

**T.C.  
ISTANBUL AYDIN UNIVERSITY  
INSTITUTE OF SOCIAL SCIENCES**



**REGIONAL INTEGRATION AND THE POLITICS OF HYDROPOWER:  
STUDY ON POTENTIAL OF HYDROPOWER INTEGRATIONS AND  
ETHIOPIA'S ROLE IN IGAD REGION**

**M.A. THESIS**

**ANWAR SEMAN KEDIR**

**Y1412.110026**

**Department of Political Science and International Relations  
Political Science and International Relations Program**

**Thesis Advisor: Assist. Prof. GÖKHAN DUMAN**

**August 2016**



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İSTANBUL AYDIN ÜNİVERSİTESİ  
SOSYAL BİLİMLER ENSTİTÜSÜ MÜDÜRLÜĞÜ

**Yüksek Lisans Tez Onay Belgesi**

Enstitümüz Siyaset Bilimi ve Uluslararası İlişkiler Ana Bilim Dalı Siyaset Bilimi ve Uluslararası İlişkiler İngilizce Tezli Yüksek Lisans Programı Y1412.110026 numaralı öğrencisi Anwar Seman KEDİR’i “REGIONAL INTEGRATION AND THE POLITICS OF HYDROPOWER: STUDY ON POTENTIAL OF HYDROPOWER INTEGRATIONS AND ETHIOPIAS ROLE IN IGAD REGION” adlı tez çalışması Enstitümüz Yönetim Kurulunun 05.08.2016 tarih ve 2016/16 sayılı kararıyla oluşturulan jüri tarafından *gözetil.* ile Tezli Yüksek Lisans tezi olarak *değerlendirilmiştir.*

Öğretim Üyesi Adı Soyadı

İmzası

Tez Savunma Tarihi :11/08/2016

1)Tez Danışmanı: Yrd. Doç. Dr. Gökhan DUMAN

*Gökhan Duman*

2)Jüri Üyesi : Yrd. Doç. Dr. Gülşay Uğur GÖKSEL

*Gülşay Uğur Gökşel*

3)Jüri Üyesi : Yrd. Doç. Dr. Özgün ERLER BAYIR

*Özgün Erler Bayır*

Not: Öğrencinin tez savunmasında **Başarılı** olması halinde bu form **imzalanacaktır**. Aksi halde geçersizdir.



## **FOREWORD**

I am an idealist, a dreamer perhaps someone who believes that the world can and should be improved. As we all contribute, we play our part in the direction of the changes made. These ideals drove me to write a thesis on the possibility of energy integration in eastern Africa as much as there is open and free single energy market in Europe. It has been a long process, which allowed me to extend my knowledge on the regionalism, regional integration, hydropower development, region interconnection through public goods, renewable energy, energy hub, Ethiopia's role on the process etc.

I wrote my senior essay on Hydro politics of Nile River where I explored the possible outcome of hydro political process. This is where I started to acquire deeper information on Trans-boundary resources, the possibility and opportunity of cooperation and conflict in managing those resources. More importantly, it was an experience I realized the untapped resource Ethiopia has on hydropower development. Further reading on regional integration, and European experience of single energy market made me to investigate the same trajectory for Eastern Africa countries. Besides, the increasing attentions given to clean energy is also one of the factors contributed to study the need for regional energy integration in East Africa and Ethiopia's role on the process.

I am deeply grateful for the support I received along the way, as for without it, my entire study and this research undertaking would not have been possible. Most of all, I would like to offer my special thanks to the Scientific and Technological Research Council of Turkey (TUBITAK) which, gives me scholarship to carry out this study with aim to assist the development process of my country. The whole things came in to good shape through the guidance of my supervisor Assist. Prof. Gökhan Duman. Without his devotion and reverence, it would have taken me much longer to finish my thesis.

