

Environmental impacts of hydro power plants Naltar [16MW]

Gilgit Baltistan

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Abstract

This article benevolence a confab on the methodical characteristics of Hydropower—reverie. How the hydropower energy converted into electricity. And quantity of produced of able energy from hydropower. What is the benefits and disadvantages of the construction of Naltar dams, how its impact on environment. This mini project is built on hilly valley of Gilgit-Baltistan. What is the aim of these projects built on Naltar River? How much electricity is generated from these mini projects? What is Riverine hydropower? Followed by the basic description, technology used to transformed hydropower into electricity. A summary of the collection of environmental impact on the, communities of peoples plants/animals, and financial factors consist in hydropower plants. The article follows by, why hydropower renewable energy source is more beneficial as compared with other renewable resources like solar, wind etc. and how conventional hydropower technologies have escalation, connected with public and ecological ramification. as electricity requirement is recognized as a big issue now a days in PAKISTAN, other factors like mechanical (e.g. dependability), financial (e.g. viability), supporting (e.g. Public and political issues, public and political contribution), and social (e.g. media description of hydropower progress, environmental and common standard) they are essential factors which is considerable.

Keywords: hydropower, hydroelectricity, land use, wild life impact, Life-cycle Global Warming Emissions, deforestation, regional development

1. Introduction

This article gives careful consideration about the environmental effect of hydroelectric power. Hydro power does not directly pollute water and air. However hydro power facilities have great environmental impacts by changing the environment and effecting land use, homes, natural habitats and global warming. And examine the many important roles that play on human society [1]. For example, large reservoir have been done a massive public works, they have not only built to flood control and also for generating electricity, shipping,

Commented [AA1]: Jonathan Kleinman, Patrick McCully2004

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water to irrigate the land for cropping and provide water for drinking, and they have a lot of other aids. The dams are mainly constructed to control flood in that area like the construction of Naltar projects I, II, III the main aims of these projects is that to control the water which comes after the melting of glacier, and the secondary consideration of these projects is that to generate electricity which is provided to the local area and reduce the short fall of light in Gilgit-Baltistan region. The hydroelectric power plant have a significant water storage capacity, being therefore dispatch able [2]. The energy which is produced by hydropower plant can be stored and used, to certain boundary. This is a very important advantage of hydropower plant as compared to other renewable source like wind and solar power plants [3]. the other advantage of hydropower is that they produced less (negligible) amount of greenhouse gases or other noxious emissions [4]. Nevertheless, it is not constructed only for improving quality of life and advancement. Dams are mainly constructed for national and ethical plans. They are considering the noticeable symbols of "progress" for a nation now days. The planned hydro power plant Naltar III 16 MWs reservoir on the Naltar River in Gilgit is this estimated to need the position of between 0.016 to 0.018 million people from their homes and homeland. The government is keen to progress the region on priority basis, and has planned to construct a number of small and mini hydropower projects to encounter existing requirements of agriculture, industry and trade on sustainable basis. This region is not connected with national grid and instead, it is an isolated network for power distribution and transmission. It has great potential for manipulating hydropower, hydro power is renewable form of energy which is more feasible, low cost and environmental friendly as compare to other source of energy. Presently, there are 98 power projects in process with accumulative installed capacity of 133 MW; most of them are called mini and minor hydropower plants. They reduced the shortfall of electricity up to 50 percent of the population which have access to electricity.

27 hydro power projects are under construction which have total generating capacity is 248MW [5]. The government planned to installed another 136 mini projects which have the total capacity of 500MW on the right bank of Naltar River. Naltar III power project will be constructed by heavy mechanical complex which based on advance technology and aiming to construct sound bases for indigenous design and engineering, manufacturing and technical services.

