



Perspectives on the Geopolitical Implications of Post-1991 Ethiopia's Hydropower Development

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Abstract

This study examines the competing perspectives on the geopolitical implications of the booming hydropower development in Ethiopia since 1991, which has generated debates on its geopolitical ramifications. The study aims to synthesize the competing perspectives on hydropower development's geopolitical implications through the lens of complex interdependence theory. The study used a qualitative research approach, gathering data from 50 purposively selected key informants from government institutions, regional organizations, academic institutions, research institutes, and power sector advisors. Additionally, documents and secondary sources were consulted. The study identifies three contending perspectives on the geopolitical implications of hydropower development in Ethiopia since 1991. While the hydro-transformative perspective considered hydropower development as having a positive implication for Ethiopia and the region at large, the hydro-skeptics considered it a source of hydro and geopolitical tensions and rivalry. By synthesizing these contradictory theses, the study introduces the third interdependence perspective arguing that the massive hydropower development in Ethiopia since 1991 is foreshadowing a new emergent region characterized by a complex interdependent grid region and grid-connected community where conflict and cooperation, rivalry, and competition coexist. Therefore, Ethiopia and countries in the region must navigate the challenges and opportunities presented by hydropower development within this complex web of competing and cooperative interests.

Keywords: Hydropower Development, Ethiopia, Geopolitics, Complex Interdependence

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Introduction

Ethiopia is considered the water tower and powerhouse of North East Africa because of its major river basins (Abbay, Baro-Akobo, Tekezze, Awash, Omo-Gibe, Genale-Dawa, Mereb, and Wabishebelle, Rift Valley) (Ministry of Water Resources, 2002). The country's gross hydropower potential in these eight river basins is estimated to be 45,000 MW, the second



largest in Africa after the Congo (Ethiopian Electric Power Corporation (EEPCo), 2014; International Hydropower Association (IHA), 2018; Ashebir, 2022; Dereje, Seleshi & Semu, 2011). The annual runoff in these river basins averages 122 billion m³, making it ideal for hydropower production (Ministry of Water Resources, 2002).

However, except the Awash River, all river basins are transboundary and flow into neighboring countries. This poses a challenge to hydropower development in the country. Only 3 percent of the country's total annual water flow remains within its borders, with the remaining 97 percent flowing to neighboring countries (Assefa, Belete & Yilma, 2014). In addition, about 80 to 90 percent of the country's total water flow and hydropower potential is found in four transboundary river basins: the Abbay, the Baro-Akobo, the Omo-Gibe and the Tekeze (Ministry of Water Resources, 2002). These river basins are home to 40% of the country's population (Ministry of Water Resources, 2002) and are equally important for downstream countries. This geopolitical setting highlights the opportunities and constraints of developing hydropower in Ethiopia, as determined by its geographical features.

While Ethiopia has significant hydropower potential that could position it as a regional anchor state, hydropower development has been slow since 1912. Since 1991, however, hydropower development increased significantly, with total installed capacity increasing from approximately 370 megawatts (MW) in 1991 to 5,256 MW in 2023 (Ethiopia Electric Power (EEP), 2023). According to EEP (2023), more than 90% of the country's total electricity generation comes from hydropower, which accounts for 4,820.2 MW of installed capacity. These changes in the energy sector are the result of the construction of large hydro projects since 1991 such as Tekeze, Gilgel Gibe I, Gibe II, Gibe III, Beles, Amerti Neshi, Genale Dawa III, Grand Ethiopian Renaissance Dam (GERD), and Koyisha (Gibe IV), after 1991. During this hydropower era, Ethiopia started to export hydropower to Djibouti, Sudan, and Kenya.

Despite these major changes over the past few decades, the geopolitical context of hydro development remains the most prominent feature of hydro development, both in terms of how it redraws the geopolitical map of the region and in terms of how it continues to impede hydro development. Yet, the geopolitical context of these developments remains largely unexplored.



This research aims to fill this gap by examining the complex and multi-faceted geopolitical implications of the development of hydropower in Ethiopia since 1991. While existing literature examines specific aspects such as hydropower potential and location (Solomon, 1998; Ashebir & Desta, 2020; Dagmawi, Weijun & Jian, 2015; Dessalegn, 2018), hydropower potentials and their development in specific river basins (Dereje et al., 2011; Ashebir, 2020), climate change aspects of hydropower development (Block & Kenneth, 2012), and various aspects of specific hydropower projects (Abebe, 2000; Abbink, 2002; Beirne, 2014; Eldardiry & Faisal; Annys, Tesfaalem & Jan, 2020), a comprehensive analysis of the interplay between hydropower development, regional dynamics, and different stakeholders is lacking. Accordingly, the following research questions were addressed in this study

- ❖ How has the development of hydropower in Ethiopia since 1991 shaped the geopolitical landscape of the region?
- ❖ What are the positive and negative geopolitical implications of the development of hydropower in Ethiopia, both for the country itself and for the region?

By addressing these research questions, this research aims to contribute to a more thorough understanding of the complex interplay between Ethiopia's hydropower aspirations, regional geopolitics, and their implications for the country and the region as a whole.