---

**JULY 2016**

**ANWAR SEMAN**



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## **ABBREVIATIONS**

<b>AUC</b>	: African Union Commission
<b>COMESSA</b>	: Common Market for Eastern and Southern Africa
<b>EAC</b>	: East African Community
<b>EACE</b>	: Ethiopian Association of Civil Engineer
<b>EAPP</b>	: Eastern Africa Power Pool
<b>ECA</b>	: Economic Commission for Africa
<b>EEPCO</b>	: Ethiopian Electric Power Cooperation
<b>EU</b>	: European Union
<b>FDRE</b>	: Federal Democratic Republic of Ethiopia
<b>ICT</b>	: Information Communication Technology
<b>IEA</b>	: International Energy Agency
<b>IGAD</b>	: Intergovernmental Authority on Development
<b>IGADD</b>	: Intergovernmental Authority on Drought and Development
<b>IRENA</b>	: International Renewable Energy Agency
<b>MW</b>	: Mega Watt
<b>NEPAD</b>	: New Economic Partnership for African Development
<b>OAU</b>	: Organization of African Union
<b>PIDA</b>	: Program for Infrastructural Development in Africa
<b>REC</b>	: Regional Economic Communities
<b>SADC</b>	: Southern Africa Development Community
<b>UN</b>	: United Nations
<b>UNIDO</b>	: United Nations Industrial Development Organization
<b>WWII</b>	: World War Two



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**ABSTRACT**

It is evident that efficient and clean energy supplies are needed to fuel IGAD member countries' development and fight against poverty as energy underpins the provision of clean water, health services, education and communication. Energy is a significant part of the total infrastructure that allows rural and urban poor to grow beyond subsistence activity. However, most proportion of IGAD region societies still dependent on traditional and energy sources and, IGAD region faces challenges of low level of infrastructural development. Fostering interdependence among countries of the region through infrastructure development such as power interconnection, road and railway constructions provide a base for alleviating common challenges and creating closer economic community. Regional integration through energy development is an important aspect of such interdependence. On this regard, as one of water towers of Africa, Ethiopia offers a great deal of opportunity for clean energy production, Ethiopia's potential to generate more than 45,000MW power is enough to meet most of sub-Saharan Africa's current electricity demand. More importantly, Ethiopia's population size, relative internal stability, military power and diplomatic strength have enabled it to position itself as a regional power and to drive regional peace and security initiatives.

This thesis aims to explore the major roles that Ethiopia is playing for the formation of integrated community in IGAD region. Theories of intergovernmentalism and neo-functionalism supported the study to understand the main principles of integration. Both theories explain regional integration through public goods such as hydropower and its knock on effect for further integration among neighbouring countries. The research questions of this thesis are well approached by qualitative analysis research methodology. The thesis also has the additional merit of being quantitatively backed, as there are empirical data on the integrated projects and potential integrated projects that underscores the theoretical concept of energy hub, and regional integration through public goods.

**Keywords:** *Regional integration, energy integration, hydropower, energy hub, IGAD region*



## **BÖLGESEL ENTEGRASYON VE HİDRO-GÜÇ POLİTİKASI: IGAD BÖLGESİNDE HİDRO-GÜÇ ENTEGRASYONU POTANSİYELİ VE ETİYOPYA'NIN ROLÜ ÜZERİNE BİR ÇALIŞMA**

### **ÖZET**

IGAD üyesi ülkeler aşırı yoksulluk, kuraklık, hızlı nüfus artışı ve gıda güvencesizliği gibi benzer problemlerle karşı karşıya kalmaktadır. Bu gibi problemlerle mücadele etmede; güç ara bağlantısı, yol ve demiryolu inşaatı gibi altyapı yatırımlarını yaparak karşılıklı bağımlılığı geliştirmek, bu problemlerin hafifletilmesine ve çevre ülkelerle yakın ekonomik ilişkiler geliştirilmesine zemin hazırlamaktadır. Enerji toplam altyapısının ciddi bir kısmını oluşturduğundan enerji entegrasyonu, karşılıklı bağımlılığın önemli bir parçasıdır. Beraberinde, bölgesel bazda enerji piyasalarının gelişimi ciddi kazanımlara işaret etmektedir. Afrika'nın su kuleleri arasında Etiyopya, temiz enerji üretimi bakımından pek çok fırsat sunmakta ve 45,000 MW'den fazla elektrik üretebilme potansiyeli ile Sahra Altı Afrika'nın büyük bölümünün cari elektrik talebini karşılayacak yeterliliktedir. Daha da önemlisi, Etiyopya'nın nüfus büyüklüğü, görece iç istikrarı, askeri ve diplomatik gücü bölgesel güç olmasına, bölgesel barışı ve güvenlik yatırımlarını yönlendirecek bir pozisyon almasına olanak sağlamaktadır.

