

HYDROPOWER DAMS, ENVIRONMENT AND POLITICS

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Abstract

Renewable energy sources are vital to fulfill the high demands of energy in the present world. The common renewable energy sources are wind, hydropower, nuclear and biomass. However, hydropower is considered the most flexible and consistent renewable energy source because it is comparatively cheaper and more available. Besides hydroelectricity production, hydropower dams can also be useful for irrigation. Though hydropower energy is considered as green energy due to its less carbon emission, still other environmental impacts of hydropower dams are many. Hydropower dams are built based on political ground. Research into the politics of building hydropower dams and environment remains underdeveloped in many ways. Thus, this paper focuses on the issues of politics of building hydropower dams and its impacts on environment. This paper has critically reviewed the extensive literature to examine the argument and counter argument. This paper argues that the building hydropower dams on international river for renewable energy has political as well as environmental impacts. Most of the literature argued that hydropower dams provide renewable energy which produces less carbon emission, but it is argued in this paper that hydropower dams have huge political and environmental impacts nationally and internationally. Displacement of the people and dispute for water distribution among countries due to the building hydropower dams are also considered to be significant for discussion in this paper. Thus, the paper critically examines the impacts and role of hydropower dams on environment, international relations and politics.

Keywords: hydropower dams, renewable energy, environment, politics, and international relations.

Introduction

The demand for energy has been increased tremendously due to the rapid population and economic growth in the present world (Ansar, et al., 2014).

Therefore, the demands for the global electricity were calculated to be roughly double between 2010 and 2035 (IEA, 2011). Thus, it has become a big challenge for the countries to fulfill these demands of global electricity. To meet these demands, the alternative energy sources are renewable energy (Bhattacharya, et al., 2016). The renewable energy sources namely wind, hydropower, nuclear and biomass have become very popular alternatives to accomplish the demands of global energy (Hosseini and Wahid, 2016). However, hydropower is considered to be the most flexible and consistent renewable energy source as it is comparatively cheaper and more available than other resources (World Energy Council, 2016).

Hydropower energy is produced from hydropower dams which are built in upstream rivers using the gravitational flow of water transferring into hydroelectricity. More than 45,000 dams have been built worldwide (Dufflo and Dams, 2007). As the most important renewable energy source, hydropower generated 71% of all renewable energy of the world which contributed 16.4% of the global energy supply from all sources in 2016 (World Energy Council, 2016). Developed countries have been using hydropower to face their challenges of demands for energy since 1980 (World Energy Council, 2016) as human civilization has been accelerated through hydropower dams. Countries that have rivers at the upstream can produce hydropower electricity more easily and efficiently. Thus, hydropower has become a very important energy source within available renewable energy sources. It plays very significant role in power generation as it is recognized as the largest contributor of renewable energy which is helping to meet global energy challenges (Botelho et al., 2017). Botelho et al., (2017, p. 896) also reveal that “Recognizing underlying resource finitude and depletion, it constitutes an opportunity not only to answer continuous energy demands associated with economic and population growth while meeting environmental standards (especially considering greenhouse gas (GHG) emissions, global warming and climate change issues) and simultaneously improving social wellbeing through power supply to underdeveloped and isolated regions”. However, the purposes of building these hydropower dams are not confined with hydroelectricity production only (Hoang, et al., 2018). The multiple social economic benefits, which can be generated by the hydropower development, are irrigation, drinking water, and flood control (Yüksel, 2010). It also meets the bilateral demands for water and energy, more specifically, in places where there is a scarcity of supply of the fossil

fuels, and the countries which desire to control the carbon emissions (Zhang et al., 2014; Dursun and Gokcol, 2011).

Regardless of these positive sides of hydropower, it certainly has various impacts on environments particularly on river ecosystem, blocking river connectivity, habitat destruction, water quality degradation and sediment deposition (Turner et al., 2017; Chen et al., 2015; Asaeda and Rashid, 2012). Also, the impacts of hydropower dams are not limited with the environmental impacts alone. It can be considered both environmental and political issue. Therefore, examining environmental impacts and identifying underlying political reasons for constructing hydropower dams are the main objectives of this paper. Thus, the paper considers that regardless of producing clean energy and environmental impacts, hydropower dams are also highly political issues both nationally and internationally. Since the history of dam buildings, millions of people have been displaced (Tilt and Gerkey, 2016). Hence, dam building draws human rights activists' attention. Again, dams those are built on international rivers can create disputes among the countries for the equal distribution of water (Olmstead and Sigman, 2015). Given the possibility of future conflicts over the matter of water distribution, hydropower dams are considered as an important element of world politics.