Conceptual and Literature Review

Hydropower development is the process of harnessing water flow for electricity generation through the construction of dams and power plants (Adhikari, 2006). However, hydropower development has been the subject of intense academic and political debate worldwide due to the unbalanced socio-economic, environmental, ecological, and geopolitical gains and losses (Ansar, Bent, Alexander & Daniel, 2014; Huber & Deepa, 2015). This debate is particularly visible in the context of Ethiopia's massive hydropower development since 1991.

Since the beginning of the 20th century, Ethiopia has been developing hydropower. However, hydropower development has boomed since 1991. This has transformed the country's geopolitical position into an emerging hydropower state and electricity exporter. However, these developments have faced opposition from various stakeholders, including local communities,



neighboring and co-riparian states, environmental and human rights groups, and international and regional institutions. GERD and Gibe III are a case in point. The former is a source of geopolitical tension among Ethiopia, Egypt, and Sudan (De Falco & Giulia, 2022). The Gibe III dam is also another bone of contestation involving local communities, the government of Kenya, local NGOs in Kenya, and International Governmental and Non-governmental Organizations (Schapper, Christine & Sarah, 2020; Carr, 2017; Beirne, 2014). This opposition has resulted in the withdrawal of financial support from international institutions such as the World Bank, the African Development Bank, and the European Investment Bank (Schapper et al., 2020).

As a result of this simultaneous process of rapid hydropower development and its increasing contestation in the post-1991 era, the regional impacts of Ethiopia's hydropower development have been a subject of debate. Some scholars with a liberalist stance have overemphasized the role of hydropower in economic development, poverty alleviation, cross-border electricity trade, and regional integration (Cascão & Alan, 2016; Dawit, 2013; Temesgen, 2018). In contrast, other studies have considered the under-construction GERD and other hydropower projects in Ethiopia as potential sources of political tension, human insecurity, ecological conflict, and geopolitical conflict (Schapper et al., 2020; Sharaky, 2018; Mohamed, 2013; Beirne, 2014). Ahmed (2021) also asserted that Ethiopia's hydropower development is part of the country's geo-economic strategy to gain geopolitical leverage over electricity importers and downstream countries. However, the literature reviewed tends to be state-centered. Furthermore, it provides conflicting conclusions ranging from the possibility of hydro cooperation to hydro wars and hegemonic power configurations at the center of Ethiopia's hydropower development. Therefore, a holistic perspective is required to understand the geopolitical implications of hydropower development in Ethiopia since 1991. Accordingly, this study aims to examine the geopolitical implications of Ethiopia's post-1991 hydropower development from different perspectives and synthesize it using a complex interdependence theory.



Theoretical Framework

This study used the theory of complex dependence developed by Keohane and Nye. According to this theory, since the 1970s world politics has entered an era of complex dependence which is “a situations among a number of countries in which multiple channels of contact connect societies (that is, states do not monopolize these contacts); there is no hierarchy of issues; and military force is not used by governments towards one another” (Keohane & Nye, 1987, p.731).

Complex interdependence theory provides a useful framework for examining the geopolitical implications of Ethiopia's post-1991 hydropower development. First, the transboundary nature of rivers on which hydropower projects are built “naturally create an inevitable network of complex interdependencies among riparian states” (Elhance, 1999 in Atwan, 2018, p.15). This has political, ecological, economic, geopolitical, and security interdependencies. Second, hydropower development is an intersection point of three interdependent resources/securities namely water, energy, environment, and food. Development in one sector affects the security of the other sector domestically and regionally. This kind of interdependency has the potential to induce both synergy and tradeoffs and conflicts. Thus, the issue is how to reduce the tradeoff and exploit the synergetic opportunities both at cross-sector and cross-border levels.

Third, hydropower development is an exemplary showcase for the existence of multiple channels of contact such as inter-riparian, inter-state, and transnational environmental regimes vis-à-vis state and local communities, government-international financial institutions, and government-construction companies. The conventional theories hardly explain such kinds of complexities. Fourth, the water resources development of Ethiopia like GERD, Gibe III, and its power export initiatives have become a foreign policy issue of several countries. Thus, the complex interdependence nature of hydropower development becomes a source of competition, conflict, and cooperation. The theory of complex interdependence, therefore, helps us to understand the complexities, and analyze how complex interdependence can induce cooperation or conflict nationally and regionally. It also helps to synthesize the competing perspectives on the geopolitical implications of hydropower development.



Competing Perspectives on the Geopolitical Implications of Hydropower Development

To grasp the complex geopolitical implications of Ethiopia's post-1991 hydropower development, it is crucial to understand the different perspectives. Two key perspectives emerge from the data gathered for this study: the hydro-transformative and the hydro-skeptical. In the following section, a discussion is made on these two perspectives. By discussing the potential positive and negative implications of hydropower development, this study aims to synthesize the two perspectives and provide a more nuanced understanding of the complex geopolitical implications of hydropower development for the country and the region.