Bu tezin amacı, IGAD bölgesinde entegre bir birlik oluşturmada Etiyopya'nın ana rolünü keşfetmektir. Hükümetlerarası ve Yeni İşlevselcilik teorileri entegrasyonun temel ilkelerini anlamada çalışmaya fayda sağlamıştır. Her iki teori de bölgesel entegrasyonu hidro-güç gibi kamusal mallar aracılığıyla ele almakta ve onun zincirleme etkisiyle çevre ülkelere daha ileri düzeyde entegrasyonunu açıklamaktadır. Bu tezin sorunsalına daha çok nitel analiz araştırma teknikleriyle yaklaşmıştır. Bu çalışmanın ek bir avantajı içeriğinin niceliksel olarak desteklenmesidir çünkü entegre ve potansiyel entegre projelerde ampirik veriler kullanılmıştır. Ayrıca, ampirik veriler kamusal mallar aracılığıyla enerji merkezi ve bölgesel entegrasyonu teorik kavramlarla vurgulamaktadır.

**Anahtar Kelimeler:** *Bölgesel entegrasyon, enerji entegrasyonu, hidroelektrik, enerji merkezi, IGAD bölge*



# **1. INTRODUCTION**

## **1.1 Background of the study**

Regional integration is a process where geographically closer countries agree to enter into an agreement of cooperation and coordination of policies among themselves through common rules and institution with aim to achieve widespread security, economic and socio- political objectives. As such, the course of forming integrated community consists two simultaneous processes; removing all discriminatory barriers for free trade followed by connecting various economies in to large economy area. This in turn requires the member states' collaborations of policies between them. Regional integration in the past involves promoting free trade for an increased free movement of goods, capitals, labour, and people across national border. More recently, the commitment to be a part of some regional organization involves endorsing united regional stance on policy issues, such as migration, climate change and environment.

The end of World War II marked the proliferations of regional integration. Regionalism through which geographically proximal countries agree to enter into an agreement of cooperation and coordination of policies among themselves in some form of regional integration agreement has become a major trend in international relations. The practice of regional integration started in the late 1950s in Europe for the vision to see united Europe. Since then, all countries of the globe belong to some regional cooperation organization and nearly all regions of the world have at least one organization, which mainly targets forming free trade area free of trade barriers between member states (Hannu, 2006).

Particularly after the end of Cold war, regional integration is proliferated throughout the world and become a subject of discussion in academic discourse. Concomitantly, several basic arguments have been forwarded in the academic discourse on how regional integrations would be achieved. On one hand, theories like intergovernmentalism, emphasize the top down approaches where they give stress on

the role of the state to achieve regional integration (Castaneda, 2006). For the supporters of Intergovernmentalists, integration is the result of series of agreement and bargains between the governments' representatives especially heads of government of strong regime at the given region. Integration dismount within domestic politics utterly as the result of intergovernmentalism negotiations with no role of supra national institutions in the process.

On the other hand, other theories like functionalism and neo-functionalism stress on the gradual development of integration from bottom up approach. Neo-functionalist stresses on a knock on effect that a growing cooperation between countries on one area will bring for further increased integration in neighbouring areas. Neo-functionalist advises integration modestly in the areas of "low politics" where its consequence led to a gradual entangling of national economies and social interest will transform their loyalty towards the new supra-national center. Hence, regional integration can be best achieved through different mechanism which include infrastructural developments like transport, information technology communication and energy which further promotes people to people relations, cultural exchanges and formation of unified regional community (Aston, 2014).

Shortly after most of African countries started to get their independence from the yoke of colonialism, regional integration has been considered as heart of policies and strategies to bring economic transfiguration. In the mid-1960s, it is the Economic Commission for Africa (ECA) which premiers regional integrations in Africa by proffering the dividing of Africa in to regions for the purpose of economic transformation. Since then various concrete agreements have been subsequently been adopted, including the Lagos plan of Action (1980) and the Abuja treaty 1990. The Lagos Plan of Action was supported by the ECA and discharged in special initiative by the then OAU. The Lagos Plan recommended the rationalization of regional economic communities to address multiple membership issues. For this end, the plan established three divided but concurrent and encompassing regional arrangements in three sub-saharan sub-regions. The west sub-region represented by ECOWAS that existed before Lagos Plan, and eventually switched in COMESA in 1993 with formation of a Preferential Trade Area in 1981 to cover the countries from the southern and eastern Africa. The ECCAS approved in 1983 to serve the central sub region arrangement. In North Africa, it is AMU arrangement that expected to lead an

all-African common market by the year 2025. The Abuja treaty also re-affirms the commitment of African leaders to integrate African economy (African Development Bank, 2011).