Data for this paper were collected from various secondary sources. Secondary sources include books, journals and reports of World Energy Council. This paper critically reviews the existing literature on hydropower dams focusing on impacts of hydropower dams on environments and politics. The paper is divided into several parts. The section two focuses on impacts of hydropower dams on environmental, while section three explains how and why hydropower dams have become a political issue and finally section four concludes the paper.

Impacts of Hydropower Dam on Environment

Hydropower projects are environment friendly as it produces relatively clean energy in terms of carbon emission, but it has some direct and indirect negative impacts on environment. Thus, it has benefits and costs for environment. However, the impacts are not equal for all projects as the value and levels of these impacts are mainly depend on the location/site, type, length and other dimensions of

hydropower plant (IPCC, 2012). The impacts many differ from case to case and thus the identifying its most significant impacts is a complex job. The literature on renewable energy claimed that hydropower is considered to have less environmental impact compared to non-renewable energy sources such as fossil fuels and hydroelectric projects contribute in controlling greenhouse gas through its low carbon emission (Botelho et al., 2017). However, harmful environmental impacts of hydropower dams cannot be ignored.

Climate change and other man made activities have endangered huge number of species of all biomes. Worldwide aquatic and terrestrial biomes' species are being endangered by dam building. Moyle and Mount (2007 p. 5711) have claimed that "Dams homogenize flows mainly by reducing peak flows and increasing minimum flow". As a result, the variability of flow is altered and turned into uniform flow. From an aquatic organism perspective, this change in natural flow is important as it reduces the channel complexity (Moyle and Mount 2007). This uniform flow and stable channel that fails to carry high flows is preferred by some species for example, catfishes in North America. But overall, it is not natural for all other species and not favorable that causes loss of biodiversity in the downstream rivers (Winemiller et al., 2016). With alteration of flow, nutrient cycle important for the fishes and other species is also interrupt which results in the same extinction both by increasing mortality rate and reducing fertility rate of the species.

Comparing between fresh water, terrestrial and marine biodiversity, fresh water biodiversity is most endangered and that is mostly due to human activities of which dam building in the upstream is the biggest threat (Winemiller et al., 2016). Flow alteration by building dams being an anthropogenic activity, significantly impacts the ecosystem of those particular rivers or wetlands provides (Aguiar et al., 2016). With the rising numbers of dams built in tropical Asia, researchers are becoming aware of the impact of the dams by altering flows that leads to huge biodiversity loss in the downstream (Aguiar, et al., 2016; Dudgeon 2000). Example from dams built in Mekong river basin in China will be best example for the loss of biodiversity. After Amazon, Mekong is the most biodiverse river in the world (Ziv et al., 2012). China built first dam on Mekong mainstream in 1995 and till 2008, there were already 7 large dam on Mekong which have strong possibility to become more than 100 as a lot of proposals for building dam on Mekong are

proposed. However, most number of dams on the 2nd most biodiverse river must have the devastating impact on the biodiversity and so it does. Barriers in the upstream stop migration of both economically and biologically important species (Dugan et al., 2010). Adding to that, larvae and eggs which sustain the amount of fishes in the downstream will be reduced a lot as juvenile staged fishes and other aquatic species will be bound in impoundment. It will reduce the biodiversity by decreasing and sometimes almost vanishing species in the downstream rivers (Dugan et al., 2010). Being a transboundary river, Mekong flows through Laos, Cambodia and Vietnam where also biodiversity will be greatly threatened as being situated in the downstream (Dugan et al., 2010).

From 2015 to 2030, 25 more dams are going to be built and either biomass or biodiversity will be greatly hampered by alteration of flow. With the biomass in the downstream being threatened, for 1% of biomass loss, there will be 6 species endangered (Ziv et al., 2012). Mekong is the home of 4 largest fishes in the world like giant catfish which is more than 2m (Mitamura et al., 2008). These giant fishes are being endangered, found in research due to the alteration of flow which hampers the natural habitat of them (Mitamura et al., 2008). In Padma, river in Bangladesh was famous for hilsha fish which once abounded in northern part of the river but now, because of Farakka barrage over Ganga River, Padma is dying there and hilsha has become an endemic species of Padma river (Whitehead et al., 2015; Banerjee 1999). Like Mekong, all other rivers having dams are also being adverse for its biodiversity. In Bangladesh, Karnaphuli earth filled dam is also regarded as threat to biodiversity of the fish species which abounded in hilly river (Ahammad 2012). Currently the number of species has significantly reduced. It is not only Asia but also in other regions and rivers too.