The Hydro-Transformative Perspective

The hydro-transformative perspective, predominantly held by Ethiopian water bureaucrats, sees hydropower development as a means of bringing about positive geopolitical changes. It emphasizes the potential of hydropower to drive development, trigger economic transformation, and accelerate energy-based regional integration. According to the hydro-transformative perspective, the first positive geopolitical implication of hydropower development in the post-1991 period is its role in repositioning Ethiopia as an emerging renewable and clean energy hub in the Horn of Africa, with hydropower at its core. This transformation can be attributed to four interrelated factors. First, Ethiopia possesses abundant hydropower resources (EEP, 2014; IHA, 2018; Ashebir, 2022) and favorable hydrological, geological, and topographical conditions (Zerubabel Getachew, personal communication, April 2022). This could make hydropower a leading source of clean energy in the region.

Second, the cost of producing hydropower in Ethiopia is significantly lower than non-hydro sources in Djibouti, Sudan, and South Sudan (Guelleh, Patel, Kara-Zaitri & Mujtaba, 2023; Infrastructure and Cities for Economic Development, 2018; World Bank, 2009; Africa Development Bank Group, 2013; US Energy Information Administration, 2022). Furthermore, neighboring countries have higher electricity tariffs, with the cost of electricity in Ethiopia being the lowest in the region (Aluru, 2022; Department for International Development, 2016; ESI-Africa, 2021). Hydropower is also a reliable and sustainable source. This has led neighboring countries such as Djibouti, Sudan, and Kenya to import from Ethiopia. Others like South Sudan,



Somalia, Somaliland, Tanzania, Eritrea, and Burundi have requested to purchase power from Ethiopia (Wondosen Teshome, personal communication, May 2022; Getu Tilahun, personal communication, May 15, 2022; Red Sea Power, n.d.; Africa Development Bank Group, 2023). This is the comparative advantage of Ethiopia to become a regional powerhouse through the export of electricity. Third, there is also an enabling policy environment to strengthen the country's position as a regional anchor, with a policy direction to become a 'regional renewable energy export hub' led by hydropower (Ministry of Water, Irrigation and Energy, 2018). Key policies and strategies support this vision, including Ethiopia's climate-resilient green economy strategy and revised national energy policy. In addition, Ethiopia's foreign policy focuses on improving regional connectivity (Zerihun Megersa, personal communication, 25 August 2023).

Fourth, Ethiopia's electricity exports are further supported by cross-border power interconnection infrastructure such as the Ethiopia-Sudan, Ethiopia-Djibouti and Ethiopia-Kenya power interconnections. Electricity exports have also increased from 562.6 million kWh in 2012/13 to 1.71 billion kWh in 2022/23 (National Bank of Ethiopia, 2015; Field Data Collected from the EEP, August 2023). Ethiopia is also planning to expand power exports along several corridors, including the South Corridor (Kenya-Tanzania-South Africa) and the North Corridor (Sudan-Egypt) (Miraje Fereja, personal communication, May 11, 2022; Tewodros Tefera, personal communication, April 21, 2022).

Second, the post-1991 massive hydropower development also transformed hydropower into a tradable commodity – meaning electricity can now be exported to neighboring countries – generating a significant source of foreign currency income for Ethiopia (Gosaye Mengste, personal communication, July 15, 2023). As depicted in Table 1, electricity export revenues nearly tripled between 2013 and 2023. During the 2012/13 fiscal year, revenue from an average export of 562.6 million Kwh of electricity amounted to 34.6 million USD (National Bank of Ethiopia, 2015). However, in the 2022/23 fiscal year, the revenue increased substantially to an average of 102.0 million USD (EEP, Filed data, 2023). Notably, this increase can be attributed to the increased production which increased to 17, 708, 307, 749.3 kWh in 2022/23 (EEP, Filed data, 2023), and the inclusion of new export destinations, such as Kenya, from which 24, 278,



276 USD was earned by exporting 374, 000, 000 kWh of electricity in 2022/23 (EEP, Filed data, 2023).

Additionally, the share of electricity in total merchandise export earnings has also increased from 1.1% in 2012/13 to 2.3% in 2021/22 (National Bank of Ethiopia, 2015, 2022). However, there was a decline in electricity export and earnings in 2015/16 due to drought affecting the water volume of hydropower dams, which caused power outages in Ethiopia as well (National Bank of Ethiopia, 2016; EEP, 2009; Gosaye Mengste, personal communication, July 15, 2023). During that year, earnings from electricity exports dropped by 26.5%, and a 30.5% decrease in export volume (National Bank of Ethiopia, 2016). With this exception, as shown in Table 1, export earnings increased in the subsequent fiscal years. These increased foreign currency earnings from power exports have positive implications not only for the power sector but also for the overall economic sector, which is an important factor in the national power capability.

**Table 1: Electricity Export Revenues and Export Share by Year**

Fiscal Year	Electricity export Revenue collected (millions USD)	Its share in total merchandise of export earnings (%)	Export volume growth rate (%)	Notes
2012/13	34.6	1.1		
2013/14	45.3	1.4		
2014/15	42.8	1.4		
2015/16	31.5	1.1	Fall by 30.5	The fall is due to the drought effect
2016/17	73.4	2.5		
2017/18	84.3	3		NBE data differs from EEP, with EEP reporting 80, 020, 392
2018/19	55.7	2.1		NBE data differs from EEP, with EEP reporting 58, 515, 790
2019/20	66.4	2.2		
2020/21	90.5	2.5	43.0	
2021/22	93.5	2.3	1.7	
2022/23	102.0			

Sources: EEP, Field data, 2023; National Bank of Ethiopia, 2015-2022.



