CHAPTER III

ETHIOPIA CONSTRUCTION OF GRAND ETHIOPIAN RENAISSANCE DAM (GERD)

This chapter described the Ethiopia that has a water resource namely Blue Nile which made Ethiopia referred as a water tower and made Ethiopia possess huge hydropower potential, the construction of GERD on the Blue Nile with its main technical data, and the last was Ethiopia objectives and expectations in building the GERD.

A. Ethiopia and the Blue Nile

Ethiopia, officially the Federal Democratic Republic of Ethiopia, is a country located in the Eastern Africa, west of Somalia. As can be seen in the Figure 2, Ethiopia shares borders with five African countries; Djibouti and Somalia to the east, Eritrea to the north and northeast, Sudan and South Sudan to the west, and Kenya to the south. Ethiopia is the most populous landlocked country in the world and Ethiopia population that had reached 73,918,505 in 2007 making it to become the second most populous countries in Africa (Milkias, 2011). It occupies a total area of 1,100,000 square kilometres (420,000 sq mi), and its capital is Addis Ababa (The World Factbook, 2017). Ethiopia is mostly made up of high plateau and mountain ranges with steep edges, sliced up by torrents of rivers and brooks, the tributaries of major waterways such as the Blue Nile, Tekezze (Atbara) and Baro-Akobo.

1. Ethiopia as a Water Tower

Ethiopia is the home to the source of the Blue Nile, traversing its national borders, which will flows down and will join together with the White Nile in Khartoum makes up the Nile River, the longest river in the world. The Blue Nile has a total length accounted from its source to its confluence approximately around 1,460 to 1,600 kilometres, of which 800 km are inside Ethiopia territory (New World Encyclopedia, 2016). Blue Nile is one of the major tributaries that exist in the Nile River. The Blue Nile originates from natural spring at an elevation of 2,900 m above sea level, about 100 km to the south of Lake Tana in Ethiopia (Ali, 2014). The countries through which these tributaries flow are arid and get not only water but also rich soil that is washed down from the mountains during the rainy season. Because Ethiopia divides the rivers flowing into the Mediterranean and the Indian Ocean, it is often referred to by geographers as the water tower of northeast Africa.

Both the White which flows down from the central Africa, and the Blue Nile which originates in Ethiopia, meet at Khartoum and then flow down to Egypt and into the Mediterranean. Ethiopia provides 86 percent of the Nile flow. The Blue Nile that starts at Lake Tana in Gondar, contributes most of the Nile flow which provides 59 percent of the flow, the Baro-Akobo (Sobat) provides 14 percent, and the Atbara provides 13 percent. The Blue Nile is also unique due to the high seasonal variability in rainfall on the Ethiopian plateau, the source of the river. During the rainy season, the water flowing from Ethiopia constitutes some 90 percent of the Nile flow (Milkias, 2011). Ethiopia refereed as a water tower is also due to the existences of Blue Nile in Ethiopia which contributes most of the Nile flow. Moreover, it is also makes Ethiopia to have the most crucial positions among others riparian countries. Ethiopia also can be regarded as the major suppliers to the other riparian countries which located in the downstream – Egypt and Sudan that can be regarded as the key costumer.

2. Ethiopia's Hydropower Potential

Hydropower is energy that comes from the force of moving water. The fall and movement of water is part of a continuous natural cycle called the water cycle. As long as the water cycle continues it will not run out of energy source which is why hydropower is classified as a renewable energy source. Other reason is because water on Earth is continuously replenished by precipitation (The NEED Project, 2016).

In the case of Ethiopia as a home of the Blue Nile, it has a huge hydropower potential if it is able to harness what its rivers offer. In fact, Ethiopia is still underutilized its hydropower resources that can be produced from the Blue Nile. Ethiopia hydropower potential is the second largest in Africa after the Democratic Republic of Congo. Ethiopia's hydropower resource has exploitable reserve 45,000 MW (Derbew, 2013). However, only, more or less 5% of the potential has been exploited so far which approximately 2,552 MW (International Hydropower Association, 2016). Ethiopia is also usually referred as the power house of Africa due to its potential hydropower resources.

