11-1-2018

Hydropower Development and Regional Integration in the Greater Horn of Africa

Temesgen Aschenek Zeleke
Pan African University, Cameroon

Follow this and additional works at: <https://digitalcommons.kennesaw.edu/yaljod>

Part of the [African Studies Commons](#), [Critical and Cultural Studies Commons](#), [Growth and Development Commons](#), [Peace and Conflict Studies Commons](#), and the [Political Theory Commons](#)

Recommended Citation

Zeleke, Temesgen Aschenek (2018) "Hydropower Development and Regional Integration in the Greater Horn of Africa," *Young African Leaders Journal of Development*: Vol. 2 , Article 20.

DOI: 10.32727/24.2018.45

Available at: <https://digitalcommons.kennesaw.edu/yaljod/vol2/iss1/20>

This Article is brought to you for free and open access by DigitalCommons@Kennesaw State University. It has been accepted for inclusion in Young African Leaders Journal of Development by an authorized editor of DigitalCommons@Kennesaw State University. For more information, please contact digitalcommons@kennesaw.edu.

HYDROPOWER DEVELOPMENT AND REGIONAL INTEGRATION IN THE GREATER HORN OF AFRICA

Temesgen Aschenek Zeleke

*Doctoral Student, Pan African University,
Cameroon.*

ABSTRACT

Inadequate and poor regional infrastructure networks posed an impact for escalation of insecurity and political instability in the greater horn of Africa. To deal with such problems, filling resource gaps through sharing resources in the way that maximizes mutual benefit is the major approach to be implemented. In this respect, fostering interdependence through infrastructural development of power interconnections is a best mechanism for energy led integration in the region. The purpose of this article is to analyze the major roles that Ethiopian hydropower development is playing in regional integration schemes. To this end, qualitative research methodology is employed to investigate the project in question. In addition to assessing and interpreting secondary sources, experts and government officials who have close proximity to the issue were used as key informants. Hence, the study recommends that energy linkage leading to economic based integration would open doors for more concrete and justified institutional and political integration in the region.

INTRODUCTION

Africa has a number of rivers with excellent hydropower development potential. However, the distribution of hydropower potential in Africa is concentrated in eastern and central Africa of which this region accounts 12% of world's hydropower potential. Sub-Saharan region Ethiopia and Democratic Republic of Congo take the lead both in potential and developing the sector of hydropower. Due to this fact hydropower is regarded as a pillar in East Africa energy production mix which accounts for 79% of the total energy consumption in eastern Africa (EAPP, 2010). However, eastern Africa energy mix varies from country to country. Particularly in the greater horn, all countries except Ethiopia are arid and semi-arid which stifles the development of hydropower sector.

In the sub region of greater horn of Africa the potential of hydropower production is concentrated in Ethiopia which is followed by Sudan, Uganda and Kenya. In this regard, Ethiopia takes the lead in production and distribution of hydropower with aggressive measures to export power in the region. For example, Ethiopia is exporting around 220KV to Djibouti and 220KV to Sudan. In addition, 500KV power will be underway in the future interconnection plans. Despite this, the region is facing a strong challenge in generating sufficient power to unlock its economic potential. Efforts to develop the economies in the region are being stifled by lack of reliable energy supply. With increasing population and expansion of industrialization, the demand for clean energy increases particularly since the last decade. Given the increasing demand for clean energy the role of hydropower is gaining importance for poverty reduction and ensuring sustainable development in the region.

Ethiopia's suitable geography with large number of rivers suitable for hydropower development coupled with its political stability makes Ethiopia a center of the power sector in eastern Africa. According to USAID (2009) Ethiopia's path towards development is constrained by its limited range of natural resources. The country's only economically exploitable resource is hydropower, which offers the potential for generation of more than 45,000 MW which is Africa's greatest hydropower potential, second only to Democratic Republic of the Congo. As the water tower of Eastern Africa, Ethiopia offers a great deal of opportunity for clean energy production which has become vital in the current global environment with a relatively lower production cost compared with its neighbors.

The energy to be generated will not only supply for the increasingly growing demand for energy in the country but will have surplus production to be marketed to neighboring countries. According to Ethiopian Water Resources Policy (1994)

the hydropower resource is estimated to have a potential in the order of 161,000 Gwh/year. However, the country's current generation capacity in all categories is around 2,000 MW, or 4.4% of the 45, 000MW potential installed capacity (UN, 2012).