The third positive transformative implication of hydropower development is its contribution to increased electricity accessibility and affordability at national and regional levels. With the expansion of the national grid and the interconnection with neighboring countries, more people have gained access to electricity, and the cost of electricity has become more affordable. In Ethiopia, hydropower has contributed to the increased access to electricity, which has risen to 56% (EEP, 2017). Power export has also increased the electricity access of importing countries. For instance, the first Ethio-Sudan power interconnection contributed to the electrification of 1.4 million households (NEPAD, 2017). 80% of Djibouti's electricity is supplied through the Ethio-Djibouti interconnection (World Bank, 2022). The second Ethio-Djibouti interconnection is also expected to increase the power supply threefold, improving the reliability of the grid and power supply (World Bank, 2022). The project intends to support the realization of Djibouti's 2035 vision in three areas of "diversification and competitiveness, regional integration, and transition towards a green growth path, with a goal of 100 percent renewable energy by 2035" (World Bank, 2022, p. 8-9). This has had a positive impact on the economic development of the country and the region, as well as on the quality of life of the population. The increased accessibility and affordability of electricity can also further drive economic growth and regional integration.

Fourth, the post-1991 hydropower development also transformed hydropower into real power, further increasing the country's geopolitical influence. First, investment in the hydropower sector has increased energy production and, in turn, energy independence and energy security. This could boost economic development and increase productivity in the manufacturing, industrial, services, and other energy-dependent sectors. In addition, foreign exchange earnings could also be used in other strategic sectors of the economy. Taken together, these factors can enhance the country's material power and influence in the region.

Second, the development of hydropower can also enhance Ethiopia's geopolitical influence by positioning it as a key player in regional and global development goals. For example, by developing its hydropower resources to generate electricity, Ethiopia can present itself as a responsible actor in global and regional development goals such as the UN Sustainable Development Goals and the AU Agenda 2063 (Befikadu Bogale, personal communication, August 2023). In these multilateral fora, interconnectivity, climate change concerns, and



sustainable development are a priority, which can serve to promote and legitimize hydropower development, thereby enhancing its image, reputation, and influence in the region (Interview with Befikadu Bogale, personal communication, August 2023). For example, the Ethiopian government presented GERD as an African project aligned with AU Agenda 2063 and UN Sustainable Development Goals, highlighting Ethiopia's ambition to achieve both continental and global goals through GERD (FDRE, 2020). Other hydropower projects, such as Gibe III, have also had similar framing.

Third, the export of electricity can also be an enhancement of Ethiopia's soft power. This is evident for the following reasons. First, Ethiopia can set a good precedent in power exports, as it has not cut off power supplies to Sudan despite the latter's inability to pay after the political turmoil (Wondosen Teshome, personal communication, May 2022). This was even though Sudan was at war and at times controlled the disputed border areas, which the Ethiopian government considered an invasion and an act of aggression (Ministry of Foreign Affairs, 2021a, 2021b). Second, Ethiopia also provides electricity to Djibouti and Sudan during their peak demand periods, such as the Ramadan season and during the night when temperatures are high (Gosaye Mengste, personal communication, July 15, 2023). Concerning Kenya, Ethiopia supplied the country while it was severely affected by El Niño in 2023, which they described as "you reach us in our lifeline" (Gosaye Mengste, personal communication, July 15, 2023).

Fourth, hydropower development can also enhance Ethiopia's ideational influence. It has strengthened the development of manpower in engineering, project management, water science, hydro-diplomacy, hydro-communication, and negotiation skills. For example, several water-related expert groups and institutions have emerged around the GERD. These include the National Panel of Experts; the Water, Hydro-Diplomacy and Communication Forum; the Hydro Politics and Diplomacy Desk within the Transboundary Resources Affairs Directorate of the Ministry of Water and Energy; AFRI-RUN Regional Conference Series, and public diplomacy centers at universities and research institutes. This shows how the physical dam is becoming an intellectual GERD. It has the potential to increase Ethiopia's intellectual power and create a water-conscious society. In summary, hydropower development can be seen as a means of



leveraging the country's geopolitical position in several ways. It can increase the country's power and influence in the region and beyond.

Finally, cross-border power interconnections, powered by Ethiopia's hydropower, have an essential role in accelerating regional integration in both the power sector and other sectors such as security, due to the positive spillover effects the power trade has (Henok Alemayehu, personal communication, April 2022). Functional power interconnection includes Ethio-Djibouti, Ethio-Sudan, and Ethio-Kenya interconnectors. Electric highways that are at the different phases of development also include the second Ethio-Djibouti power interconnection, the second Ethio-Sudan power interconnection, the Ethio-Somalia power interconnection, the Ethio-South Sudan power interconnection, the Ethio-Sudan-Egypt high-voltage interconnection, and Kenya-Tanzania power interconnection project. The Kenya-Tanzania power interconnection project is part of the North-South High Voltage Alternating Current (HVAC) transmission corridor that will connect the Eastern Africa Power Pool (EAPP) to the Southern Africa Power Pool (SAPP) through the Tanzania-Zambia high-voltage interconnectors (FDRE, 2019). Once all these power infrastructures are operational, Ethiopia will become a central hub of the interconnected power systems that stretch from Cairo to Cape Town, supplying hydropower in both directions. This power sector integration is also backed by the Nile Basin Initiative (NBI), Eastern Nile Technical Regional Office (ENTRO), and EAPP.