However, Ethiopia that has the basin's most suitable locations for hydropower production is still underutilized. The underutilized of Ethiopia hydropower potential is perhaps mainly because of Egypt. Egypt as a downstream country is almost totally dependent on Ethiopian water and slit. Egypt also has filed complaints that interfere the natural flow of the Blue Nile would lead to the drying up of Lake Nasser which would be harmful to Egypt's survival. Unlike Ethiopia, Egypt receives the least rainfall of any state in Africa throughout the year.

Apparently, in the past decades, Ethiopia has started to reveal its intention to exploit their hydropower potential even more. It could be seen from the five hydro-power plants that were proposed by the Ethiopian namely GERD, Karadoby, Mendaia, Mabil and Jemma respectively from Lake Tana to the Ethiopian-Sudanese (Ali, 2014). However, GERD has been selected as the first priority project because it is the most economically attractive to produce 15,130 GWh annually and it is the simplest to construct due to the favourable morphology, it also offers the opportunity of opening multiple simultaneous and fully independent construction fronts (Ali, 2014).

B. Grand Ethiopian Renaissance Dam (GERD)

In 2011, Ethiopia under the Prime Minister Meles Zenawi unilaterally announced the construction of the Grand Ethiopian Renaissance Dam (GERD) which did not give any prior notification or even holding preparatory discussion to Egypt about the project commencement. Egypt found out the construction commencement from the media, not officially from the Ethiopian government. The unilaterally decision of Ethiopia has created great worry on the part of Egypt which is 97 percent dependant on the Nile waters (Nunzio, 2013). This section describes about the construction of the GERD with its main technical data and the ulterior motive of Ethiopia in unilaterally deciding the construction of the GERD.

1. GERD Main Technical Data

The Great Ethiopian Renaissance Dam (GERD) is a gravity dam on the Blue Nile River in Ethiopia which currently under construction. In 2011, The Government of Ethiopia has started undertaken the implementation of the GERD which formerly known as the Millennium Dam and expected to be completed by July 2017. Then soon will be two large reservoirs built on the Nile – Aswan High Dam and Grand Ethiopian Renaissance Dam. GERD is located on the Blue Nile just upstream of the Ethiopian-Sudan border, in Benishangul-Gumuz Region of Ethiopia which can be seen in the Figure 3. The United States Bureau of Reclamation is the one who identified the site for the Grand Ethiopian Renaissance Dam during a Blue Nile surveyed conducted around 1956-1964, then in October 2009 and August 2010 Ethiopian government continued the survey of the site (Mulat & Moges, 2014). The GERD has an active storage capacity 60,000 Mm^3, greater than the yearly average inflows (48,770 $Mm^3 year^{-1}$), thus acting as a multiannual regulating reservoir (Melesse, Abtew, & Setegn, 2014). At the end of the works, the Grand Ethiopian Renaissance Dam will be the largest dam in Africa: 1,800 m long, 155m high and with a total volume of 74,000 million m^3 and is supposed to generate 6,000 MW of hydroelectric power (Salini Impregilo).

This project is owned by Ethiopian Electric Power Corporation (EEPCO). The construction of the Grand Ethiopian Renaissance Dam was started in April 2011 after the ETB80bn ($4.8bn) Engineering, Procurement and Construction (EPC) contract was awarded to Salini Impregilo Costruttori (Kable, 2017). The project involves the construction of a main dam in Roller Compacted Concrete (RCC) with two power stations installed at the foot of the dam. In the following section, the main technical data of GERD are described in detail below.