HYDROPOWER DEVELOPMENTS IN THE GREATER HORN: REGIONAL OVERVIEW

Hydropower is a renewable energy source based on the natural water cycle. It is the most mature, reliable, cost effective, and environmentally friendly energy source available (Brown in IRENA, 2012). It is the largest renewable energy source that produces 16% of the world's energy demand. According to International Renewable Energy Agency (IRENA) 2011 statistics, Africa has an abundance of renewable energy where hydro, solar and wind supply the entire demand. With respect to regions in hydropower potential eastern Africa ranked second next to central Africa with the potential to generate 578 TWH/year. Currently, the major source of electricity in eastern Africa is hydropower where 95% of East African countries' current consumption is dependent on hydropower generations (AUC, 2013). Hydropower represents 97% of it where Ethiopia alone expected to contribute 64% (all of it is from hydropower). The remaining 18% Uganda, 11% Tanzania, 4% DRC, and 3% Rwanda (Infrastructure Consortium for Africa, 2011).

Ethiopia has exploitable capacity of 45,000MW hydropower potential. Large potential for small hydropower projects also exist. So far, more than 600 traditional hydro mills that could be used for hydropower have been identified (Ministry of water and Energy 2013). With this potential Ethiopian Government plans to produce 25,000 MW clean energy by 2030 (UNIDO, 2013) and wants to satisfy domestic demands as well as to export power to neighboring countries. On the other hand, the overall hydropower generation capacity of Kenya is estimated 6,000MW installing capacity. Over half of it is attributed from small scale hydropower developments (UNIDO and ICSHP, 2013). The demand for electricity in Kenya shows upward trend in the last 6 years. The average annual demand growth is recorded as 8.7% (Kenya Vision 2030, 2011). According to Kenya Vision 2030 Least Cost Power Development Plan (LCPDP), Kenya's demand will increase from 1,302 MW in 2011 to 15,026 in 2030MW. In line to meet these demands are targets to build 5,110MW from geothermal, 1,039 from hydro, 2,036 from wind, and 2,000 from imports.

Sudan's energy consumption mix is dominated by oil. Energy power infrastructure at the moment is developed only among urban centers most of it from hydropower. Sudan's 2,000 energy law opened for the expansion of energy sector and tripled power generation from 800MW in 2005 to 2,687 in 2007 (UNIDO, 2013). Sudan has an overall estimated potential of 4,920 MW hydropower generation capacities where 10 % of it is currently utilized. But due to political unrest, social problems, regulatory and policy constraints, Sudan's hydropower development is still at its lowest stage. Similarly, in south Sudan though it has a potential of 5,583MW hydropower generation; political crisis, social unrest, lack of renewable energy policy, poor institutional and technical capacity, hinder development of the sector. Thus, even though it has sufficient potential to satisfy domestic needs, large hydropower development plants to be built along the river Nimuri to juba may take decades to be commissioned. According to UNIDO (2012) report the current total installed capacity is 62 MW in contrast to the total electric requirement of 450 MW. The current population with access to electric is only 1%. To increase access to electricity the major options are either developing small scale hydropower developments or importing from neighboring countries particularly from Ethiopia and Uganda.

On the other hand, Djibouti, Eritrea and Somalia, the major option to satisfy their needs is from imports. Though, studies show as these countries have a potential to produce wind and solar energy, still they are at the lowest level of energy production (AU statistics, 2013). The united Nation Energy Development organization (2013) stated the complete or part desert climate coupled with recurrent drought hinder the development of hydropower generation in these countries.

¹.GWh/year- refers Giga watt hours per year is a measure frequently used for electric generator output of a certain country.

².TWH/year = terawatt=114MW ³.UNIDO- United Nations Industrial Development Organization ⁴.ICSHP-International Center for small Hydropower

HYDROPOWER DEVELOPMENT AS A TOOL FOR REGIONAL INTEGRATION

With the asymmetric distribution of rivers suitable for hydropower development, power integration and trade has begun. In the western hemisphere, electricity integration is common. For example North America has the most active and integrated electricity market in the hemisphere, with 51 multinational electricity transmission lines connecting USA, Mexico and Canada (US department of Sustainable Development, 2007). In South America, hydropower plants helped the integration of cross-countries interconnections between Venezuela, Colombia and Brazil with more than 15 interconnection lines. In Europe too, interconnections between the various national systems have been designed largely to promote security of supply. In line with this, during the last decades, the European Union has worked intensively towards building the most integrated, competitive and sustainable common energy market of the world. The EU has worked Projects of Common Interest (PCI) to bring its electricity interconnection level to 10% by 2020 on its way to create a resilient energy union with a forward looking climate policy (European Union Commission, 2015). Furthermore, the countries of Central America have pooled resources and expertise to build infrastructure and create institutions to increase cross-border power trading. This provides an example of how decisions can be reached on critical, often contentious, trading issues such as pricing principles and transmission investment (ibid).