Commented [AA2]: Juan I. Pe' rez-Dí' az n, Jose' R. Wilhelmi 2010
Assessment of the economic impact of environmental constraints on short-term hydropower plant operation
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IEA Implementing Agreement for Hydropower Technologies and Programmes, 5450 Canotek Road, Unit 53, Ottawa, Canada K1J 9G3
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Apparently, the vested benefits have unfulfilled so far the government efforts to support the present capacity of local engineering industry to adapt related advanced technology [6]. The political peoples and engineers which is related with mega-monument projects commitment to construct this mini dam. Hydropower sources have no negative impacts on environment. The growing deficiency of power in gilgit-Baltistan is uncontrolled due to rapid growing population, an amplified cognizance of these effects of dams on ecologies. This article tries to present hydropower development and conversation on the technical and environmental impacts aspects within the social and political perspective defined in this opening. This article has two sections of covering riverin of hydroelectricity resource of Gilgit-Baltistan, as whole, has as the generation capacity of hydropower around 22000 MW [7]

Commented [AA6]: Naltar hydropower projects delayed
Dawn Newspaper
PUBLISHED JAN 09, 2011

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Hydro power resources of Pakistan
Private Power and Infrastructure Board



Figure 1.1 show the Eastern, Northern and Southern Regions of gilgit baltistan

2. Riverin Hydropower

Hydropower is a “renewable” energy source for the reason that of its necessity or reliance on the solar-driven hydrological cycle of water in a form of rainfall and evaporation. This is the only form of energy which is fully developed and not required too much research to exploit. It’s required only proper attention and political stabilities [8]. The tools or technology which is used to exploited the hydropower is itself-non-renewable, after some time period the lost their strength and steadily misplace their water storage space ability to settle carried from downstream to upstream. The hydropower plant is considered true renewable if it has the potential massive costs to restore archaic dams and consume of the sediments. From small power projects removal of sediments may be economically and technically easily achievable. Method of reservoir reddening can prevent sediment accreting in reservoir at a certain damaging levels. However the performance of these reservoirs works only in definite hydrological and geographical conditions.

The hydrological cycle cycle is driven through sun light fluctuation—the amount of energy up to 750 (W/m²) dropping on the water surface. When the sunlight fall on the water bodies the molecules of water will evaporate & released or spread into the atmosphere. These water molecules make clouds. The water go back to freshwater lakes or the river or oceans after consumed the optional energy flows across the lands. For landscape and changing of weather required a potential amount of energy which is available in riverine hydropower.

2.1 Technology

Hydropower generation capacity depends upon the amount of water a head. While the top is frequently connected to the height of the dam, a low height dam has a high head if the powerhouse with its turbines and generators is situated near to downstream of the dam. The major’s equipment’s are reservoirs of water, intake, control gate, penstock Pipes, turbine, generator, transformer and outflow of water.

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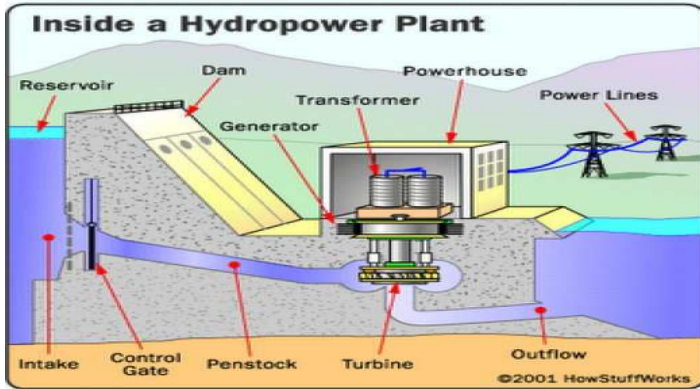


figure 2.1 show the equipments used inside a hydropower plant

The “penstocks” is also known as pressure pipes which convey the water from the reservoir to turbine and convert the potential and kinetic energy in to mechanical energy. [9] Once the water has rotated a turbine it move into the “tail water” beneath the dam via a “tailrace” pipeline.

