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Dam Building and the Over-Concretization of Japan

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I. Introduction

Within the ancient country of Japan, thousands of hydroelectric dams exist. The first hydroelectric dam built in Japan was the Oi Dam in 1924. These concrete megaliths have many purposes, with one major function for the Japanese and humans worldwide being the production of hydroelectric power. In essence, the electricity produced by hydroelectric power is a renewable resource generated through the movement of water. This form of energy produces no waste and does not emit carbon dioxide. Yet, many people do not consider large hydroelectric projects to be a sustainable energy source due to the belief that they do not produce enough energy to make their construction necessary. Indeed, the construction of the dams harm the environment in many ways, such as land clearing; the destruction of animal habitat, and the dispersal of humans from their ancient homelands. According to Alex Kerr, in his book *Dogs and Demons*, "the River Bureau has dammed or diverted all but three of Japan's 113 major rivers" (2001, p. 15). In addition, Kerr states in his own introduction that there were over 2,800 dams already in existence in 2001, with Japan's Construction Ministry planning to add 500 new dams in the future. Current data via the International Commission on Large Dams shows that as of August 2015, there are 3,116 dams in Japan.

The purpose of this descriptive essay will be to introduce the over-construction of dams in Japan. The author will first describe the background and history of the use of damming in Japan. Second, the author will briefly discuss what purpose dams serve, especially with regards to hydroelectricity. Third, the author will describe environmental issues surrounding Japanese damming projects, with regards to deforestation, loss of animal habitat and destruction of sacred lands. The author will argue that the overreliance of damming projects in Japan are not an economically sustainable way of achieving electrical power for the country. Also, the author will

argue that dams inherently impact the environment in various negative ways and that these outweigh the potential benefits.

II. A Brief History of Power Utilities in Japan (1951-2015)

During the Allied Occupation (1945-52) there were few electric utility plants in Japan. In the early 1950s power was rationed as there were many power failures and the manufacturing industry had an incresingly tough time reviving themselves (Eyre, 1965, p. 1). After 1951, Japan began to rebuild and create more energy plants. However, Eyre states "in spite of their best efforts the demand for power remained well ahead of the supply as the Japanese economy moved into high gear" (1965, p. 1). Eventually, around 1962, there was a balance achieved concerning supply and demand, thus, the government wanted to keep ahead of the demand and began to build many hydroelectric dams. By 1963, thermal power was relied on for the base load of all power within Japan, and hydroelectric power was demoted to a peak-load role. Thus, "thermal became primary and hydro secondary" within the sphere of electric utilities (p.3). In 1963 there were 1578 hydro plants in operation compared to the 3,116 dams, which existed in the country as of 2015. It seems illogical that this number has doubled in the last 45 years, especially since hydroelectric power took a reduced role within the Japanese power sphere in 1962, when energy options were limited.

As of August 2015, Japan was dependent on imports for 82.4 percent of its energy supply and was the second largest net importer of oil in the world.[i] Yet, within the 17.6% of energy that is generated within Japan, as little as 2.9% to 5% comes from hydropower dams. Japan's energy consumption has increased almost consistently since the mid-1980s. While energy consumption by the industrial sector has remained mostly flat, growth in energy consumption by the commercial/residential sector and transport sector has risen sharply. The transport sector includes energy consumption for all transportation purposes, whether household or commercial. In the commercial/residential sector, energy consumption has particularly risen in recent years. This has been mainly caused by (i) the rise in the total floor area of office buildings and large-scale retail stores, (ii) an increase in the amount of air conditioning equipment and lighting appliances used in those facilities, and (iii) the growth of office automation.

When focusing on the years between 1985 and 2012, the amount of output that was produced by dams was quite low in contrast to the number of dams that actually existed. Interestingly, in figure 1, the amount of dams was 1,695. This statistic comes from the official website of the Japanese Ministry of Internal Affairs and Communications (MIAC).[ii] One could consider this as skewed, since

many small dams can serve one major dam's purpose of storing energy. Comparing this form of energy production to nuclear power plants, the number of nuclear plants are small (17 in 2015), in relation to energy output which was significantly higher in 2010 before the Great Hanshin Earthquake, at 288,230 kWh. However, post-earthquake, the energy output shrank dramatically (Figure 1). Thermal power plants, which produce energy through the power of steam, numbered 2,696 in 2012. Figure 2 gives a clearer representation of how much power each of these three-power utilities produce.