Where flow of water is being altered by damming the river, river basin areas are also being affected by hydropower dams (Zarfl et al., 2015; Nilsson 2005). Dams need large area to be built including workers' living, residence of the engineers are for other technical support for which, large river basin area is used. A global overview on dams' impact has shown that 8 of most biodiverse areas were affected by dam building (Zarfl et al., 2015). The adverse impacts are by forest fragmentation, flooding large area which is a catastrophe towards the terrestrial biodiversity. The research has found that more than half of the catchment areas of

the dams worldwide are highly affected by the dams (Harris et al. 2016; Nilsson 2005). Catchment area strongly affected Large river system (LRS) constitutes more than 50% of three biomes; broad leaf and mixed forest, temperate grassland and savannas (Jager et al., 2015; Nilsson 2005). In desert biome, affected catchment area of LRS is more than 82%. This area also includes Mediterranean forest, woodland and forestlands enriched with medicinal plants and other rare plants which are threatened to extinction by dam building (Jager et al., 2015). Other animals and species depend on these forest land and biomes are also highly threatened as their habitats are being threatened. Also, with the extinction of aquatic species due to alteration of flow has an impact on the terrestrial biodiversity as they are interlinked through the ecosystem. Of all biomes, only tundra is less affected as that includes less LRS as being less favorable landform and climatic to have dams built in that region. However, most of the affected areas lies in Asia as the dammed rivers are transboundary and affects the biodiversity of hotspots.

Is Hydropower Energy Really a Clean Energy?

Hydropower dams use gravitational force of water as the source of energy production. Because of that, it does not require burning of any fossil fuel in order to produce energy and produce almost zero to minimum greenhouse gas. That is why the energy from hydropower energy is called green energy. However, despite not emitting any carbon, hydropower dams impact environment in many other ways. Hydropower researchers have found hydropower dams as producers of green house gas (CHG). Yang (2012) argues that “After reservoir basin inundation, the readily decomposed carbon stocks in now submerged plants and soil are largely converted into carbon dioxide and methane”. In high temperate countries like Southeast Asia where more dams are built, high temperature accelerates the process of decomposition and produces more CHGs to emit. The rate of emission of CHGs is more than 3 to 6 times than in countries with reservoirs in temperate weather (Yang 2012). Carbon off-setting scheme CDM (Clean development mechanism) is well-known for funding eco-friendly projects and they have funded for dams in China and India near Himalaya but the main purpose of clean development is not achieved as the dams emit CHGs (Erlewein 2011). Water level in Mekong delta has risen significantly which clearly shows the negative impact of building dams randomly for energy production without maintaining sustainability (Grumbine et al., 2012).

While damming in the upstream, many downstream rivers are dying without flowing of enough water in the dry season. Dams are killing the rivers as argued by many researchers (Stone 2010). Due to Farakka barrage, the northern part of Padma in Bangladesh has almost died and wide flow of water is now flowing like small canal there which has also destroyed the biodiversity there (Banerjee 1999). Aral Sea which was world's 4th largest saline lake was feed by Amu darya and Syrdarya, two large river (Karthe, 2018). In 1960s, the soviet government decided to alter the river flow to the desert to support agriculture instead of watering the Aral sea basin which brought catastrophe drying the whole Aral sea into desert. This environment hazard destroyed not only the environment but also the biodiversity of Aral Sea (Micklin, p. 2016).

Terrestrial, aquatic, marine, tundra, grassland, savanna or freshwater biome; all of them have some certain characteristics including temperature, rainfall and biodiversity (Van Manh et al., 2015). When they are adversely affected by hydropower dams being in the LRS, the natural rate of evaporation and precipitation are also affected adversely and the natural rate of rainfall is no more. This is a scary indicator of climate change as rainfall is one of the main components of weather (Van Manh et al., 2015). Altering rainfall and increasing world temperature by emitting CHGs, hydropower dams are accelerating the climate change adversely which is not going bring any good neither for the earth system nor for the biotic and abiotic beings that together build the ecosystem.

Politics of Hydropower Dam and International Conflict

Construction of Dams on international rivers is an important source of creating tensions and crisis among the countries in recent days (Ehsani et al., 2017). Building dams by the upstream country affects the riparian country directly or indirectly in many ways (Ramachandran, 2015). For example, India is an upper riparian state to Pakistan and Bangladesh and lower riparian state to Nepal and China. In the case of Farakka Dam, India is an upstream country and Bangladesh is lower riparian country to India. Thus, Bangladesh is really facing serious problems due to the building of Farakka dam over Ganges which has become a tension area to the Bangladeshi government (Gain and Giupponi, 2014).

