. arrangement of balance equity was made.
- PRs 5700 million revised PSDP allocation.

3.4) The Phases of Project delay:

Improvement of design and increase in generation capacity along with tunnel length increment was made after project approval in 1989. It was believed that project will be completed in 2008 after beginning in 2002, but due to problems meeting rising cost noteworthy delay was experienced by this tenure.

With all these whole area was damaged by earthquake 2005 and to meet mega hydroelectric power projects international levels; the overall task was redesigned.

An agreement to construct dam and power station was offered to the Chinese consortium CGGC-CMEC on the 7th July 2007. The letter of beginning was issued in January 2008 after settlement of

terms and conditions at the end of year 2007. President Pervaiz Musharraf declared the start of project in October 2011 on 8th February. A tunnel for rerouting river of Neelum near the dam site was finalized in October 2011.

The Prime minister of Pakistan Syed Yousaf Raza Gillani publically specified the concern for the delay of project on 1st November. The project had to cost 167 million USD in 1989 at the time of appraisal and the cost rose to 935 million USD after another redesign in 2005. Currently, in 2018 costs have risen to 5.89 billion USD. Up to August, 2013 66% of project was complete and at the same time 75% of reroute tunnel was complete.

Economic Affairs Division at the time did not safe guarded 475 USD in funding. By the mid of 2015 at least one generator would be required for operation was expressed by prime minister Nawaz Sharif after visiting site of construction in middle of 2014. Four workers including Chinese engineer were killed by breakage of wall near reroute tunnel intake on 24th December 2014.

With 100% accurate design and achievement of 85.5% progress, Neelum Jhelum hydropower project reached conclusion phase on November 5th, 2016. Despite all delays in resources, weather condition and lack of power in initial stage of construction and delays in land accession project heads towards finishing.

The dam cost had increased to RS. 500 billion was reported in March 2017; so Pakistani rupees 20 per unit will be the cost of electricity from this project. Completion of civil work i.e. boring of tunnel, generators and installation of turbine was done and hence on 17th October 2017 water filling of dam start to test it.

Commissioning of Neelum Jhelum project will lead to reduction of Neelum river flow through city of Muzaffarabad was extreme fear expressed by Muzaffarabad citizens in October 2017. Report presented in Jan, 2018 stated that 18mm shift from original position in the holding wall of rock filled dam has occurred; the dam was stuffed to design 1017-meter height. Generation of electricity from this dam got delayed till July 2018. Water filling in headrace terminal begins and first unit started electricity generation at end of March.

The 1st unit of 242.5 MW started working at a price of RS. 13.05 Per unit in April 2018. As the program reached it maximum capacity of generation of 969 MW on 14th Aug 2018; a remarkable position was achieved by vital project near Neelum Jhelum hydropower. Power was generated to maximum capacity by all units.

3.5) Engineering side:

The project is one of the most technical programs. The 90% of task is underground & underneath high mountain areas. A dam at Nauseri and an underground water system comprising of 52 M long tunnels and underground power house at chattar kalas is part of project constructed at river Neelum AJ&K with four power generating units. This project will provide approximately 5 billion units of electricity to the national grid every year, which will benefit annually to an estimate of Rs55 billion.

The Neelum Jhelum dam is a 197ft high and 410 ft. high force dam. It holds a connote with a 6,486 acre ft. capacity while 2,270 acre. Ft. is its prime capacity. The dam diverts approximately 9,888 cu ft. /s of the Neelum southeast into a long (28.5 km) headrace tunnel. First 15.1 km of the headrace is two tunnels which later merge into one. The tunnel passes 1,247 ft. below the River of Jhelum and through its bends. At the tunnels terminal, the water reaches the surge chamber which contains a 1,119 ft. tall surge shaft to prevent water hammer and a 2,690 ft. long surge tunnel. The surge chamber splits water into four different penstocks which feed each of the four 242 MW Francis turbine generators in the underground powerhouse.

Through a 3.5Km long race tunnel water is ejected south east back into Jhelum river after electricity generation. Average hydraulic head of 1378 Ft was afforded by elevation drop between dam & power station.