Regional Integration through electricity is also getting a great attention in Africa. Recognizing limitations of national energy markets, Africa is experiencing a shift towards regionally integrated energy markets. Regional Economic Communities (RECs) like Economic Communities of Western African States (ECOWAS), East African Community (EAC) and South African Development Community (SADC) are already working on regionally integrated power pooling, policy planning and development and energy access programs. In line with this, there are primarily five power pools acting as specialized agencies of their respective regional economic communities (RECs): the Central Africa Power Pool, the Eastern Africa Power Pool, the Southern Africa Power Pool, and the West Africa Power Pool established to facilitate cross boarder power trading (World Bank, 2011). According to African Development Bank Infrastructure Consortium for Africa Division (2012) report the northern African Region is connected to a regional electricity network in the Maghreb Region (Morocco-Algeria-Tunisia-Libya). There are presently a number of connections between Spain, Morocco, Algeria and Tunisia, and connections between Algeria-Tunisia-Libya and Egypt. Furthermore in Central Africa, Congo and Zambia; Congo to Burundi are interconnected through grid lines.

HYDROPOWER HUB IN THE GREATER HORN OF AFRICA: ANALYZING ETHIOPIAN'S ROLE

Ethiopia offers a great deal of opportunity for clean energy production and distribution. It has the potential to export energy to the region and beyond. Furthermore, Ethiopia boasts a regional comparative advantage, ecologically and economically, in hydropower production and distribution. According to Mr. Chekih a senior energy analyst in African Union, Ethiopia's hydro-electric potential is enough to meet most of sub-Saharan Africa's current demand. Within Africa, Ethiopia's capacity is surpassed only by that of the Democratic Republic of Congo. With this potential, Ethiopia envisioned selling at least 4,000 MW of power to regional partners in the next decade. Such a role, a veritable hydraulic mission, would transform the perception of Ethiopia from that of a poor country, dependent on outside assistance, to that of a leading state with resources that are valuable to the entire region (Verhoeven, 2011).

Stretching its capacity of exporting power to its neighbors and beyond, Ethiopia tries to influence others. In this respect, Ethiopia's foreign policy also clearly started regional cooperation as one strategic objective of the nation. According to Ato Tesfaye from Ministry of Foreign Affairs of Ethiopia such hydropower integration is believed to bring the nations of the region under a closer community. Furthermore, assuming, Ethiopia as a regional player, the Ministry of Water and Energy prepared a road map for possible regional interconnections in east, west, south and north directions. In this respect the eastern roadmap extended to Yemen, in the south Somalia, Kenya and Uganda, in north Eritrea and Egypt and in the west South Sudan and Sudan. The map below shows such interconnection plans.

Mr. Cheikh- Former Minister of water resources in Burkinafaso and currently working as an Energy Advisor and analyst in African Union Infrastructure Development Division.

Tesfaye Yitayeh is Former Chief Executive advisor to the Minister of Foreign Affairs on the Affairs of IGAD and currently the director of IGAD affairs I n the Ministry of Foreign Affairs

HVDC- refers high voltage direct current (preferred for long distance transmission network)

Map1-Possible Interconnection lines in IGAD region

Source: Ethiopian Ministry of water and Energy (2013)

In line with this, Regional Integration through hydropower development in Eastern Africa with particular emphasis to the greater horn of Africa has a great prospect for success. However the questions like: Could integration through hydropower sustain for long? What factors could promote interdependence in exchange to power export? Must be explained. The following section intends to explain these and other questions.

Mutual benefit

Hydropower integration promotes mutual benefit to the countries of the region. This is because all countries in the region are dependent on each other in that while Ethiopia exports power at some other point she also requires other services and products. For example Sudan's oil-Ethiopia's power (Black Gold with Blue Gold) shows one aspect of mutual benefit. Ethiopia has no proven oil resources. All fuel consumption in one or another is imported from other countries. In this respect, Ethiopia has a comparative advantage importing oil from Sudan than other countries. Oil and water resources or 'black and blue gold' could contribute to sustainable growth and more harmonious relations between the two countries if they were managed with an explicitly regional perspective. According to Verhoeven (2011) there is a strong case for building regional economic interdependence around an energy deal exchanging Sudanese oil for Ethiopian electricity and thus providing a new framework for political relations. Joint energy initiatives could provide a greater, cleaner and more reliable power supply for both Sudan and Ethiopia as each country grapples with providing jobs for burgeoning populations and services to marginalized areas.