Commented [AA9]: RaviKumar n, S.K.Singal 2015
 Penstock material selection in small hydropower plants using MADM methods
 Alternate Hydro Energy Centre, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand 247667, India

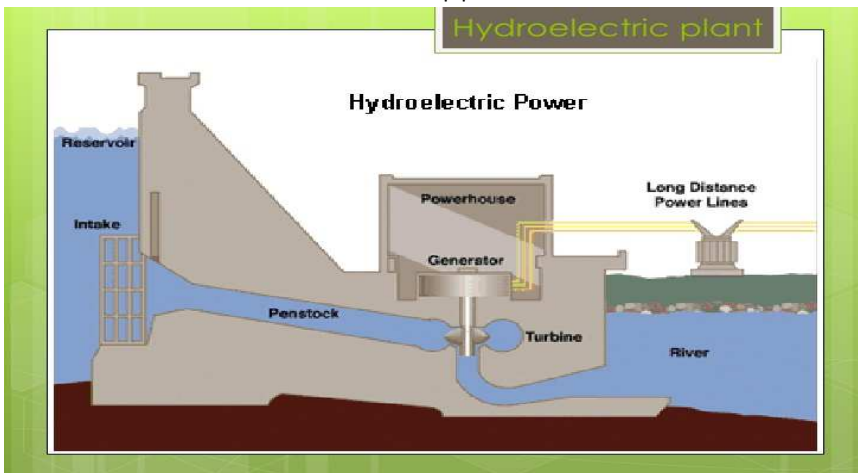


Figure 2.2 show the pipes or penstock of hydropower plants.

Hydropower plant operating pattern is consist of two types "storage" and "run-of-river." Storage plants have reservoirs, which store rain water during rainy session during round the year. Plants with large reservoirs are generally used for generating a relatively higher energy. Long time droughtiness of reservoir is harmful because it can reduce power generating capacity. Hydro power plant reservoir store water during low demand of power and then it allow sharply begin generation during peak load time. The Water Power Program funds R&D to isolate test and installed new resources and building techniques to improve the performance and reduced the manufacturing costs of hydropower. Program-funded research applications on resources or electroplating iron material for prevention of corrosion and moisture content of turbine runner, penstock, and draft tubes. Research and development also concentrate on recognizing and testing techniques to better generation capacity and reliability [10].the small reservoir have less space for the storage of water and cannot regulate downstream flows of water continuously. The Nalter power plant operating pattern is based on storage of water or riverin plants.

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2.2. Energy and Environment Interactions

Energy is mandatory for human beings for cooking of foods, to rise up or down the temperature, etc. in our societies. Energy is required to run locomotive engines and transport goods. All mechanical equipment's required energy to speed up the performance of work and run industries and increased the proficiency. [11]They construction of hydropower plants have negative consequences on the environment there are Flooding of communities, both human and plants/animals These dames have released water which sometime create flood in that areas or near to the dames.

Commented [AA11]: Suleiman Iguda Ladan Number 6 (2013)
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The construction of dams includes large amount of water to remain Stationary which is the idle breeding ground of routes of diseases such as *Schistosomiasis*, *onchocerciasis*, malaria fever etc. which are the common diseases found in the people live near to dam sites.

Construction of dames disturbed ecosystem and local wild life. These dams damaged the ecosystem. [12]

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By disturbing the timing and volume of the flow of water, nutrients and sediments of downstream which are harmful for local habitants, Hydro power dams have great local and regional ecological impacts. These impacts result from both existence of the dam and as well as operation of dam. These impacts are shown in blow table.

Reservoir and dam impacts	Operational impacts of dam due to their pattern
1. Upstream change from river valley to reservoir change in downstream hydrology.	1.deviation of water flow
2.alteration in downstream morphology	2. Changes occur in flow when session changed.
3. Seashore due to different sediment load.	3.instibility in flow
4. Due to change in flow pattern effect on nutrients and river temperature, and concentration of heavy metals, dissolve gases and turbidity.	4. Change in high and low flow rates.
5.Diminishing of biodiversity due to hindering of movement of organism	5. Reduction in river in/riparian flood plain habitat variety because of eradication of flood.