However, the project seems to be engineering wonder on ground the finishing of which will not only supply national grid with 969 MW of cheap electricity but presently under threat from India's water violence, Pakistan's water rights over Neelum river get secured.

The large amount of water in Neelum River has already been redirected through smaller 500-meter reroute tunnel to dry out the riverbed for the construction of dam (786-foot).

Project already begins to change landscape of Azad Kashmir with completion of physical progress. Few kilometres away from LOC and 41 KM from Muzaffarabad even where armed forces approach through confined jeep able track; landslides and snow often block them. A small part of Nauseri in valley of Neelum has wide road access.

Company of foreigners from China and Venezuela already perceived cultural change after interacting with local engineers and professionals. Jobs for 100 of locals were created. They get on job training, other got trained for tunnel boring machine in Germany and some establish business around project area.

Minor clashes with inhabitants who still resist the cleaning of area in spite of full compensation, results in disfiguring of construction of critical disinter at cove of project. As local authorities try to clear clash close the LOC the first module of project faced one-year delay.

Around 22 km downstream from Muzaffarabad at Chattar Kalas the first TBM on a seventy ton sixty-four wheeler of country. People of area did not see a truck of more than 21 tons of weight. The project completion in 24 months was made possible by introduction of tunnel boring machine.

The TBM accelerates the building of 32 km tunnel that will pass 400m under the Jhelum river bed to reach Chattar Kalas where an underground powerhouse is located to consign 5.15 billion units of electricity annually to national grid at Ghakkar Mandi near Gujranwala.

3.6) Cost of the Project:

The government accepted the task of Neelum-Jhelum power project at a cost of RS. 506.8 billion. The cost of the 969MW project approved after fourth revision. The National Economic Council's

executive committee set away the misconduct and corruption accusations. In 1989, the cost of this project was estimated around PRs. 15.2 billion. It took almost 29 years complete this scheme.

The Prime minister of that time Shahid Khaqan Abbasi refuse the request by the planning secretary to solve the problems related to the delay of project and cost boom. During PMLN's period from June 2013 cost of the project increased from Rs274.9 billion to Rs506.8 billion. This is the highest cost by local and global standards in terms of megawatt electricity generation.

3.7) Financial aspects:

At the time of its evaluation in 1989 the project was to cost 167 million United States Dollars and after another redesign in year 2005 the cost increased to 935 million USD in 2011. Now costs have increased to 5.89 billion USD in 2018. The project is built under the supervision of WAPDA (Water and power Development Authority) and funding for the project is being achieved through the taxes, bond offerings from Chinese and Middle Eastern banks and Neelum Jhelum Hydropower Company.

Machines for the boring of tunnels were purchased to increase the speed of the excavation of the remaining tunnels. These machines started digging in February 2013. In August 2013 this project was 66 % completed along with the 75 % of the tunnel. At that time the Economic Affairs Division did not secure US$475 million. Nawaz Sharif expressed hope about the completion of one generator by 2015 after visiting the site in 2014.

The government of Pakistan was also considering raising the funds from local market through inviting leading banks, common citizens, public-private participation and business houses through different financial products.

The Fund's loans are generally made available quite easily and quickly, without conditions and its repayment conditions are generous for up to 50 years (plus 10-year grace periods) with servicing costs at about 1 %. And almost 60 % of these loans are outright grants.

A board which look after's the construction of the Dam is led by the WAPDA chairman having three members and three chief engineers. "The cost escalation because of involvement of tunnel boring machines change in design and specifications after the 2005 earthquake and more importantly currency depreciation has forced the government to secure $1.5 billion loans and equity participation from the Saudi Fund for Development (SFD) and Islamic Development Bank (IDB) for the project, now facing a financing shortfall of over Rs232 billion.

Separately, negotiations are already in advanced stages for finalization of a $450 million loan from the Exim Bank of China to bridge a huge financing gap arising out of over 296 per cent or Rs250 billion cost escalations.