Regional integration is sought to play fertile ground to forge diversiform and booming economies, and lay down loops for development and growth. It further helps to mitigate escalation of societal, resource and government driven conflicts. It the result of various processes of cordial adjustment to enforce agreements and treaties between countries that produce the room for market and economies in a region to become more closely interconnected (African Development Bank, 2011). Regional integration particularly in energy sector helps to reduce investment costs. However, Africa's abundant energy sources especially in hydropower are unevenly distributed resulting in under exploitation in some areas and high cost in the other areas (African Infrastructural Synthesis Report, 2012).

Hydropower is a renewable energy sources based on the natural water cycle. It is the most reliable, cost effective, and environmentally friendly energy sources available that account for producing 16% of the world energy demand (Brown in IRENA, 2012). 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 region's in hydropower potential Eastern Africa ranked second next to Central Africa with the potential to generate 578 TWH<sup>1</sup>/ year. Currently the major source of electricity in eastern Africa is hydropower generation where 95% of East African countries current consumption is depend on (AUC, 2013). Identified regional generation projects up to 2025 in Eastern Africa have a total capacity of 1087MW; Hydropower represents 97% of it where Ethiopia alone expected to contribute 64% of all it is from hydropower sources. The remaining shares contributed by: Uganda 18%, Tanzania 11, DRC 4%, and Rwanda 3% (Infrastructural Consortium for Africa, 2011).

East African countries have a huge potential of hydroelectric power generation. However, the whole Africa's share of the world's hydroelectricity generated in 2001 was only 3% (IHA, 2010). Recently there are robust evidences entailing Africa will continue to be the area of the world where hydropower will play the significant role

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<sup>1</sup> 1 TWH/year = terawatt = 114 MW

in future economic prospect. Several countries describe their hydro potential as one of their most valuable resources, or as the backbone to future development. According to African Union report (2012), renewable energy particularly hydropower is baseline for regional integration in eastern Africa. To facilitate this, the Eastern African Power Pool (EAPP) was established in 2005 and adopted in November 2006 as a COMESSA's specialized institution and a vehicle for the enhancement of energy interconnectivity in the region and the rest of Africa (Zelalem, 2013). Regional electricity (energy) cooperation involves the combined operation of power systems, the interconnection and the harmonized management of infrastructural services, including the design and operational criteria (US department of sustainable development, 2007). It entails a common strategy around policy harmonization among the countries of the region.

Ethiopia has Africa's largest hydropower potential next to the Democratic Republic of Congo with the potential to generate more than 45,000MW. As the water tower of Africa, Ethiopia offers a great deal of opportunity for clean energy production, which has become vital in the current global environment. Ethiopia's suitable geography with large number of rivers makes a country suitable for hydropower development. Most of Ethiopia's rivers originate in the highlands and cascade down steep slopes to the surrounding lowlands. Furthermore, Ethiopia boasts a regional comparative advantage in hydropower production and distribution both in terms of ecology and economy. Ethiopia has the potential to export energy even beyond the region. Ethiopia's hydroelectric potential of 45,000 MW is enough to meet most of sub-Saharan Africa's current demand. 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 mission would transform the perception of Ethiopia from that of a poor country, dependent on outside assistance, to that of leading state with resources that are valuable to the entire region (Verhoeven, 2011).

Ethiopia is increasingly described as a regional power in the horn of Africa. Ethiopia's military power, population size, relative internal stability and diplomatic strength have enabled it to position itself as a regional power and to drive regional peace and security initiatives. Ethiopia has also been able to influence regional security agendas through sub-regional and regional organizations. The convergence of Ethiopia's interest and those of its western partners further give Ethiopia

legitimacy in its regional role and status. Ethiopia's increasing engagement in regional peace and security issues further indicates that it has the will to lead and influence the region. Hence, together with this political aspect the obvious core elements to build and perpetuate regional integration are infrastructural development. In this respect Ethiopia, sometimes referred as green energy sector tower of Africa is now involved in multi-billion dollar climate- resilient green energy sector developments that will lead to it becoming one of the main producer and exporter of power in Africa. The government is heavily investing in mega hydro projects, wind farms, solar and geothermal energy to provide the bedrock for the transformation of the political, social and economic landscape of Ethiopia, and for the region. It is already implementing an energy trading strategy among IGAD members to help accelerate their development efforts and significantly reduce the emission of green house gases.