On Ethio-djibouti perspective, Ethiopia's Power- Djibouti's Port complements well. In line with this, the port of Djibouti is the first viable option. In this respect Ethio-Djibouti power integration will help to promote deep political and economic integrations. As a power sector development helps to expand investment in both countries, this will help in further promoting other infrastructural developments like road, railway, building of huge industries and agricultural investments.

Furthermore, other than the port, Djibouti will benefit Ethiopia as the latter use the former to export power to the Middle East.

Ethio-Kenya integration will also be strong as Kenya will serve as a transit state to export power via Kenya's territory. In this regard according to east African power integration program study (2012) that was conducted, in the first phase Ethiopia-Kenya (500KV) interconnection will be finalized. In phase two of the program the interconnection will be done via Kenya-Tanzania double-circuit 400 KV line. Furthermore, in the third phase of the program, Tanzania-Rwanda and Tanzania-Uganda interconnections will be established. In this regard the two countries will be mutually integrated as both are directly affected by the interconnection projects.

Ethio-Eritrean perspective, even though Ethio-Eritrea relation is not favorable at the political level, and if the two countries relation is still impossible to be reversed, Eritrea has a chance to get electric power from Ethiopia via Sudan. In this regard, Verhoeven (2011) stated Sudan and Eritrea agreed to export 200MW hydropower to Eritrea. On the deal to energy linkage Mr. Zelalem, director of Eastern Africa Power Pool, stated that the most viable, cheap and simple interconnection is between Ethiopia and Eritrea as their historical people to people communication and geographic proximity would be much feasible than any other country in the region.

Seasonal Demand

The other major factor of the regional interdependence is seasonal demand varying from country to country. In this respect the countries of the region power demand considerably varies from season to season. For example, Ethiopia, which has a strong Orthodox Christian tradition, consumes less power during its weekends, leaving a surplus for export to Muslim neighbors Djibouti and Sudan, where Sunday is a working day. The countries of IGAD region also have hot climate where they require more energy at night to mitigate heat and temperature, while Ethiopians need more during the day.

Different energy mix

The nature of energy production in the region is different. Some countries have ample amount of solar and hydropower energy potential, while others have fuel energy reserves. For example, Sudan has a huge exploitable actual and potential of fuel energy while Kenya has a good potential of geothermal energy. Thus, Sudan's oil, Ethiopia's hydropower and Kenya's geothermal power can complement one another. In this respect to complement one's country demand on different energy mix integration is not only necessary but also becomes mandatory. Furthermore, different energy mixes will only be complementary only if the integration process is strengthened.

Its spillover effect

Regional integration through hydropower not only satisfies energy demand but also it has other spillover effects. It helps to smoothen regional conflicts, mitigates climate and drought prone areas, expands consumption of technological products and further promotes innovation and advancement of technology. Hydropower development is unique in that, it is environmental friendly, renewable and no proven disadvantage except its high cost of construction at the beginning. The most unique nature of hydropower development for regional integration is its spillover effect for mitigation of climate change and environmental protection. In line with this, the horn of Africa has a comparative advantage in fostering hydropower developments and interconnection projects so as to mitigate the overly increasing drought, climate change, and conflict and security challenges.

Comparative advantage

Hydropower is cheap source of energy compared with other sources of energy. Furthermore, the life span of hydropower is 50 years which is advantageous than other sources. The countries of the horn have a comparative advantage to buy Ethiopian energy because it is cheap. For example Kenya will buy Ethiopian hydropower with 7 US cent per kilowatt which is too cheap compared to generating geothermal energy which has a production cost of more than 10 US cents per

Mr. Zelalem is the Current director general of Eastern African Power Pool

kilowatt. Furthermore those countries with huge diesel energy potential like Sudan costs 20 US cents per kilowatt which is too expensive than importing from Ethiopia. Furthermore, compared with Ethiopia's hydropower site distribution with that of DRC, Ethiopia's hydropower is simple for interconnection as most of hydro plants are distributed in different parts of the country while in DRC most hydropower sites are concentrated in Western DRC which makes the distribution more difficult and costly.