The Kishenganga hydropower project that has been challenged by Pakistan before the international court of arbitration could reduce river flows at Nauseri the off-take point of Neelum Jhelum project by a minimum of 7 per cent and a maximum of 34 per cent, with an expected energy loss of 13 per cent of $141 million per annum. The loss of capacity will be overcome through a 45MW additional power house at a diversion spillway.

The project offered robust returns of about 22.5 per cent. Even with increased cost, the average electricity generation cost has been estimated at about Rs2 per unit after first eight years of interest repayment. The external financing had become all the more crucial for speedy deployment of tunnel

boring machine and its synchronization with river crossing effort that is expected to reduce project implementation time by at least 18 to 24 months.

3.8) Impact of India's Kishanganga Project:

In 2007 India started the construction on a run of the Neelum River known as Kishanganga upstream of the Neelum Jhelum Dam. Kishanganga Hydroelectric plant functions same as that of Neelum Jhelum using a Dam to divert Kishanganga river to a power station before the discharge of water in Wular lake which is fed by Jhelum river. The kishanganga Dam can divert a portion of Neelum River which will minimize the power generation at Neelum Jhelum Hydropower plant. According to an estimate33% reduction in power generation will occur by disturbing the flow of river. In 2010 Pakistan appealed to the Hague's Court of Arbitration, complaining that the Kishanganga Hydroelectric Plant violates the Indus river treaty by increasing the catchment of the Jhelum River and depriving Pakistan of its water rights. In June 2011, the Court of Arbitration visited both the Kishanganga and Neelum Jhelum Projects. In August 2011 India was ordered to submit more technical data on the project. India had previously reduced the height of the dam from 322 ft to 121 ft. After their application was first rejected, the court asked India late September to stop constructing any permanent works that would inhibit restoration of the river. While India could not construct the dam, they continued work on the tunnel and power plant. Hague ruled I February 2013 that India could divert a minimum of water for the Kishanganga Hydroelectric Plant.

Chapter # 4

Research Methodology

In this chapter the detailed methodology used for the research is discussed. Research methodology plays an important role in any study as it is the basic key to find the scientific and reliable findings. An authentic study depends alot on the adaptation of right methodology. This part deals with extensive nature of the research, data collection, techniques of arranging data, sample size, target audience etc. Research revolves around the views and observation of people regarding environmental changes after the completion of Hydropower project. Study is conducted in context of Muzaffarabad city. Qualitative approach is used in order to record the perception, behaviour and experiences of people around the environmental changes occurred in the locality.

4.1) Qualitative Approach:

Qualitative research technique is used to understand the issue widely and thoroughly. This sort of approach deals with the non numeric data such as words, themes, content, snaps, videos, documents etc. Moreover, the qualitative approach gives an insight to the issue and comprehends the problem in more better way in the forms of behavioral patterns. Therefore, this study has also adopted the qualitative style and it gives real importance to the view points of the respondents about the environmental disability.

4.2) Universe of the Study:

The Capital city of Azad Jammu and Kashmir is selected for the research due to the direct impact of hydropower plant on the city's atmosphere. However, the city is quite large with respect to its geographical nature and it is quite difficult to cover the big area and huge population. Therefore, visited different areas randomly mainly covered the university, bar council, secretariat and related departments. The data collected from the locality will enlighten about the current situation and changes seen in the past five years regarding the environmental Hazards. The findings of the study will be generalized as the overall views of the local people.

4.3) Sampling and Justification:

The purposive sampling method has been used for the selection of the sample of the study. This sort of sampling relies on the objective of the study and the respondents have to be selected from the different parts of the city. Sarantakos (2005) explained that in ordrer to get reliable results, the purposive sampling is quite reliable and consistent. Hence, due to the specific requirement of the

topic, the method of purposive sampling was adopted in the study. Furthermore, the purposive sampling is one of the most appropriate types of sampling as it supports in targeting the appropriate respondents for the study.

4.4) Sampling Size:

The selection of the sample size is another important phase in methodology. The sample size greatly influences the reliability, authenticity and the generalization of the findings. However, qualitative research gathers a bulk of data and it does not go with the huge sample size as compare to the quantitative research. The 21 respondents from different locations of the city have been selected to record their perceptions, beliefs, behaviors and experiences about the issue of changing environment.