The Hydro-Skeptical Perspective

Conversely, the hydro-skeptical perspective highlights the challenges associated with hydropower development, emphasizing the externalities of hydropower development in geopolitical terms. From this perspective, hydropower development can exacerbate existing hydro-political and geopolitical tensions in the region, potentially causing conflict over trans boundary water resources. It can also create new rivalries and tensions due to the shift in power dynamics caused by hydropower development.

The first negative geopolitical implication of hydropower development in the post-1991 period, according to the hydro-skeptical perspective, is its role in increasing dependence and geopolitical vulnerabilities of downstream and power-importing countries on Ethiopia. Downstream and



power-importing countries in the region have concerns about their reliance on Ethiopia for water and energy security respectively. In the first case, the dependency concern and geopolitical fear of downstream countries partly stem from their downstream geographical positions. For instance, Ethiopia's upstream position is a source of fear and anxiety for downstream countries (Zerihun Megersa, personal communication, August 2023; Abdurahman Jemal, personal communication, November 2021). An informant asserts that "any development we do on water resources that flows into our neighbors will be opposed by them, even if it is harmless" (Zerihun Megersa, personal communication, August 2023). This assertion was also supported by another informant:

Water is a liquid, it flows from top to bottom. The one who occupies the top has natural leverage. The bottom always looks at the top with threat and suspicion, fearing that the water flow might slow down or stop at some point. As long as the water continues to flow, Ethiopia will remain the source of the water. Whether Ethiopia utilizes the water or not, downstream countries will continue to perceive Ethiopia as a threat. The adversarial behavior between upstream and downstream countries [in this case Ethiopia and Egypt] will also continue (Abdurahman Jemal, personal communication, November 2021).

This is because an upper riparian position is considered the "most influential type of overt power" as it "provides an upstream state the ability to manipulate flows, i.e. to dam or divert them" (Cascão & Mark, 2010, p. 31). Geographical power is also considered a "very strong source of bargaining power when combined with other dimensions" such as material power - especially when the upstream state controls the water through hydraulic infrastructure such as dams (Cascão & Mark, 2010, p. 39).

Given these geopolitical settings, hydropower development may transform Ethiopia's geographical power into a real hegemonic power. This may have implications for the existing hydro-political order and hydro-political relations as it gives Ethiopia leverage over issues of "who gets how much water, how and why" (Warner Mark, 2006, p. 435). Furthermore, power exports may further strengthen Ethiopia's resource exploitation potential. This power reconfiguration, due to the combined factors of geography and hydropower development, could concern downstream countries over issues of decreased water volumes and sedimentation. Thus, while giving Ethiopia leverage in its relations with downstream riparian, it also creates



dependency on the part of downstream countries as it may further exacerbate their geographical vulnerability stemming from their downstream position.

In the second case, there are claims by those who import power from Ethiopia's hydropower about their possible energy dependency on Ethiopia which risks their energy security. For instance, an informant discloses that "in their security analysis, Sudan initially believed that relying on Ethiopia for electricity could harm them" (Zerubabel Getachew, personal information, April 2022). Djibouti also has similar concerns about its dependency on Ethiopia where more than 80 percent of its total power comes from the latter. Ahmed (2021) asserted that Djibouti's heavy reliance on power imports from Ethiopia poses energy security risks for Djibouti. He claimed Ethiopia's hydropower has an unreliable and unsustainable power supply due to the effects of climate change on the water levels of dams. The power purchase agreement also favors Ethiopia and poses energy security risks for Djibouti by only requiring Ethiopia to export surplus power (Ahmed, 2021). His assertion, however, is not without evidence. An informant from the power sector disclosed that

Under our Power Purchase Agreement (PPA), we are obligated to pay if we fail to meet the energy supply requirements, while they bear the responsibility if they choose not to purchase. However, we retain the right not to supply power to them during droughts or water shortages (Miraje Fereja, personal communication, May 2022).

The claim is also further supported by practical issues. Ahmed (2021), for instance, referenced a past incident in 2009 when Ethiopia stopped power exports to both Sudan and Djibouti due to decreased water levels at the Gibe III dam, leaving them without power. Furthermore, Ahmed (2021) asserted that Ethiopia's hydropower development is part of its geo-economic strategy to generate revenues and gain geopolitical leverage over importer and downstream countries' energy and water security.

Sources also indicate that though Kenya was beneficiary from the power generated by Gibe III, they are reluctant to welcome Ethiopia's hydropower development: "When we start Gibe III they know that they will be beneficiary. When we start Koyisha (Gibe IV) they are indifferent" (Zerubabel Getachew, personal communication, April 2022). This indicates the competitive atmosphere between Ethiopia and Kenya.