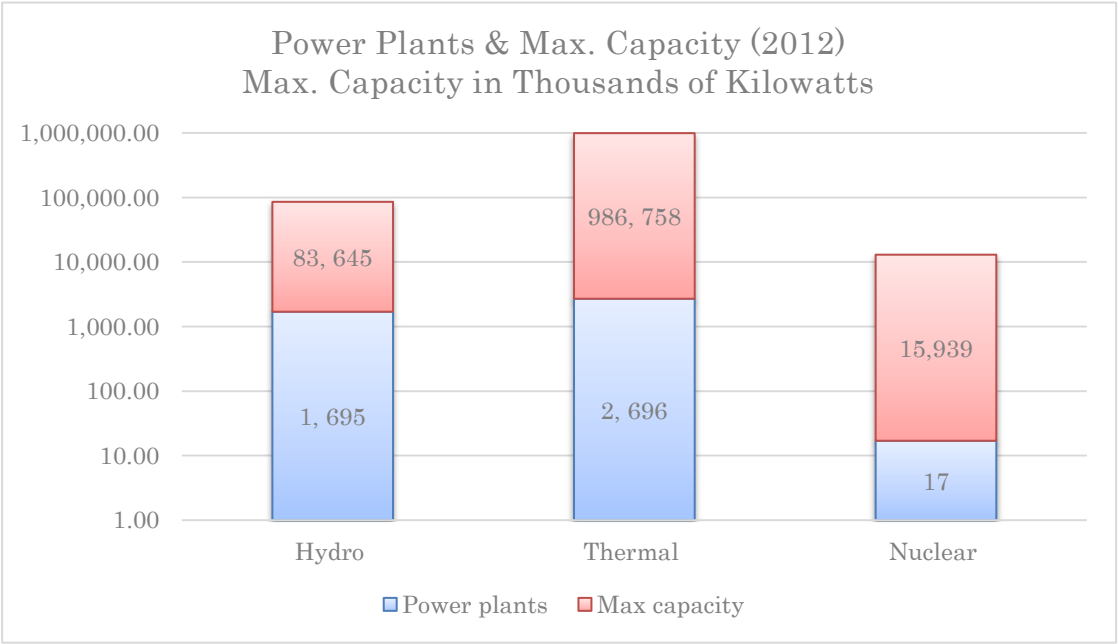

Figure 1. Hydro, Thermal, and Nuclear power plant numbers and their output capacities