4.5) Target Audience:

The local residents were selected for interview from different parts of the city. It was decided to get mature facts, the minimum age of respondents will not be less that 20 years. Since urban women in Azad Kashmir are mature and educated so, the female respondents have also been taken into account for the study.

4.6) Tool of Data Collection:

The instrument or tool of the study helps in gathering or collecting the data from the respondents. It is a qualitative research, therefore an in depth interview (IDI) guideline or unstructured questionnaire has been devised to get the data from the respondents. The questions were regarding the situation of people and surrounding environment after the completion of project?

The interview guideline was comprised of three sections, First part deals with the demographic details of the respondents asking them about their gender, age, education, family background, income etc. The second part seeks to assess their knowledge, behavior and experiences regarding the topic and the third or last section deals with the performance of the local government regarding the preservation of natural environment?

It was a qualitative research in a sense that the open-ended questionnaire has been used. The purpose of using the open ended questionnaire or interview guideline was to, understand the information thoroughly, capturing the detailed views of respondents, getting familiarity with the underlying reasons and logic and revealing the opinion based trends.

In this study, the interviews were conducted at the available, appropriate and suggested places by the respondents in order to develop a comfort level with them. The medium of communication for conducting interview was the Pahari, urdu and english language.

Chapter # 5

Field Data Analysis

Construction of dam will create a negative influence; dams are not deliberately built under this belief. No doubt there are positive as well as negative impacts of the Dams which are seen in Neelum Jhelum hydropower task case.
To analyse the whole project and to know the views of the people of Muzaffarabad city visited the project and the whole locality to know the actual on ground situation. Conducted a survey and met students, civil society activists, lawyers, teachers, journalists and some general public to prove the hypothesis of the study.

Questions:

1: What environmental changes are seen by the residents of Muzaffarabad in last five years?

2: What precautions are taken by the relevant authorities to overcome the worsening conditions of the environment?

3: Why the Government failed to address the Environmental Impacts of the project?

Mr Asif Raza Mir working as a journalist for Express media group worked on this environmental story and possesses a deep research He said "In Muzaffarabad the hottest topic of today is "Save the river movement" started by the civil society and citizens. At first people were not accepting the fact that the river can be diverted, He added that as a citizen I have a major concern that what would be the situation after the diversion of the river? What will be the future of effected? Neelum Jhelum power project disturbed approximately six lack people of the surroundings. Neelum is on the right side while Jhelum is located on the left; the project brought drastic environmental hazards. Now when Government is further extending it and working on Kohala Hydropower project people started protests and "Darya Bachao Tehreek" was initiated. He added that the NOC which was attained to before starting the project was not even considered by the construction company, not a single clause of the NOC was fulfilled. We are afraid that what the Government will do with Kohala power project, we can't let them produce 1124MW without addressing the concerns of the citizens. The people are not in favor of diversion instead they want the Government to design the project on run of the river. He further claimed that after Neelum Jhelum Hydropower task the temperature of the area rose 5 to 6

degree and in the result the surrounding glaciers are melting heavily for the time being the water level is ok but I am afraid that ultimately after some years we have to face the drought. These are the elements along with many others that people are concerned to be addressed. Government promised to initiate water bodies, vocational institutes, plantation campaigns and many other supporting projects which were not further fulfilled".

As a local do you think that the drinking spring water got reduced in result of Neelum Jhelum Hydropower project?. He answered: "The major part of the project is tunnel which affected all the surrounding areas. He added that the people of surrounding areas like Khawra migrated in thousands due to lack of water. Poor people of the area could not afford to purchase the drinking water. A water can here costs RS 250. After the earth quake people already migrated in great number towards the city and after this project the burden of migrants increased on Muzaffarabad city. The tunnel in such a dangerous area which is already on fault line and bears an earth quake of 7.6 on rector scale is not a safe step for the future. In case of any earthquake in future what will be the impact on this project which costed 5 to 6 Arab Rupees of the nation. Government approved the project on running river but then diverted the river from Nauseri to Chattar kalas then how they can claim that this is a project on running river? He concluded after a pause that for locals and for environment this project bought more harms then benefits".