Brahmaputra River is an enormous transitional river spanning more than 2880 kilometers across China, India and Bangladesh. China's location, upstream from both India and Bangladesh, gives it an advantage in terms of controlling the management of Brahmaputra's flows. China's grand plan to harness the waters of the Brahmaputra River has set off ripples of anxiety in the two lower riparian states: India and Bangladesh (Ramachandran, 2015). According to Chinese Policy documents reveal a plan of building four hydroelectric dams on the rivers; it has only built the Zangmu Dam (Chowdhury, 2016). Besides the Zangmu power station, the Chinese government has approved other hydropower projects along the Brahmaputra. It maintains that all these are run-of-the-river projects that involve no storage or diversion and that they will not affect the river's downstream flow into northeast India. However, India is seriously concerned that China may divert water from Brahmaputra to Yellow River through Sichuan province (Chowdhury, 2016). Fact is that China has also its own concern regarding the recent development activities in Arunachal Pradesh. Though Arunachal Pradesh is a part of Indian Territory, China is still claiming this province as an integral part of China. Recently India increased its development activities in Arunachal Pradesh, and plans to build a series of dams in the region for energy production. Seeking control of Arunachal Pradesh, China is concerned that Indian development there will strengthen New Delhi's presence in the area. While China cannot force India to stop building dams in its sovereign territory, this could create potential for Chinese retaliation upstream, in the form of diverting water flow or withholding water level data (Chowdhury, 2016).

Water distribution and dam building can also result in dispute between countries. For example, the newly proposed dam in Shalkot, Kashmir is predicted to be an element of dispute that already exists between India-Pakistan relationships impacting the flow in rivers in Pakistan (The Guardian, March 2017). There's already dispute between Bangladesh and India about the water distribution due to Farakka dam. China's dams on Mekong river impacts its relationship with Cambodia, Vietnam and other neighbour countries (United Nations Department of Economic and Social Affairs, 2014). Upstream countries can build dam using gravitational force of water but it is not possible for the countries in the downstream because they don't have the same force as the upstream countries. However, the impact of dams is suffered by the downstream countries because flows are weaker

in the downstream because of dams in the upstream. Because of dams, the rivers in the downstream have less supply of water and often fall prey to desertification. During dry season, countries in the upstream can close the barrage and reserve water which cause desertification in the downstream and in the rainy season they open the barrage which cause flood in the downstream. This is the case between Bangladesh and India because of Farakka dam and Bangladesh being situated in the downstream. However, because of power imbalance and political issues between current government of Bangladesh and India, Bangladesh is kind of accepting the injustice towards them because of dam. But in other countries, the issue won't be accepted without any dispute which might turn into war. Thus, dams and distribution of water is important enough to give birth or stop wars.

Water is a natural resource and like other natural resource, it does not follow any boundary. There are 263 transboundary lakes and river basins in the world and together they cover almost half of the earth's surface (United Nations Department of Economic and Social Affairs, 2014). 145 countries in the world share international river basins and of them, 21 are completely depending on the water of the international shared basins (United Nations Department of Economic and Social Affairs, 2014). Most of the rivers are shared between two countries but there are cases of more than five countries sharing the same river basin. There are 5 river basins, the Congo, Niger, Nile, Rhine and Zambezi, are shared between 9 and 11 countries. Danube, the longest river in Europe, travels within the territory of 18 nations (United Nations Department of Economic and Social Affairs, 2014). It shows that water distribution is an important element of international treaty. Actually, it is said that the first ever treaty was also signed about the distribution of water. During 2500 BC, when the two Sumerian city-states of Lagash and Umma crafted an agreement ending a water dispute along the Tigris River - often said to be the first treaty of any kind (United Nations Department of Economic and Social Affairs, 2014). There are more than 150 treaties on water distribution and they are followed more attentively than other treaties may be because water is really important for a country than most other resources. Water treaties like Indus water distribution between India and Pakistan has saved two countries for involving into more wars (United Nations Department of Economic and Social Affairs, 2014).