Second, the development of hydropower has also led to the emergence of multilayer competition and rivalry among a web of actors. First, a multilayer inter-state rivalry is manifested in the power sector. The first layer of rivalry is between Ethiopia, Egypt, and Kenya which have competing interests in the EAPP (Wondosen Teshome, personal communication, May 2022) which has slowed its progress toward the creation of a regional grid and a multilateral power trade (Gosaye Mengste, personal communication, July 15, 2023). In the views of the informants in Ethiopia's power sector (Wondosen Teshome, personal communication, May 2022; Gosaye Mengste, personal communication, July 15, 2023), EAPP's role in coordinating the regional electricity market is not yet effective due to political pressure primarily from Egypt, but now Kenya is also exerting pressure. EAPP is also seen as a prisoner of its history of creation. Egypt became a member considering it as a Watercourse State of the Nile River (Gosaye Mengste, personal communication, July 15, 2023). Then Egypt brought Libya as a member of the EAPP which is interpreted by the Ethiopian power sector elite as Egypt's strategy to create coalition forces, at times necessary, against Ethiopia's proposal and position in the EAPP (Gosaye Mengste, personal communication, July 15, 2023).

Egypt's pressure is largely interpreted as a strategy to contain Ethiopia's power trade expansion. Because, Ethiopia has the comparative advantage to dominate the electricity market due to its hydro which is flexible, inexpensive, green, and grid stabilizing role (Shimelis Habte, personal communication, January 2023; Yonas Tesfaye, personal communication, May 2022). Additionally, there is disagreement over tariffs. This partly explains the motivation of Ethiopia to begin a bilateral power trade agreement with Djibouti, Sudan, and Kenya. An informant claims that

We entered into a bilateral power trade agreement with Djibouti since the existing situation is not conducive to multilateral power trade. If the power pool is realized, anyone connected to the grid will be able to sell and purchase power. You will be able to sell power to those who require it daily, and those who are in need will purchase it from you (Gosaye Mengste, personal communication, 15 July 2023).

The second layer is the re-configured geopolitical rivalry between Ethiopia and Egypt partly due to the construction of the GERD project. Ethiopia aims to become a clean energy hub in the region, which may alter the regional balance of power, while Egypt seeks to block Ethiopia's



power agreements (Mikhail, 2021). For instance, Egypt is expanding its power cooperation to Tanzania, Djibouti, Burundi, Sudan, South Sudan, and Kenya which can be seen as Egypt's containment strategy of countering Ethiopia's power expansion plan (Mikhail, 2021).

Third, the energy market also faces another layer of competition, namely between hydropower producers, primarily Ethiopia, and other renewable energy producers, including Independent Power Producers (IPPs), and wind and solar technology producers. Solar and wind energy producers may view hydropower as a business rival due to its cost-effectiveness and reliability (Getu Tilahun, personal communication, May 2022). This has led to a perceived rivalry between hydropower and other renewable energy sources, with private companies involved in the production and sale of solar and wind technologies in the region seen as having a vested interest in anti-dam movements (Zerubabel Getachew, personal communication, April 2022). Additionally, the development of hydropower may impact the business interests of those who sell fossil fuel energy for electricity generation, as hydroelectric power has lower production and selling costs (Yonas Tesfaye, personal communication, May 2022). The hydrocracies in Ethiopia are concerned that this competition may lead to an energy proxy, rather than a balanced energy mix, with each group striving for market penetration and dominance at regional levels driven by their market interests (Yonas Tesfaye, personal communication, May 2022).

A Complex Interdependence Perspective

In light of these contrasting perspectives, this study introduces a third perspective: the complex interdependence perspective. This perspective argues for the creation of a complex interdependent grid interconnected region and community where both conflict and cooperation, rivalry and competition coexist. This perspective recognizes the potential for both positive and negative geopolitical implications of hydropower development. First, instead of creating dependency, hydropower development can lead to energy interdependence in the region for the following reasons. First, Ethiopia is hydro-dependent and needs to import power from countries of the region during drought seasons, power outage, and peak demand (Zerubabel Getachew, personal communication, April 2022; Wondosen Teshome, personal communication, May 2022). Some power interconnection grids were also designed for both power sale and buy, bidirectional.



For example, the Ethio-Kenya electric highways were designed for bidirectional energy flows, meaning they are intended for both exporting power to Kenya as well as importing from Kenya and other energy producers connected to the Kenyan grid. Moreover, in the regional power pool, every country is both seller and buyer depending on their energy production and consumption level (Gosaye Mengste, personal communication, 15 July 2023). This is a win-win, and give-take deal, instead of creating a dependency relationship between the seller and buyer. For instance, one of the objectives of the second Ethio-Djibouti power interconnection project is to bring transformational change to Djibouti's energy mix by integrating it with the EAPP, an enabling environment for its future export plan from its renewables such as geothermal, wind, and solar power (World Bank, 2022).