Visited Muzaffarabad University and interviewed Mr Bilal who is a student at the Department of Environmental studies."All the adjacent roads affected by the Neelum Jhelum power project are still badly broken, crushing and grinding resulted in heavy land sliding. Government promised the local people that they will be provided with free electricity that is the reason locals have not opposed the project but lately it never happened. The population of Muzaffarabad is so congested and all the waste and sewerage of the population goes into the river. If the water of river goes down a certain level whole city will be dumped by the waste". Said Mr.Bilal.

Another brilliant student of Muzaffarabad university from the department of environmental sciences Ijlal naqvi added that" We as a resident of Muzaffarabad have seen the cities before the project and after impacts are also in front of us. We are in favour of development but we want our rights this project gave rise to the environmental pollution. Polluted environment resulted in swine flu recently 5 people died due to this virus. A recent report issued by testing the spring water in which only four springs were declared safe for drinking water and obviously this is the impact of these mega projects". He added further that this river was disposing off the waste of whole city. Questioned Mr Ijlal that don't you think this river is not supposed to hide the wastage of city? He replied "Yes you are right but people need to be aware, the Government should start educating them in its capacity that how to manage the waste of houses and sewerage. According to my understanding the solution to this environmental issue is to make mini lakes. The flow of the river should be increased and Government should find a win win situation for all".

Another conversation with a civil society activist Mr Hasnat who is again a local of Muzaffarabad. He added that "We cannot limit the environment only to Muzaffarabad and it is not only associated to this project, making a Dam and stopping the river was the need of people as well as environment. I think from 10 to 12 years now India could have built a Dam on this water as according to Indus water treaty any country can use the flowing water. Environment protection needs a certain level of water which is still possible. In case we are not going to Dam up the water there will be no future of our environment after 10 years. I have not seen any noticeable temperature change as the project is going on for two or three years now. River is not the only issue our problem is environmental pollution, waste disposal

and sewerage. There is not a single project of waste disposal in the city. There are dumps of waste alongside the river; this is not the fault of the Dam, not the fault of Pakistan.The only fault is our own waste management system and lack of awareness in the people. There is no setup of biodegradation, no proper program of tree plantation. So you cannot mould the environmental issues and temperature change under the cover of this river only. I am an activist but I am not the part of this movement started by the people to save the river because I don't agree with their point of view.

Hasnat answered to the question that What do you think that much heavy drilling and mining in an area which is already at fault line is safe? "See Mam China is also an earthquake effected area and the same construction company built the largest Dam in China and that Dam decreased the revolution of the world to 0.001 second. We have to trust the technology in today's world. Let me give you a political example that 30 years back a Prime Minister said that we have to build up tunnels with Gilgit Baltistan because we have to do the amalgamation otherwise we will suffer in future, all the people opposed him at that time that how you can cut the mountains? Now people are realizing that there is a great need of connectivity through such a tunnel. We need electricity and power for our secure future. I am in this locality from my birth and I have seen the environmental conditions from last 30 years, let me admit the fact without any hesitation that unfortunately this river has given us nothing except a source of dumping our sewerage and in fact due to this polluted water source our spring water was getting worst day by day. I appreciate the Neelum Jhelum and kohala Hydropower project and I think the environmental impacts in future would be very fruitful due to these projects. It is not right to say that due to these rivers our environment is a healthy and controlled environment. You can see near Neelum Bridge that there are heavy gutter lines opened in the river. Air pollution was always here despite of a big river flowing through the city. Let me now come to the other side of the story that what if the river will be converted into the Dam, no doubt we will be able to control the energy crisis on National level. For environmental protection it is needed to take other steps on Governmental level lakes are the best option to for the safer environment. As a lawyer I will add it that it is the duty of Government to give a protected and safe environment to its citizens. Our environment has many offences and it does not fulfil the clauses of Environmental protection act 2000".