Many argued Ethiopia's geographical location together with its huge potential of hydropower serve as a power hub for eastern African countries (EACE Bulletin vol, No 1. 1999). Apparently, Ethiopia already started its regional electricity interconnection with the export of power to Djibouti and Sudan. Cable infrastructural development is already underway with Kenya and there is a plan to reach Libya to the north and Yemen to the East. Therefore, this study is to assess the enabling factors and future prospects of Ethiopia's role for regional integration through hydropower development as these huge and encompassing regional developments has to get attention of the academic discourse.

## **1.2 Justification**

The countries of IGAD region face similar challenges such as poverty reduction, climate change, population growth, food security, inadequate and poor regional infrastructure network, weak institutions, low human capacity, insecurity and political instability. To deal with such problems, fostering interdependence through infrastructural developments like power interconnection, road and railway constructions provide a base for alleviating such challenges and creating closer economic community. Energy integration is an important aspect of such interdependence as energy is a significant part of the total infrastructure. An increase in cross- border grid interconnection will also improve power system reliability,

sustainability and result in lower production cost, which can represent an important reduction in electricity prices and other commodities. According to African Union (2014) report estimate, effective energy integration among African countries would have save \$ 860 billion over 2014-2040. More importantly, power interconnection has a spill over effect for other forms integration as it creates a platform for creation of regional integrated community.

Energy interconnectivity in the eastern Africa and increased power production using renewable energy sources have been identified as action areas for consideration. However, Eastern Africa energy mix varies from country to country. In the sub region of IGAD, the largest potential of hydropower production is concentrated in Ethiopia; followed by Sudan, Uganda and Kenya. Ethiopia takes the lead in production and distribution of hydropower with various huge projects to export power in the region. Ethiopia's potential in clean energy production together with its relatively stable political atmosphere in the region may help to facilitate regional integration schemes and serve as a power hub of the region.

However, these enabling factors, which may promote Ethiopia's role as a regional power hub, are not yet studied well and deeply investigated. The region also lack well-articulated common strategies, regulatory frameworks and complementary policies to facilitate regional integration. Therefore, this study contributes its part to the available scanty literatures and helps to fill such knowledge gaps in the field. The study has a significant value to anyone who is interested the issues of regional integration and hydropower development. The finding of the study will also contribute in providing concrete recommendation for IGAD members for their effort to promote regional integration through hydropower development. Moreover, the study will bring some findings that will have policy implication for respective countries and regional communities.

### **1.3 Objectives of the study**

The study has the general objective to investigate and analyze the role of Ethiopia's hydropower development to foster regional integration in IGAD region. It is a study designed to explore the major roles that Ethiopian hydropower development is playing for the formation of integrated community in the region. Besides, the study

aimed to critically analyze the potential and enabling factors that help Ethiopian to be a power hub of the IGAD region and to critically interpret the possible scenarios how Ethiopian hydropower development serve as a source of interdependence for the countries of the region. The study also explore the major imperatives using hydropower as a tool for regional integration and to analyze the major actual and potential challenges facing the countries of eastern Africa to form a closer community integrated with different infrastructures.

#### **1.4 Research Questions and Methodology**

The research intends to answer the following research questions: why hydropower development is preferred tool of integration in IGAD region for the formation of closer society, would Ethiopia be the power hub of Eastern Africa with particular reference to IGAD members and what are the enabling factors for Ethiopian hydropower development as a source of interdependence in the region.

The research questions of this thesis are well approached by qualitative analysis of research methodology. The qualitative method is used to explain, interpret, and analyze the myth and realities of regional integration through infrastructural development. Customary practices, legal and policy frameworks, governments' policies, and other social factors that either promote or hinder regional integration through hydropower development have been analyzed qualitatively. Qualitative methods of analysis further helps to analyze dependence verses interdependence debates, the demand- supply matrixes of eastern African countries in electricity consumption and production and further to analyze Ethiopia's integrating role in the region.

The theories of intergovernmentalism and neo- functionalism supported the study to understand the main principle of integration. Both theories explains regional integration through public good like hydropower and its knock on effect for further integration in neighbouring areas.