2.3 Land Use

Hydro power reservoir depends on the size of power generation capacity of project and land. The Hydroelectric plants which are constructed on flat areas are needed more land as compare to hilly and mountain areas. In valleys, where bottomless reservoirs can hold more water in a smaller space.

At one extreme, the Naltar hydropower plant, which was built in a mountain area of gilgit, flooded 200 square kilometers. The hydro power plant of 16W generating capacity is equal to more than 150 acres per MW in this area there are three other mini dams are under construction which have required 2 acres land which is nearly equal to quarter of an acre per MW.

Hydro power projects have extreme environmental impacts, it destroy forest, wildlife, agricultural land and barren land. It also effect entire communities have also need to relocate to spare land for reservoir and power plant.



Figure 2.3 Construct Site of Nltar Hel power project

2.4 Wildlife Impacts

Dam reservoirs are used for different purposes; Dammed reservoirs are used for multiple purposes, such as flood control, agricultural, irrigation and recreation. The major impact of hydro power is on ecosystem such as killing of fish because turbine blades can be injured and killed this organism. Wildlife species have been vanished like wolf, markor, leopard and birds. Hydro powers after needs the use of dam changes ecosystem and affecting people and wildlife. And also population of these areas whose depend on those water. The bottom water of dam reservoir is too much cold and not favorable because change in temperature decrease supply of oxygen and effect ecosystem composition and thermal shock occur, fishes and other organism adapted to particular temperature range can be killed by abrupt change in water temperature, education in dissolve oxygen concentration of dissolve oxygen decrease when too much cold water. The cold water fish required about 6ppm to survive sudden change in temperature is harmful for life of fishes due to lack of oxygen [12]. some time storage water of dams suddenly release which cause flood and create turbidity, this act upset plants. And wildlife habitats effect on supply of water [13]

Wildlife impacts both within the demand reservoir and downstream from the facility. Reservoir water is more stagnant than normal river water. Resultantly the reservoir will higher than normal amount of sediments and nutrients. Which can cultivate more algae and other aquatic weeds? These weeds can crowd out other river animal and plant life, and they must be control through manual harvesting or introducing fish that eats these plants.

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Figure 2.4 Construction site of Naltar Hyde power plant

Reservoir water is more stagnant than normal river water which is more sediment and nutrient than normal water. Which cultivate more algae and other aquatic life, these weeds and aquatic life can crowd out other river animal and plants life. It is very necessary to control through manual harvesting or manage by introducing fish that eat these harmful plants. Too much water stored behind Reservoir River can be dried out. Thus most hydro power plants are required to release some water at certain times of year if they do not release appropriate water the plants and animals will vanish. Reservoir water is colder than normal water. When this water is released it gives negative impacts because the coldest water has the lowest dissolved oxygen.

2.5 Life-cycle Global Warming Emissions

Normally global emissions are produced during installation and dismantling of hydro power plants. Warming emissions are also produced during facility operation and can also be significant. These emissions greatly depend on the size of the reservoir and land area.

In a cold climate the emission of CO₂ from hydropower plant is 15g equivalent/kilowatt-hour. This is 30–60 times less than the emission of CO₂ from fossil fuels plants.