Table 1: GERD Main Technical Data

MAIN DAM	**POWERHOUSES (x2)**
Height: 155 m Length: 1,780 m Excavations: 3,500,000 m^3 Volume: 10,200,000 m^3	Right river-bank: 10 Francis turbines, each offering 375 MW Left river-bank: 6 Francis turbines, each offering 375 MW
POWER & ENERGY	**ROCKFILL SADDLE DAM**
Installed power: 6,000 MW Generation capacity: 15,130 GWh/year	Height: 50 m Length: 5,000 m Rock fill Volume: 16,500,000 m^3

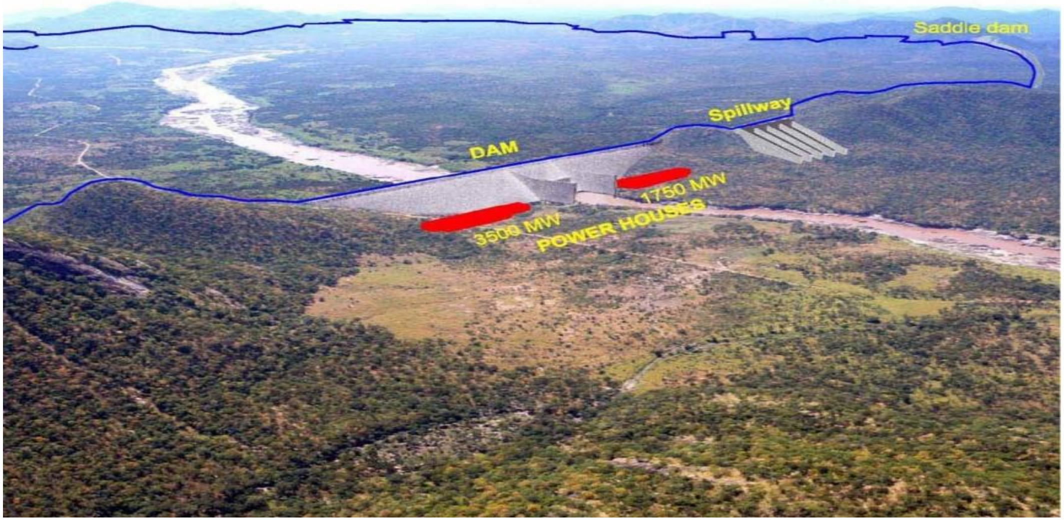
Source: (Salini Impregilo).

Figure 3: GERD Location

Source: (Ezega, 2017).

As can be seen on the main technical data of GERD, the main dam which will have a volume 10,200,000 m^3, will be divided into three sections; Right bank, Central section and Left bank. According to Attalla (2015), the central section is used as a stepped spillway, and it will be kept at a lower level than the left and right banks to allow maintenance of the Dam body and allow for flood in raining season. The power houses will be on the downstream of the dam; one on the left bank and the other on the right bank of the dam. Figure 4 shows the main dam body with its power houses and reservoir area.

Figure 4: Aerial Photograph of the GERD Construction area



Source: (International Rivers, 2014).

The saddle dam will be built across a north western stretch of the boundary of the reservoir as can be seen in the Figure 4. It will be located approximately 10 kilometres from the main dam (Jameel, 2014). It is planned to be 5 kilometres long and up to 50 metres high, it is said making it one of the largest saddle dam in the world. The sole purpose of the saddle dam is to prevent water stored behind the dam from spilling out of the north western end of the reservoir.

The spillways which located on the left abutment and at the top of the GERD are designed to provide way for excess floodwaters to be safely released so that water never overtops the dam structures because this could lead to catastrophic dam failure. Water released from the main spillway is regulated by the radial gates at the head of the spillway chute. In addition, when the level of the reservoir reaches the height of the low block spillway (El. 640 metres above sea level), excess water automatically spills. If the reservoirs levels reached its highest level and an unexpectedly large flood occurs, then the spillways will take care of it (Jameel, 2014).

The estimated cost of the construction of GERD is estimated around US$4.8 Billion. According to the (The Economist, 2011), approximately 30% of the funding for the dam was secured from China which is about US$1.8 Billion. Meanwhile the rest of it is funded by the Ethiopian government through selling the bonds and donations, both within Ethiopia and internationally (Water Technology, 2014).

It is said that the primary objective of GERD is to generate an electric power of 6000MW, with an annual energy production of 15,130 GWh/year to cover the power supply demand in the Ethiopia as well as in the East Africa region. Beside that the dam construction is expected to create up to 12,000 job opportunities and had to resettle approximately 20,000 people (Kable, 2017). The Ethiopian government believe that the benefit of GERD is not limited with power supply solely, but it will also benefit the downstream countries mainly Egypt and Sudan. Ethiopian also claimed that GERD would not harm the downstream countries; Egypt and Sudan (Federal Democratic Republic of Ethiopia Ministry of Foreign Affairs, n.d).