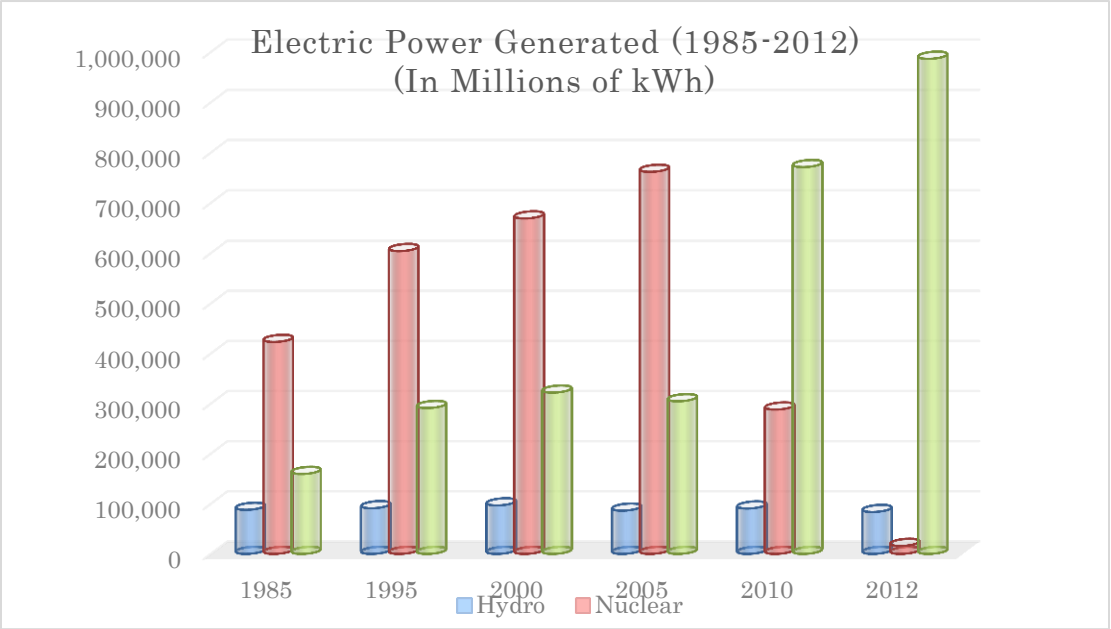

Figure 2. Electric power generated by Hydro, Nuclear, and Thermal power utilities

III. Dam Functions

In essence, a dam is a physical barrier which divides bodies of water. However, the main purpose of the hydroepectric dam is to retain water in a reservior, which is transformed at a later point into hydroelectricity. Then, when the powerhouse needs more power it lets water from the reservoir into the penstock and through the turbine which generates energy from the water. This energy is then stored in a generator that is transferred long distances through power lines to serve populations with electricity. Dams are built in Japan for irrigation, flood prevention, and land reclamation. However, according to MIAC, of the estimated 3000 dams in Japan in 2005, 1739 were supposedly used specifically for hydroelectricity, and this number remains approximately the same at the time of writing this report.

However, many of the dams are classified as pumped storage plants, which build up a body of water behind the dam (Figure 3). Thus, they are concrete structures that withhold a body of water, and this is evidently unlike the typical hydroelectric dam in figure 4. “Many dams are used to stabilize river flow enough to benefit other dams”, and sometimes as many as two to three smaller dams can serve the purposes of one major hydroelectric dam (Eyre, 1965, p. 16). So, if one were to suppose that out of the 1739 hydroelectric dams, that 500 of them had one pumped storage plant dam associated with it, then that would make the number of dams actually working towards the purpose of hydroelectricity closer to 2239.

This statistic helps confirm the theory that damming in Japan serves mainly one purpose, yet dams are built under the misnomer that they actually serve other purposes other than hydroelectric power. Kerr states that Japan is in the midst of a "dam-building frenzy" and that Japan has become a "construction state" because it has become big business to build concrete structures i.e. roads, tetrapods, and dams, that seemingly have little purpose other then being huge eye sores (2001, p. 26).