Second, the region could ensure energy independence and security through developing an energy mix and regional power pool. Power generated from Ethiopia's hydro resources can serve the region's base load needs, while power from other countries' renewable sources mainly solar and wind can be used to meet intermediate and peak demand periods. For example, Djibouti has the potential for geothermal, solar, and wind energy (Power Africa, 2014; Guelleh, 2013). South Sudan has the third largest oil reserves in Sub-Saharan Africa (Elahi, Rahul, Fouzul & Chrisantha, 2013). Kenya has the largest geothermal potential in the region at 7,000-10,000 MW (Power Africa, 2016). Somalia has a strong onshore wind power potential estimated at 30,000 to 45,000 MW (USAID, n.d.). Eritrea also has untapped renewable energy sources such as hydropower, wind, geothermal, and solar (United Nations Environment Programme, n.d.).

Developing these diverse energy resources across countries is important for developing an optimal energy mix in the region and moving towards an energy interdependence rather than unilateral dependency on any single country or energy source. An informant noted that,

Our neighbors are entering into solar and wind energy development. Solar and wind need to be integrated with hydropower to achieve energy security. During the summer, our hydropower generation capacity increases while solar decreases. By efficiently integrating these resources, we can enhance efficiency. Ethiopia benefits not only by exporting hydroelectric power but also through grid stability. When our energy demand is high, we can also import energy through our interconnected grid (Wondosen Teshome, personal communication, May 2022).



Second, the development of cross-border power interconnections in the region centered on hydropower has the potential to create an emerging interdependent grid community or grid interconnected communities. Because, the power trade has socio-economic, and political dividends. For instance, on the commercial side, Ethiopia can earn foreign currency from power sales, which supports its economic development. The revenue collected from power export could have positive social impacts if they are spent in the social domain of development such as education, health, housing, agriculture, and employment (UN, 2006). This reshapes people's perceptions towards the power-importing countries.

The importing countries, on the other hand, gain access to cheaper and more reliable electricity to meet the needs of their industries, services, and households. This boosts their economic activity and growth. Moreover, power imports can have positive impacts on the society of the importing country, which can reshape their perception of the people and country from which the power is imported. These societal benefits may include improved access to reliable power, increased rural electrification, enhanced agricultural production through powered irrigation and agricultural activities, better access to household water through powered pumps, upgraded healthcare facilities as power supports the operation of essential health services and devices, job creation during and after the interconnection construction phase, and improved educational facilities due to enhanced access to power for school facilities (UN, 2006).

For instance, because of the first Ethio-Sudan interconnection project that operated in 2013, 1.4 million households accessed affordable electricity (NEPAD, 2017). Through this project, Ethiopia also upgraded the existing 260 km single-circuit transmission line from Bahir Dar-Gonder-Shehedi into a double-circuit 230/220kv transmission line (NEPAD, 2017). Installation of fiber optics of telecommunication systems, and extending and rehabilitating substations at Bahir Dar, Gonder, and Shehedi were also part of the project (Ethiopia-Sudan Interconnector Financing Agreement, 2008). As a result, in both countries power supply and reliability have been improved with increased access of power to social services.

In addition, the power exports to Sudan and Djibouti's peak demand during Ramadan and night as well as Kenya during its power outage caused by the El Niño effect in 2023 can strengthen



social bonds and people-to-people ties across borders. Thus, the power interconnection in the region due to the hydropower development in Ethiopia creates grid-interconnected societies which may further widen people-to-people ties and the area of cooperation between countries.

Third, hydropower development can contribute to the creation of a power-centered security community and security cooperation. This is largely due to the spill-over effect of power trade and cooperation in the security domain. As it is a cross-border critical infrastructure, it pushes countries of the region that are connected by the grid to ensure the physical and cyber security of the power infrastructure. An informant recalled that

The Power Purchase Agreement is a 'take or pay' agreement based. It is Ethiopia's responsibility to ensure the security of the cross-border power interconnection infrastructure within its borders. The power-importing country will safeguard the security of the infrastructure within its border, starting from its border with Ethiopia. To ensure the security of the infrastructure, there is cooperation between the security sectors (Wondosen Teshome, personal communication, May 2022).

This may enhance existing inter-state security cooperation in critical infrastructure, cyber security, and counter-terrorism efforts. They may also cooperate in anti-terrorist and anti-insurgency operations to protect cross-border energy infrastructure from being attacked by terrorist and insurgent groups. This may further push the countries to enhance infrastructure-centered security cooperation.

Finally, the coexistence of conflict and cooperation, competition and rivalry is one of the geopolitical implications of hydropower development in post-1991 Ethiopia. This implies that hydropower development is neither the sole source of cooperation nor the sole source of conflict. At the grand level, there are water rights claims and conflict over water uses among the riparian countries on the major river basins of Northeast Africa that originate from Ethiopia.

Despite the unsolved water rights issues, these countries have initiated cross-border power interconnections and power trade from hydropower sources. These hydropower projects are built on rivers that are sources of conflict among some of the countries involved in power trade. Moreover, power trade operates in the absence of a multilateral and bilateral agreement on transboundary water resources, which are the sources of hydropower energy.