To scrutinize the issue under investigation, extensive review of related literature has been conducted, of both primary sources such as official documents, policy documents and reports, as well as secondary literature such as journal articles, internet materials, magazines and books covering the topic. Some of the notable

thinkers on theories of regional integration such as Earns Haas and Castaneda have been also covered. Besides, news releases, government official's interviews, reports and other statistical information are analyzed to get a comprehensive picture of hydropower development and consequent regional integration schemes in the region

The topic of this thesis has the additional merit of being to qualitatively backed, as there are empirical data on the integrated projects and potential integrated projects that underscores the theoretical concept of energy hub and regional integration through public goods. For this end, reports from EAPP with regards to current trends , regional interconnection plans, technical reach outs and road maps of the regional integration schemes to foster power trade among the members of IGAD are explored. Substantial impetuses on the Ethiopia contexts were received from, ministry of water and energy of Ethiopia to get first hand information about the roles, prospects, potentials, current assessment and benefits of hydropower energy sector towards regional integration. Besides, report from Ethiopian foreign ministry with regards to roles of Ethiopian hydropower development for sustainable economic, social, and political integration in the region is well articulated. Empirical data from African union commission is also used assess the role of hydropower development for the formation regional communities and integrated societies at continental level.

Finally, Ethiopia's potential in hydropower to serve as a power hub in IGAD region is analyzed in a manner that is unbiased, within available information and the casual inference of presumed energy integration role to create closer regional community is made by employing extensive range of literature and empirical data.

### **1.5 Scope and Limitation of the study**

Regional integration is the vast topic that covers integration through transport, ICT, infrastructural development, shared projects on trans- boundary resources and energy outlook developments. However, this research is delimited to the role of hydropower development as a means to regional integration with particular emphasis to the role of Ethiopian hydropower developments for regional integration in IGAD region. The research examines the region that covers IGAD member states, which are Ethiopia, Sudan, Kenya, Uganda, Eritrea, Djibouti, South Sudan, and Somalia.

The major limitation encountered while conducting this research was scanty of resources, where it was difficult to get sufficient data resources. Particularly lack of well-organized documents about the issues was the major problem I encountered to conduct this research. More importantly, the study lacks accurately telling how much the knock out effect of power sector integration will contributed and will contribute for other forms of integrations, as there is methodological problem on the field on tools to monitor regional integration and assess its impact.

## **1.6 Organization of the study**

The thesis begins with introductory section that introduces the background of the study, statement of the problem, methodologies, objectives, and limitation and scope of the study. It gives theoretical and conceptual clarification of the terms, concepts on regional integration, hydropower development, energy integration and regional power hub. It also introduces the research questions and the study area under scrutiny. This part is followed by theoretical approach in the second part that deals with the concepts and theories of regional integration in wider perspectives. In this part, regional integration theories that explain and justify integration schemes through hydropower developments have been selected and analyzed. Besides concepts such as imperatives of regional integration, approach of regional integration, hydropower development, energy hub and regional experience of energy integration have been dealt in detail.

In the third part, the study starts with the need for energy integration in IGAD region. It justifies factors necessitated for energy integration, and how specifically hydropower is selected to accomplish the goal. For this end, the current integration schemes of power sector in IGAD analyzed, and country-by-country analysis is employed to examine the existing demand and supply matrix. This part also tries to address integration regimes in the region, which facilitates the process of integration. It try to identify institutions, legal and policy regimes that assist the implementation of interconnection through hydropower development.

The study in its part four analysed the role and potential of Ethiopia to serve as power hub among countries in the IGAD region. It seeks to extract the actual and potential role of Ethiopia's hydropower development to serve as a centripetal force to

integrate the region. For this purpose, the study examined current development interconnection grid and potential projects that that will serve as energy hub in the IGAD region. This chapter also examined the animosity between domestic consumption pattern and export of electricity in the region. It discusses the enabling factors that make Ethiopia as a power hub in the region. Furthermore, it examines the nature of integration in the region whether it fosters interdependence or dependence based on empirical analysis. The last chapter provides concluding remarks and policy recommendations. It provides recommendation for regional bodies to come up with complementary policies, common strategies and regulatory frameworks for sustainable interdependence among the members of IGAD.

## **2. THEORETICAL APPROACH**

### **2.1 The Concept of Regional Integration**

In addition to the global economic regime based on the GATT and IMF systems, which has sustained the world economy since World War II, regionalism, through which neighbouring countries seek to strengthen their economies by entering into some form of “regional integration” has become a major trend. This trend was triggered by the EU market integration. In both developed and developing countries, customs unions and free trade areas (FTAs) continue to increase and expand. Today, they account for a considerable amount of world trade. In the WTO, regional trade agreement (RTAs) is referred to as customs unions, FTAs, and interim agreements <http://www.meti.go>. (Accessed on 29/04/2016).