Is there any treaty which supports the construction of Dams by law? He replied that "Of Course, according to the water treaty signed between India and Pakistan if any country constructs a dam on the river water it is legally ok to utilize the running water. Pakistan has availed this opportunity first and they are justified to do so. Our future generation can be given a better environment by taking some other measures and the other hand we will give them a nation free of energy crisis".

Talked to one of the oldest manager famous as "Chacha" of Neelum view hotel as He was the eye witness of the whole environment from many last years he said "The water level of the river decreased to a noticeable point after the construction of these projects. The local public is not aware of the consequences of opening all the sewerage and gutter lines in the river, they are also a cause of creating diseases and hazards for marine life. Due to unpleasant weather in summers the tourists in the area are decreasing"

Saima ayub is a lawyer at Muzaffarabad Bar council she expressed about Neelum Jhelum Hydropower project that 'for human survival, water is basic need. Some countries have serious scarcity of water and energy and still have increase demand. Economy and prosperity of many countries is adversely affected due to lack of clean and fresh water. For many states water has taken a deliberate role and could be serious dispute cause in future due to this shortage. As believed by many experts future wars will be fought over water. Neelum Jhelum Hydropower project undoubtedly

affected the environment I personally witnessed the change in temperature and unhealthy environment after the water level was controlled due to the project".

One of the most knowledgeable people on this topic is Dr Shabir Chaudhry and I luckily got a chance to meet him. I asked him that suppose if there is no Dam in the locality what will be the situation of environment after 10 years in your point of view? He answered "If there was no Dam or any mega construction then the natural environment flourishes; and with that natural habitat of all species benefit from it. It would surely have helped the human race, as their livelihood is dependent on clean drinking water, Remember water is fundamental to human life. Without water we human beings can't survive or thrive. Future wars will be on water and we are lucky to have this natural resource in abundance. This natural resource is more valuable than oil. Countries can survive and develop without oil but they cannot survive without water. So you can see that if we had control of this natural resource, we could be in apposition to become economically self-sufficient "I questioned "Sir what are the precautions Government should take to minimize the negative impacts of flowing water"? He answered with a sigh "which Government, if you mean Azad Kashmir Government they have no control or role in this matter. If you mean by Pakistani Government then they have delegated powers to WAPDA; and this white elephant do not care what is good for the people and environment. They are only interested in exploiting the resources with impunity. Do you know canal upper Jhelum was constructed by the British with the consent, and after the written agreement with the Mahraja of JK. The Punjab Government under the British Raj gave royalty to the Government of JK up till 1947. After west Punjab became part of Pakistan we did not revive single penny for use of the water of this canal. Whereas Pakistan made trillions of Rupees since 1947. I hope you know that the every household of AJK had to pay about 15 to 20 RS per month for many years for the construction of Neelum Jhelum Dam. " Hamari jooti aur hamara sir" worst kind of exploitation. The WAPDA will not take any measure to help AJK people. They want to protect their investment and get best returns by producing the targeted megawatts. I don't want to be the Devil's advocate but my feeling is WAPD and Government would like people to move away from this area mainly in Pakistan. This is to disperse the population of AJK, as they did when Mangla Dam was built in 1967.These people could have been settled within AJK but they were settled in various towns of Pakistan, and they became Pakistanis. We have lost manpower. You may not know how imperial mind-set works; I do as I have studied their policies. If they do release some water that will be because of generators are not working to full capacity". I then asked him that do you think marine life got disturbed in the whole process?. He replied "This is 100% true. Natural habitat was disturbed immensely during the construction and after the diversion of the Neelum river.