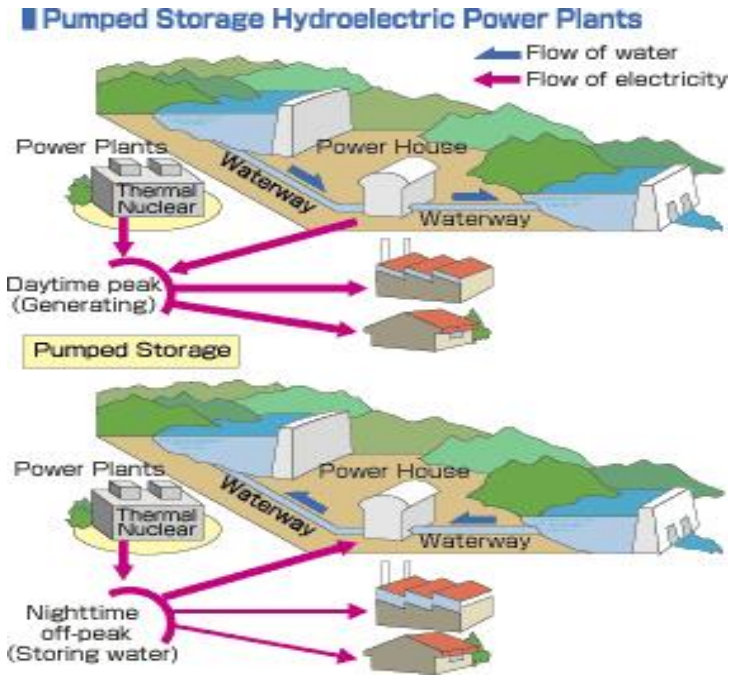

Figure 3. Pumped storage plants

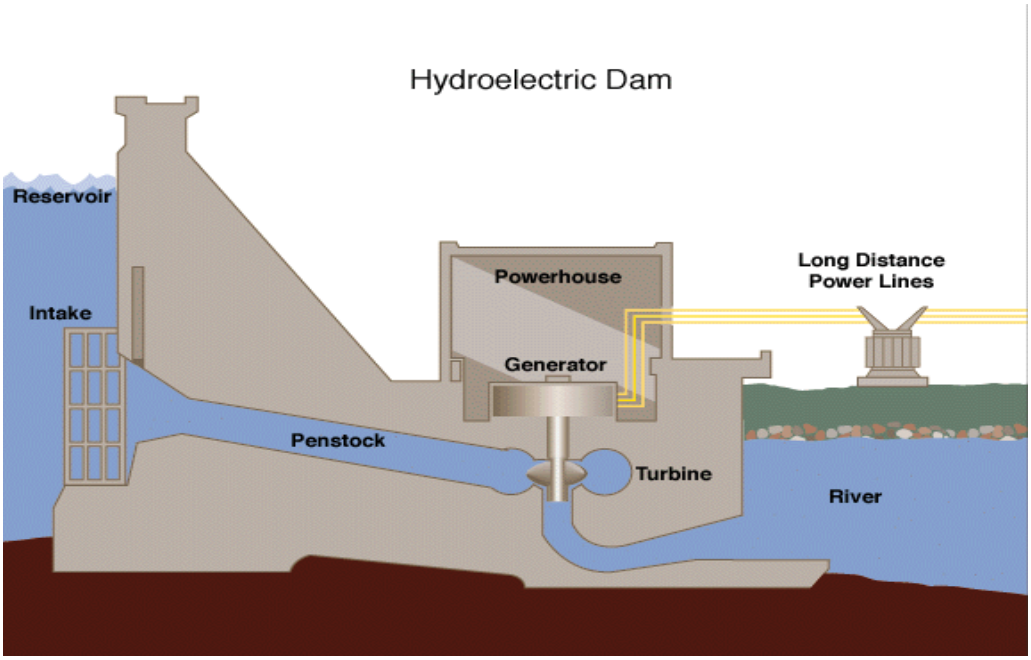

Figure 4. A typical hydroelectric dam

IV. Japanese dam processes which negatively impact ecological habitats

The dam building frenzy, as Kerr called it, is based on old projections used by the River Bureau, some of which come from the 1950s when there was an extreme water shortage in Japan (2001, p. 26). This shows that there is little relief for the environment if the governmental agencies cannot see that the amount of dam building in Japan has reached a large amount. Perhaps this frenzy reached its apex as soon as towns started advertising for dam tours at dams such as Atsui Dam. Nevertheless, no matter how many dams are built, the environment is what bears the brunt of such boundless construction. In Japan there are 113 major rivers, and there are no less than 2,734 dams in the country (Frederick, 2006, p. 1). According to Jim Frederick, the Tokyo bureau chief of TIME magazine, dams can generate less than 1% of the electricity in certain areas within Japan, and that they would be more expensive to maintain than to destroy (2006, p. 2). Tadahiko Sakamoto (2004) argues that dams are needed in Japan to provide consistant water to the population. He also adds that the long-term benefits of damming bodies of water offer recreation areas for people (p. 3). These are questionable benefits as it is hard to see how the damming of important rivers for recreational use should trump the ecological considerations, for example, the roles rivers play in fish spawning, drinking water, etc. Also, the pollution created by water vehicles and the daily

function machinery of dam areas defeats the purpose of dams producing clean drinking water. Furthormore, the amount of concrete it takes to make dams is enormous.