For example, Sudan, Egypt, and Ethiopia are conflicting parties regarding the GERD and have varying interests regarding the utilization of the Nile River. However, there is cooperation among these countries in hydropower-based power trade, particularly between Sudan and Ethiopia. They are also engaged in negotiations regarding the GERD project and reached an agreement that priority is to be given to downstream countries in power purchase as outlined in the Declaration of Principles as a trust and confidence-building measure.

Despite the securitized geopolitical landscape between Egypt and Ethiopia regarding the Nile River in general and the GERD in particular, Ethiopia is interested in connecting its grid with Egypt. Egypt also has an interest in purchasing power from the GERD project (Zerubabel Getachew, personal communication, April 2022). Sudan and Ethiopia are involved in a power transmission interconnector project from the GERD to Khartoum, which includes the construction of new 500kv transmission lines spanning 850 km (16 km in Ethiopia and 564 km in Sudan) (NEPAD, 2017).

Kenya initially contested the Gibe III project but now benefits from the power generated by it. However, the Koyisha (Gibe IV) project, which will increase Ethiopia's power exports in the south corridor, is seen by Kenya in a more competitive than cooperative spirit. Ethiopia and Kenya also have competing interests and development plans regarding the Gibe-Omo and Genale-Dawa rivers.

While Ethiopia and Somalia have competitive interests and plans over the Wabishebele and Genale-Dawa rivers (Mohamed, 2013:148), they are currently undertaking a feasibility study for the Ethiopia-Somalia power interconnection. Djibouti imports power and water-103, 000m³ per day from Ethiopia (Ahmed, 2021; Grönwall, 2022), but it claims rights over the Awash River (Guelleh, 2021).

There is also a competitive spirit between Ethiopia, Egypt, and Kenya in the regional power market. Both Kenya and Egypt seek reliable energy sources, including Ethiopia's hydropower. Conversely, Ethiopia is also seeking access to its markets for its hydroelectric power, despite the rivalry and competition, particularly between Ethiopia and Egypt. Ethiopia sees Egypt as a gateway to the power market in North Africa, the Middle East, and Europe, necessitating



cooperation. However, hydropower development has reconfigured the geopolitical rivalry between Ethiopia and Egypt, entering the stage of power trade rivalry.

In addition to the sovereign states involved in cooperation, conflict, and competition, there are non-state actors involved in this complex geopolitical interdependence. These actors include Independent Power Producers, local community agencies, environmental groups, and human rights groups, each with their diverse interests.

This implies that hydropower development in post-1991 Ethiopia has created a complex, interdependent region where the interests of various actors intersect, and where conflict and cooperation, rivalry and competition coexist. Overcoming siloed thinking and addressing the lack of cross-sectoral and cross-border water resource development planning and investment are major obstacles to catalyzing the transformative potential of hydropower in creating a fully energy-peaceful and interdependent region.

Conclusion and Recommendations

This study examined the key geopolitical implications of Ethiopia's post-1991 hydropower development. The analysis is based on data collected from key informant interviews, documents, and literature found to be relevant to the issue studied. The findings reveal the existence of competing perspectives concerning the geopolitical implications of the development of hydropower for Ethiopia in particular and for the region in general. These perspectives are the hydro-transformative, which sees hydropower as playing a transformative role at national and regional levels. The main thesis is that hydropower has the potential to serve as the 'battery of the region'. It can also reposition Ethiopia as an emerging renewable and clean energy hub. It serves as a source of foreign exchange earnings, a source of emancipation, a source of ideational power, soft power, and material power. For the region, it is an enabler of green development and decarbonization through the provision of reliable and affordable energy. It is also a catalyst for energy-led regional integration.

In contrast, hydropower skeptics argue that hydropower development is a source of hydro-political and geopolitical tension, exacerbating existing fault lines, tensions, and geopolitical



rivalries. Hydropower is at the intersection of a multi-layered set of hydro-tensions and rivalries between and among riparian countries, IPPs, environmental groups, and local communities. The main rivalry is between Egypt, Ethiopia, and Kenya, each struggling to become an anchor state. Hydropower has also reconfigured the rivalry between Ethiopia and Egypt from one centered on water to one centered on electricity trade. There is also market competition between hydropower and other renewable energy producers.

Finally, the complex interdependence perspective synthesized the opposing continuum viewpoints, arguing that hydropower is neither a cause of overt conflict nor of genuine cooperation. Rather, it indicates a complex interdependence region and networked community where conflict and cooperation, conflict and competition coexist among a web of actors.

Based on the above discussion, the study makes the following recommendations.

- ❖ Harness the opportunities of hydropower development, such as enabling regional cooperation and integration, while mitigating risks of conflict and geopolitical tensions.
- ❖ Realize the geo-transformative potential of hydropower for Ethiopia and the region by shifting from a conventional, hydropower-focused energy development approach, to a more sustainable approach that promotes a balanced energy mix.
- ❖ Ensure the sustainability of hydropower development in Ethiopia by shifting from a siloed approach to a nexus-based approach that considers the synergies and trade-offs between water and energy security from a regional perspective.
- ❖ Address potential competition and rivalry between hydropower producers and other renewable energy producers by establishing collaboration to develop a balanced regional energy mix, rather than competing against each other. Hydropower producers could partner with independent power producers of solar and wind energy to invest in hybrid power plants combining different renewable sources.



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