Hydropower Dams and Displacement

According to the world commission on dam, more than 40 – 80 million people have been displaced by dam (Available information at: <https://www.internationalrivers.org/human-impacts-of-dams>, Accessed: June 18, 2017). There are more people who have been displaced by road construction, reservoir, power station construction which come along with dam. Many more have lost the access to clean water, transportation system those have been destroyed by dams and have become environment refugee. People have been displaced by dams as their lands have gone under water, as there is no livelihood of them in their own land (Tilt and Gerkey, 2016). Also, there are disease outbreak found in India, near the Narmada dam and in Africa, malaria outbreak have made people suffer more due to dam buildings (Bosshard, 2015). Case studies from The World Commission on Dams shows that a disproportionate amount of the adverse impacts caused by dams affected mostly the poor and rural populations, subsistence farmers, indigenous peoples, ethnic minorities, and women (Cooney, 2012). These groups, especially in developing countries, are underrepresented in politics, and seldom have equal human rights.

Starting from the first large dam, Hoover dam in USA, almost every dam has displaced people from small to large number. Hoover dam alone has displaced more than 25 million people from their home, from their previous job and made them homeless and worker earning 4\$ per day by working in the risky dam site which has caused death more than 200 worker in unhealthy and risky workplace (Leslie, 2007). In west, new dam building has come to an end but in Asia, it is going in full swing in China, India and other countries. In India, The construction of the Bargi Dam (1971-1990) on the river Narmada affected (Si, 2013), 432ha of land and displaced 5,475 families (Global Water Partnership, 2013). People there not only lost their land but also lost their livelihood which they used to earn by fishing and farming (Global Water Partnership, 2013). In Bangladesh, the first ever dam was built in 1960s, on the river Karnaphuli that displaced more than 1 million people who were 30% of the total population and indigenous people (International Labour Organizations, 2000). By Kaptai dam, indigenous peoples became panicky and because of insecurity, finding no other alternatives, from among them some 40,000 Chakma people obliged to migrate to India and about 20,000 other community people had to take refuge to Myanmar. The refugee

people who were settled in Indian State of Arunachal are yet to be awarded with citizenship (International Labour Organizations, 2000). Karnaphuli hydropower dam supplies almost half of the electricity in Bangladesh and has also protected Chittagong city from flooding but the opportunity cost of these cannot be made up. Dams on Mekong river have comparatively less impact because of maintained more properly but still it has more than millions of people throughout China (Si, 2013). People living near dam have been resettled in towns and other villages where they have lost their livelihood of farming (Si, 2013). The three gorges dam in China is named as environmental catastrophe which has displaced 123 people per production of megawatt (Jobin, 2004).

Damming the upstream create shortage of water in the downstream where people do not have any water for irrigating their lands which takes away their livelihood that can also become a cause for displacing (Si 2013). Water diseases in India and Malaria in Africa have already been diagnosed caused by dams which destroy the fresh water resources not letting the regular flow and make it favorable for mosquitoes to breed in that water (Outbreaknewstoday, 2015). Dam building is being regarded as new barrier against source of fresh water and human health (Jobin, 2004). As well as for human rights and rights of the minorities, dam building is an important issue to discuss.

Conclusion

In conclusion, the paper identifies the negative impacts of hydropower in worldwide particularly in Asian. It can be said that the opportunity cost of hydroelectricity and irrigation from the dam are enough but the lost of biodiversity, scarily accelerated climate change, water conflict and displacement of millions of people should not be ignored. Renewable energy can easily be produced and irrigation has been developed miraculously by building hydropower dams. But huge lands have dried and become unusable for farming. Hydropower dams are producing renewable energy and side by side it has been destroying other resources and biodiversity. Without taking into account of the environmental and political impacts of hydropower dams, the sustainable development cannot be ensured. Building hydropower dams for safe energy should be encouraged due to its less environmental impact but the politics of water distribution, conflicts and displacement of the people should also be taken into consideration by the policy

makers. Otherwise, hydropower would promote international conflict as well as it will be considered as a tool for power inequality. Then the cost of producing hydropower energy would be more than the benefit that we are getting from it.

Some environmentalists have suggested producing energy from nuclear rather than hydropower dams (Ansar, et al., 2014). It seems to be more sustainable if the nuclear projects could be well maintained and protected to avoid accidents (Marples, 2018). Solar power energy could be used more to ensure sustainability. The paper does not claim to stop building hydropower dams entirely but considering its impacts on biodiversity and politics, it should be limited. Damming that might be the source of international conflicts and that may have extensive impact on environments should be stopped immediately. Displaced people due to damming should be given proper rehabilitation with alternative jobs, shelter and other needs. Near the dam area, it should be strictly maintained that health hazard like water break diseases and malaria and other diseases cannot be broken out. Finally, diplomacy among countries should be strengthened for implementing water treaties properly to avoid conflicts among the countries.

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