2. Ethiopia’s GERD Objective and Expectations

The construction of GERD that was announced in 2011 by Meles Zenawi has put a great worry on the part of Egypt. This construction signals Ethiopia’s prioritisation of hydropower projects as drivers of development and of regional integration. The GERD according to Ethiopian government will pull Ethiopia out from poverty (Tawfik, 2015). According to the data received by Tesfa (2013), from 2008 to 2013, Ethiopia's power demand has been growing at an average rate of 25 percent per year and the forecast also showed that the demand for the next five year is estimated to be 32 percent per annum as per Ethiopian Electric Power Corporation. To meet the expected need of Ethiopia, GERD is playing vital role here to accomplish it which the dam will generate an electric power of 6000MW, with an annual energy production of 15,130 GWh/year. According to Jameel (2014), when the dam is completed, the average hydropower generation produced by GERD is roughly 50% more than the average hydropower generation from the High Aswan Dam over the past decades and equal to the entire current national electricity consumption in Ethiopia. The Hydropower produced by the dam would allow meeting the expected Ethiopia domestic needs which will allow Ethiopia to become a net of electricity to a host of potential buyers in the region, such as Djibouti, Kenya, Somalia, Sudan, Uganda and even possibly Egypt (Nunzio, 2013).

In the meantime, the dam received international fund from China, approximately 30% of the funding while the rest of it is funded by the Ethiopian government. Ethiopian is making substantial scarifies to implement the construction of the dam from domestic financing sources. The financial returns that they will receive in return are the revenues from the hydropower generated at the GERD, which will accrue for many years. Ethiopia expects that the GERD hydropower will be sold as soon as it can be generated and at a good price (Jameel, 2014).

Furthermore, the construction of GERD clearly reflects Ethiopia's steadfastness to exercise its rights to use its own rivers, and yet the Ethiopia willingness to bear the heavy financial and political cost (Zenawi, 2013). At the beginning, one of the factors the potential of Blue Nile within Ethiopia territory is still underutilised is because Ethiopia's economic underdevelopment. However, in the late 2013, the economic growth of Ethiopia has averaged 7.5 per cent a year in the last three years (Nunzio, 2013). The consequence of such growth is an ability to fund major project such as GERD. The construction of GERD which the estimated cost US$4.8 billion is a proof to its economic improvement. It is also can be said that the GERD is represents a leap out of Ethiopia's dark ages of underdevelopment and humiliation.

Ethiopian government presented that the dam would give a benefit to all riparian countries, especially downstream countries. The dam would slit and sedimentation enhances the operation of dams in Sudan and Egypt, control floods, regulates Nile flow, and provides cheap electricity to the neighbouring countries. Ethiopia government also stated that the benefit of the dam would ease the tension over equitable utilisation of the Nile water (Tawfik, 2015).

The unilateral construction of GERD is intended that Ethiopia to send a strong message to Egypt that they would not be able to prevent Ethiopia from building its largest dam. By unilaterally constructing the GERD, Ethiopia has moved from challenging to tend to want changing the status quo, pursuing new.

Few months after the construction plan were launched, International Panel of Experts (IPoE) formed to review the design documents of the dam. At that time, Egypt requested that the construction of the GERD to be suspended until the IPoE finished its work. Surprisingly, Ethiopian ignored Egypt request and stressed that the construction of the dam won't be delayed (Berhane, 2011). It is mean that the IPoE is assessing the project that already under construction. Furthermore, Ethiopia has started to divert the Blue Nile few days before IPoE submitted its final report. Even though IPoE recommended that further studies to assess the impact of the GERD is still needed, Ethiopia refused the request to halt the construction of GERD (Tawfik, 2015). The aggressive move of Ethiopia to rush the construction of GERD has forced Egypt to reluctantly accept it. Once the dam becomes complete, decision making is likely to change significantly.