In 1965 Sir Arthur Lewis wrote, “These islands did not start on the federal road in a fit of idleness. They started because it was clear that a Federation is the only possible solution of their problems.” To better understand what Sir Arthur meant, we must first define the term regional integration. Although this term has been in existence for a long time, a precise definition is not easy to formulate. Generally it refers to the unification of nation states into a larger whole. On one hand, regional integration can be described as a dynamic process that entails a country’s willingness to share or unify into a larger whole. The degree to which it shares and what it shares determines the level of integration. There are different degrees of integration depending on predefined criteria. On the other hand, regional integration also refers to an outcome, occurring when pre set criteria are met. For example, if the criterion for the establishment of the Organisation of Eastern Caribbean States was only the establishment of a Central Bank, then it could be said that we have achieved integration. However, there are many other aspects to the Treaty of Basseterre. When political leaders call for the deepening of integration, they must recall the measures on which they previously agreed and then specify the next set of measures Regional

integration involves some compromise on the part of nation states, but should enhance the general quality of life for the citizens of those states. The OECS member states have also had the longest and most sustained engagement with regional integration. At times when the other Caribbean islands have not seen the movement to be in their best national interest, they have withdrawn. The OECS members have however moved ahead to forge their own identity and have received many benefits from those efforts (<http://www.eccb-centralbank>. Accessed on 21/02/1016).

In Africa, the process of regional integration started with different phases. The first generation of regional integration schemes in 1950s were motivated partly by not only the political vision of African unity, but also as means of providing sufficient scale to import substitution industrialization policies. However, the failure of this inward looking strategies lead countries to progressively switch from import substitution to open- door policies since the early 1980s, where the second – generation regional integration scheme have become characterized by open regional arrangement which is still an ongoing activity (Kritizinger, 2005).

Although, the term regional integration is becoming a popular term in academic discourse its meaning sometimes used in confusing manner as it is used as a process and an outcome. Different literature define regional integration along three dimensions: the first is geographic scope, which illustrates the number of countries involved in an arrangement. The second dimension is substantive coverage refers width that is the sector or activity coverage and, the final aspect is the depth of integration – to measure the degree of sovereignty a country is ready to surrender, that is from simple coordination or cooperation to deep integration. Substantiating, all these three dimensions regional integration simply refers a complex web of cooperation between countries with in a given geographical area supported by harmonization of policies with regard to trade, investment, infrastructural development and monetary policies of member countries (Andi, 2005).

Ernst Haas (1976) provided the following definition of regional integration:

*“The process by whereby political actors in several distinct national setting are persuaded to shift their loyalty , expectations and political activities toward a new center, whose institution posses or demand jurisdiction over pre-existing national states. The result of a process of political integration is a new political community, superimposed over the pre-existing one”.*

According to African Development Bank (2012), Regional integration is a complex process with three dimensions. The first dimension involves hard infrastructure that requires the development of regional transport networks, energy interconnection telecommunication infrastructures and trade arrangement, which set the institutional arrangements for management and maintenance of the infrastructure. The second dimension is soft structure that involves removing intangible barriers to the free movement of goods, services, capital, and labour with institutional arrangement to integrate market. The third one refers regional public goods where arrangements for managing shared resources and joint investment takes place for the benefit of the region as a whole. In this respect, regional integration involves the area of economics, security, environmental, social aspects that in a process creates an ever-closer community. Where the process reaches at advanced level, it could be referred as an integrated community.

Forms of interdependence can be in varying intensities based on scope of activities. It ranges from discrete projects, programs, policies and institutions to the loss of sovereignty to supra national institutions. Kritizinger (2005) identified three levels of interdependence based on the depth and intensity of activities. The first level is cooperation where countries agree to cooperate in a joint development projects. At this level, sub regional common goods are the subject of some form of joint development and management schemes. The second level is harmonization where a formalized degree of cooperation and commitment takes place with the inclusion of policy and legal frameworks to foster integration process. The final one is integration which is a higher level of lock in where countries relinquish sovereignty to supra national authority.