Lower Cost of Production

Ethiopia not only has a huge potential of hydropower development prospects but also minimum cost of production compared to other east African countries. According to World Bank Eastern Africa highway integration project appraisal document (2012) Ethiopia has vast hydropower potential estimated at 45,000 MW, of which less than four percent is currently developed. The long-term marginal cost of developing this generating capacity is around US\$0.04-US\$0.05 per kilowatt-hour, significantly below that of neighboring countries. If there were no barriers to developing and trading Ethiopia's hydropower, the country would have the potential to export more than 55 terawatt Hours (TWh) of electricity per year, or about a third of the total demand in Eastern African Power Pool countries by 2030 (excluding Egypt). The cost of producing hydropower in Ethiopia is much less costly than producing geothermal energy in Kenya or other east African countries.

CONCLUSION

In the greater horn of Africa, water is becoming the most important domain for future cooperation, linked as it is to both energy and agriculture. Energy serves as essential catalyst to economic and social development. This is so because if there is energy production and distribution based linkage, there can be a better opportunity for economic cooperation and consequently a strong and direct interest of one state on the conditions of the other, which is more practical and real than a concern borne out of sentiment or fraternity. Hence, energy linkage leading to economic based integration would open doors for more concrete and justified institutional and political integration, drawing a collaborative effort in tackling problems and effectively utilizing opportunities.

Poor hard and soft infrastructural developments accounts the lion's share of a barrier to regional integration in the greater horn of Africa. The hard infrastructural factor hinders the interconnection between the countries, while the soft infrastructural factor provides a fuel to restrict integration schemes. Infrastructural developments stimulates integration through bringing together economic spaces, reduces physical barriers and upscale and facilitates relation between countries. Hydropower interconnection developments has a spillover effects to promote regional trade, attracting investments, provide reliability of supply, reduces regional uncertainties and promotes cooperation in regional commons. In line with this, it has no question that expanding such infrastructural developments will promote regional linkage and interaction. When these interactions are supported by harmonized policies, standards and norms, it will ultimately lead the formation of one regional community.

REFERENCES

- Abdi A. & Seid H. (2013). *Assessment of Economic Integration in IGAD*. The Horn Economic and Social Policy Institute (HESPI) Policy Paper no. 13/2, Addis Ababa, Ethiopia. The Horn Economic and Social Policy Institute (HESPI).
- African Development Bank Group. (2011). *Eastern Africa Regional Integration Strategy paper 2011-2015*. Abidjan, Cote d'Ivoire African Development Bank Group.
- African Union Commission. (2013). *Fifty Years of Energy in Africa*. Addis Ababa, Ethiopia: African Union.
- African Union Commission. (2014). *The Program for Infrastructure Development in Africa (PIDA): Transforming Africa through Modern Infrastructure, synthesis report*. African Union Commission.
- East African Power Pool. (2012). *East African Power Pool Corporate Plan*. Addis Ababa, Ethiopia: East African Power Pool.

- Economic Comussion for Africa. (2014). *Energy Access and Securty in Eastern Africa*. Kigali, Rwanda: United Nations Economic Comussion for Africa.
- European Union. (2015). *Energy Union Pakage: Achieving the 10% interconnection target*. Brussels: Uropean Union.
- Infrastructure Consortium for Africa (ICA). (2011). *Regional Power Status in African Powr Pools*. Tunisia, Tunis: African Development Bank.
- Ministry of Mining and Energy. (1994). *Federal Democratic Republic of Ethiopia , Energy Policy*. Addis Ababa, Ethiopia: Ministry of Mining and Energy.
- United Nations Economic Commission for Africa. (2010). *Assessing Regional Integration in Africa:Enhancing Intra-African Trade*. Addis Ababa, Ethiopia: Economic Commission for Africa.
- US department of Sustainable Development (2007). *Regional Electricity Cooperation and Integration in the Americas:Potential Environmental, Social and Economic Benefits*. US Department of Sustainable Development, Organization of American States.
- USAID (2009). *Regional Economic Integration in Africa Building on Successes and Lessons Learned*. Arlington: USAID.
- Verhoeven, H. (2011). *Black Gold for Blue Gold? Sudan's Oil, Ethiopia's Water and Regional Integration*. UK: Chatham House.
- World Bank. (2009). *Directions in Hydropower Development*. Washington DC, USA. International Bank for Reconstruction and Development.
- World Bank. (2012). *Kenya Ethiopia interconnection projects impact assesment report*. Kenya, Nairobi, Gamma Systems LTD.