"Sir there is an active movement in AJK as "Darya bachao tehreek" your views about it?" He replied "When I started writing against the construction of Neelum Jhelum dam, that was the time something could have been done. At that time these people were asleep. Even people of Muzaffrabad said ignore Dr Shabir choudhry, he is anti-Pakistan and agent of India. He is creating rift between people of AJK and Pakistan. They could not see or understand what I was saying. This dam was not going to hurt me or my relatives but it was going to hurt the people of Muzaffrabad region and their future generations. I regarded them as my people that I why I spoke for them. My friend Afzaal suleria, a citizen of Muzaffarabd was charged for speaking against this Dam. He is still facing charges. Dam was not the requirement of the local people. Pakistan needed electricity ,They have plenty of places where they can build Dams and meet their requirements. Even on canal upper Jhelum, they could have established many projects without diverted the natural flow of canal inside AJK, and within Pakistan. They have setup one project near Mirpur which produces 85 megawatt. If I need water, I should dig a

well in my back yard and not in the front garden of my neighbour to satisfy my water requirements. I f Pakistan, WAPDA or so call leaders had been sincere to AJK then they should not have diverted the natural route of the river which was fundamental to the wild life, human life and beauty of the region. Dam is a disastrous option for the environment and you will see the results in coming ten years".

Dr Misfar Hassan said in his interview "The diversion of water will deprive a large area from its surface water for most part of the year. The populations living along the riverside including that of Muzaffarabad city will be affected extremely from water shortage they use for everyday purposes as visiting the riverside is part of the cultural life of the towns and villages located around the course of the river. This will affect aquatic habitat ecology and human environment with regards to downstream water supplies to human communities and sewage dilution needs for Muzaffarabad city. During seven months of a year the downstream discharge of water will be reduced to a bare minimum that is considered incompatible to maintain the needs of human life. Owing to a massive earthquake in 2005 that resulted in about 80,000 deaths these hills were destabilized. A large area was prone to land sliding since the earthquake the incidents of land sliding have increased since. Depriving the area of its naturally occurring moisture would have an adverse impact on the environment. The terrestrial riparian habitat would be adversely affected along the riversides. It would negatively impact on the wild life and the forest population that is already under threat due to increased human movement and mismanagement of the forests. The ESIA report has indicated that fish population would be adversely affected in particular the population of Kashmir cat fish would become extinct that is one of the sources of food for deprived local communities. There are concerns among the local people that during the rainy season the risk of mud sliding, and flash flooding would be greater that could endanger the populations living on the hilly terrains of rural areas".

Chapter # 6

Conclusion

After the survey and detailed study it is stated that "The construction of Neelum Jhelum Hydropower project has a great contribution to the National Grid but on the other hand it also impacted negatively on surrounding areas and forests by its huge solid constructions, human interference in natural environment, and additional pressure on wildlife systems. It must be precedence to avoid negative impacts of surrounding dam locations. Government should have to relocate necessary resources (trees, plant species and animals) and sustain healthy environmental conditions for regrowth in areas that are affected by variations in the watershed (caused due to creation of dam). Unfortunately, these measures are not practiced because of the incompetency of policy makers and weak environmental departments.

The project caused other major devastating factors that are not mainly considered in the planning or construction of the big dams. The project undergoes with huge mining which maximized the chances of earthquake as the construction and digging is already on the fault line of the area. Construction materials and wastes also polluted the water of the river, can cause ruin the surrounding wildlife in coming years and will contribute to air pollution. Major environmental changes drawn after the survey are as follow:

6.1) Displacement of Flora and Fauna:

There is a risk for backwater build-up due to this project, this condition is faced when a running river meets a stagnant body of water, this caused damage to upstream environment and property that was not predicted in the dams planning. Aquatic ecosystems got disrupted, weak species that are small in number will go extinct, terrestrial flora and fauna will also go extinct with the passage of time. The loss of forests and wildlife species will be a threatening condition in near future, yet very little is done to overcome these large scale losses.

6.2) Increase In Temperature:

Water deprivation and decreased flow would cause an estimated rise in local temperatures by three degrees that would have a detrimental impact not only on local crops but the forests and wild life as well as the health and wellbeing of local population with an anticipated rise in disease incidence and prevalence rates.

6.3) Displacement of Populations:

With the anticipated water deprivation there are concerns raised by members of the civil society that about half a million population forced ultimately to migrate. Although the studies carried out have down played this massive issue yet independent sources have stated that the reports are flawed. Hence the survey of the area showed that people migrated mainly because their lands were utilised by the Government for Dam's construction.