Kerr illustrates a statistic that shows the height of concrete production. In 1994 "concrete production in Japan totalled 91.6 million tons, compared with 77.9 million tons in the United States. This means that Japan lays about thirty times as much per square foot as the USA" (2001, p. 46). This statistic comes from an article by Guy De La Rupelle, in his article titled *Kayak and Land Journeys in Ainu Mosir: Among the Ainu of Hokkaido,* which discusses the Nibutani Dam in Hokkaido in detail. In *A New Look at the Four Traditions of Geography*, Robinson (1976) posits that Japan should operate with a high degree of integrity concerning human-land interactions. This applies to the current issue discussed in this paper, most notably the alarming rate that Japan is turning into a concrete state. Take the Ainu for example: they still are very conscious about the contact between themselves and the organisms existing within their environment so this is why the Nibutani Dam has become such a horrible reality for them (Robinson, 1976, p.525).

V. Case example: Nibutani Dam, Hokkaido

Since the Japanese government enacted its *Former Aboriginals Protection Act* in 1899 (Howell, 2005) the Ainu in Hokkaido have suffered significant land loss and the Nibutani dam is no exception. The Nibutani dam, located on the Saru river in Hokkaido, has been a hot topic worldwide since it was completed in 1997. In maps 1 and 2, one can see how the Saru river resembles a lake just north of the Nibutani dam; however, following the dam northward it thins out again, which is how the Saru river would have looked before the damming project. The land around the Saru river is an important and sacred land for the Ainu, as was argued in the Nibutani Dam court case of 1997 between *Kayano and Others vs. Hokkaido Expropriation Committee*. In the Nibutani area, traditional Ainu spiritual and technological culture is preserved. This heritage is not just from the many who hand down the folklore of Ainu to future generations, but also from Japanese and foreign scholars. Many deem it as a site worthy of protection since it is known as the birthplace of Ainu culture. In addition, Japan is located in the monsoon climate zone. Subsequently, in the case of the Nagara River, an estuary dam was built on the brackish zone, which is the most important ecosystem for various species of fish and birds, many of which have been lost because of the dam. Also, the deterioration of water quality has been a result of increased sedimentation in dammed lakes which cause flooding. The Ohi River Dam is one clear example of this.

Also, dams tend to destroy or negatively intrude onto spawning grounds, as documented at the Yoshii, Nibutani and Nagara Rivers.

Map 1. Close view of the main Nabutani dam at the sound end of the dammed section of the Saru river. At the north end is a smaller dam. Satelite image courtesy of Google Earth

Map 2. Far off satelitte image of how the dammed section of the Saru river resembles a large lake when compared to the thin Saru river south and north of the two dams. Satelite image courtesy of Google Earth

VII. Conclusion

In 1999, Japanese energy consumption amounted to 5.7% of the world total. Compare this to the fact that Japan's population only makes up 2.1% of the world's population and it becomes evident that Japan consumes a high rate of energy, despite a lack of natural resources, like coal or oil. It seems extreme for the continuation of dam building in Japan when much of the usable low-lying land has already been transformed into concrete habitation zones. It seems necessary that human-land interaction and harmony should be a priority for the various stakeholders, including the government and its citizens. Even Japan's native religion, Shintoism, stresses a harmonious life between humans and nature, to the point that one of its *Four Affirmations* describes nature as sacred (Williams, 1962, p. 4). Humans have left a malignant imprint on much of the planet due to the over concretization of lands and waters and Japan is not an exception. However, there are those who remain optimistic about the ecological future of Japan as it relates to energy production: "Geography is fundamentally interdisciplinary by nature: that is, it has biophysical, socioeconomic, and technological sides and it stresses synthesis" (Yarnal, 2004, p. 32). For many of us who do not partake in the understanding of how important proper land use is, then as with Japan, governments usually take over and destroy huge parts of ancient and scenic lands. The sad reality seems to be that dams will just keep on being built in Japan in the foreseeable future for no other reason than to keep the construction industry busy. The unification and balance of environment and construction must always be at the forefront of discussion, regarding the future construction of any kind of energy producing structure in Japan. Finally, the author believes solar and wind power are Japans only two options moving forward regarding environmental sustainability and power creation.

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[ii] MIAC (Japanese Ministry of Internal Affairs and Communications) http://www.stat.go.jp/english/data/nenkan/1431-10.htm under the heading 'Electricity' 10-14 Electric Power Generated (Excel:32KB)