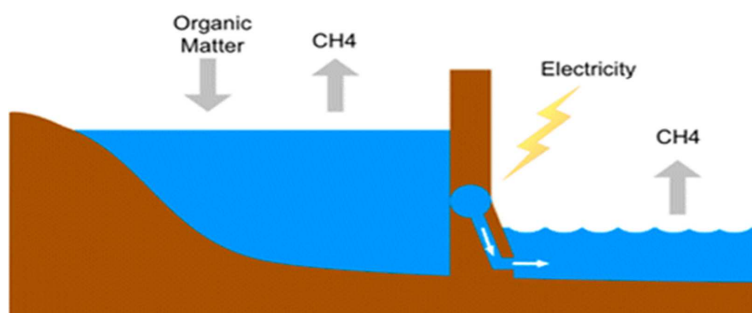
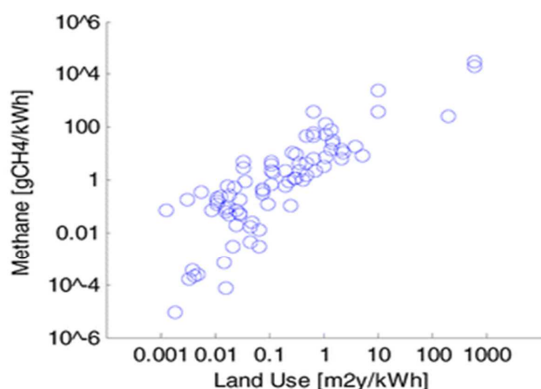


Figure 2.5 show emission of methane gas from hydropower plant.

The capability of hydropower plant of subsidize to climate change the moderation is sometime is questionable, mentioning the emission of CH₄ and CO₂ causing from the degrading of biogenic carbon in hydropower plant. [14] Life-cycle emissions of CH₄ and CO₂ from huge hydroelectric plants constructed in semi-arid areas are also modest: almost release 0.06 pounds of carbon dioxide corresponding per kilowatt-hour. But the life-cycle global warming emission of these gases increased when hydropower plants construed in hot areas or the weather of that area is much higher. When flood in occur in these areas they decomposes the plant and animals and they release a lot amount of methane and carbon dioxide. The particular amount of emission of these gases depends on specific characteristics of that site. The current evaluations propose that life-cycle emissions can be over 0.5 pounds of carbon dioxide equivalent per kilowatt-hour.

Commented [AA15]: Edgar G. Hertwich, August 02, 2013
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 Industrial Ecology Programme and Department of Energy and Process Engineering, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway
Environ. Sci. Technol., 2013, 47 (17), pp 9604–9611

2.6 Water for irrigation

The Naltar dam irrigates approximately 500 acres of land and provides fresh water for drinking and irrigation to the entire population of Naltar valley. This land was barren before construction of Naltar dam. This dam reservoir provides drinking water for people. Besides environmental impacts of hydro power, they have some great significance, they are providing water for irrigation for land and this water is used for sanitary purposes.

Effect on natural habitat

Majority of hydro power projects have dams and reservoirs. These structures affect fish migration and affect their population. During operating hydro power plants, they change water temperature which affects fish life, fish have a limited ability to survive at 32°F and 6.4 ppm BODs if temperature increases from this level, it affects fish. When temperature increases, dissolved oxygen decreases, which causes serious problems for fish and also increases toxicity and acidity. Reservoirs and dams of hydro power also affect homes, plants, and agricultural land. And it also produces greenhouse gases and methane, which are excellent heat absorbers and cause global warming [15]



Dam site of Naltar power project before construction

Conclusion:

Hydropower dams badly effects on our environment because when new dams constructed they captured lot of area and great corrosion and deforestation occurs. Due to the deforestation global warming is increased and they affected many habitats and their survival make impossible. The Naltar hydro power dam effect local population which is big task to rehabilitate whole population. But hydro power is comparatively less dangerous fir environmental as compare to thermal power and geothermal. They importance of naltar power plant they provide fresh water for drinking to the local people to the valley and also irrigated their land for cultivation. Before the construction of the dam when they glacier melt they create flood in the valley and destroyed a lot of the area due they construction of dam the flood is control. This project produces cheap electricity and overcome existing crisis of energy in region. They provide electricity to 0.016 million peoples to the valley.

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