6.4) Traffic Noise Pollution, Health and Well Being:

The reports do acknowledge that increase in heavy traffic in the rural areas would lead to increase in the noise pollution that the local residents are not used to. The increase in use of heavy vehicles with high emissions would lead to increase in the prevalence of respiratory diseases like asthma and allergic skin disorders that have not been assessed in any report. The noise and increased atmospheric pollution could have an adverse effect on emotional wellbeing of the local population. Increased traffic would increase the risk of accidents for local people who are not used to such increased traffic flow.

6.5) Traditional Populations Of The Region:

The region has quite a large number of nomads that travel towards the higher mountainous regions during the summer months around in April time and they travel back to the plains during the winter seasons around September October time. These nomads rely for their living on their live stocks herds of goats and sheep. These populations travel on foot along with large numbers of animals. These are vulnerable communities and the increased flow of traffic carries a higher risk of accidents to this population and their animals. There are no well-equipped hospitals either to provide emergency trauma treatment or routine treatments to any major ailments the people have to travel up to Muzaffarabad for treatment that would be an additional burden on their stretched resources.

6.6) Earthquake Impact Assessment:

The reports have not taken into consideration any assessment of the safety of the project as it is located in the seismic zones and the powerhouse is located with one km range of Muzaffarabad thrust Holocene age considered to be responsible for 2005 earthquake that left about 80,000 people dead.

Neelum Jhelum Hydropower project is still one of the major issues of that area. Many pressure groups, student unions and civil society is still negotiating with Government and pressurising that "Let the Neelum Jhelum flow, don't disturb the eco system and flowing water as it will destroy the identification and beauty of Muzaffarabad city which is a tourist destination due to the flowing river".

They are also demanding their share in jobs as they are locals and it is their right to be considered as priority, but so far the administration appointed.

6.7) Public movement to save the river:

A new social movement started specifically in Muzaffarabad and the demand of public is to save the river and let it flow in order to maintain the realness of their city. People think that Neelum Jhelum is the beauty and attraction of their city and diverting the river will lose the real image of the city.

Ch # 7

Recommendations

7.1) Negotiation:

There is an active movement which is the talk of town named (Darya Bachao movement) lead by the civil society activists. Many students and citizens are the part of this campaign and they are demanding that the natural flow of the river should not be disturbed. Government must talk to them on priority basis to find out a win win situation for both parties.

7.2) Plantation:

Forest department must take action against the mafias illegally cutting the trees at massive scales. Deforestation is giving rise to sliding and land is getting soft, along with that the temperature change can only be controlled by planting maximum trees.

7.3) Sanitation plan:

Whole Muzaffarabad city is seen with the dump of garbage due to lack of sanitation and waste management plan. All the waste should be managed on priority basis to minimize the water pollution of the river.

7.4) Settlement of Migrants:

Due to construction of project thousands of people migrated to different areas of Pakistan. The adjacent villages are lacking the pure drinking water and hence many people are migrating from there too. This is reducing the man power and qabila system of the locality is getting weaker. So Government must take measures to resolve their issues so they may live at their places again.

7.5) Relief for locals:

As the local citizens faced many environmental, social and political issues, they must be compensated in electricity bills in reward of their sacrifices. The Dam is contributing to the national grid so it's the right of locals to be preferred.

7.6) Marine life:

Marine life is very important to promote tourism, as the marine ecosystem got badly disturbed by changing the natural habitat of the fishes and other species. A proper framework must be developed to save and minimize the loss of marine life.

7.7) Drinking Water:

Locals are lacking the fresh drinking due to disturbance caused by the construction to the spring water which was a major source of survival and people were greatly dependent on that. Government must provide an alternative to minimize the risks of migration due to lack of drinking water.

7.8) Red zone Area:

All the upcoming construction projects must be earthquake proof as after this huge cutting and mining the chances of destruction during the earthquake become double as the complete city is on fault line and already declared as red zone.

7.9) Infrastructure:

The roads, bridges and link roads must be focused by the relevant authorities to promote tourism and to strengthen the life style of locals. The local businesses will flourish with good infrastructure.

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