Furthermore, since regional integration a process that requires the consent of the states of the region, it can be seen in different stages. In this regard, Balasa (1987) elaborated the most commonly cited forms integration based on the assumption that integration most likely follows a linear route. At first place, a free trade area where trade restrictions among member countries are removed in full while each country retains its own policy. The second is custom union; member countries adopt a common external tariff against third country. The third is common market where a custom union allows a free movement of factors of production among member

countries. The fourth stage is monetary union, which establishes a single currency and monetary policy for a single market. The fifth is economic union in which countries harmonize macroeconomics and regulatory policies. Finally is a political union where two or more countries unite to form a sovereign nation under a supra national authority. This is the stage, which involves integration of legislative and judicial process.

Generally, regional integration involves somewhat complex web of cooperation between countries within a given geographical area with the objective to ensure stability and sustainable economic growth and development within the integration area. The success of any integration scheme be it free trade area, custom unions, common/single markets, monetary union or even political union, enhances competition and efficiency within the integrated area, through increased specialization, and generally ensures better allocation of scarce resource into the most productive areas(Andi, 2005).

## **2.2 Imperatives of Regional Integration**

The impact of globalization (the unprecedented trend of global interconnectedness in all spheres of life) reaffirmed the need to press forward with regional economic and political integration. The rational for integration has been highly popularized with the belief that by integrating a country with its neighbouring countries small and developing economies can better positioned to take part and compete at global and regional supply chains (African Development Bank, 2012). There are two contending interpretation of integration to global and regional market. On the one hand dependency theory advocators believed integration is a form colonization which benefits some countries with the expense of others. These groups argued regional integration promote dependencies of weak economies with the larger one; small countries may lose economy policy tools, produces loser and winner in the short term by shifting resources from lower areas to higher areas. Furthermore, this theory believes as integration promotes erosion of national sovereignty and culture by transferring power tom supra national institutions (Dyner& Ryabova, 2013).

On the other hand, liberals argued the role of integration in poverty reduction and technology transfer. In this regard, World Bank (2008) indentified the following

imperatives of integration. At the first place, it provides for integrated region for coordination and collective bargaining power in negotiating positions in international arena. Second, it helps for a shared management of natural resources, which further promotes sustainable development. Besides, it helps to combat regional commons, which include pandemic diseases, vulnerabilities arising from climate change. In addition, it helps to policy lock in and commitment mechanisms where it reduces the likelihood of economic and political policy reversals. Forth integration helps to deal with emergencies, which provide insurance to members. In this respect trade shocks, conflict, and other natural calamities can be best dealt with through integration. It also promotes collective security where regional integration may lower the risk of conflict through common defence arrangement, inter and intra trade arrangement and interdependence with key infrastructural developments (Africa Development Bank 2012).

In this regard, such infrastructural arranges further helps to address development asymmetries in particular countries, which bridges development gaps among members (Das, 2009). Furthermore, peculiar to Africa, African Development Bank (2000) argued two broad goals regional integration, which are expanding intra-regional trade through the liberalization of trade barriers within region and promoting inward an inward looking instrument of industrialization where to get the protection of infant industries in the region from external competition.

### **2.3 Theories of Regional Integration**

Theories of regional integration offer explanation on how and why supranational governance has developed. Major theories of integration come from the field of international relations particularly, after WWI when states pledged to cooperate rather than conflict one another. In this respect, since the inception of the idea of regional integration, several economic and political theoretical models of regional integration were developed. These models were usually more concerned with exploring the optimal technical way of implementing integration schemes in a particular region.

## **Neo-functionalism**

Neo-functionalism was developed in 1950s to theorize new forms of regional cooperation after the end of WWII. It focuses on the idea of spill over which helps to integrate certain regions. It essentially shows the way in which increased cooperation between states integration in one area has a knock on effect for further integration in neighbouring areas (Aston, 2014). Neo- functionalist argue that member countries' economies are reasonably interdependent before the emergence of integration program. Integration is the outcome of joint action by all parties as a problem of one area could only solve through resources of other areas. This theory view integration as a process where joint activities in non-political areas would gradually promote the political unification (Andi 2005). This theory advises integration modestly in the areas of "low politics" where its consequence led to a gradual entangling of national economies and social interest will shift their loyalty towards the new supra national center.

The view of neo- functionalist societies are composed of various interest and the integration process would better satisfy them. According to Rosamod (2000), the core idea of this theory is the idea of spill over where integration will deepen from economic to political and the result would be integrated union of states and societies. This theory focuses on the process-increased integration rather than the interaction of actors in stabilized environment. It emphasizes the dynamics of integration and the role of supranational actors in the process (Ghering 1996, pp225). However, this theory is highly criticized because of its failure to account for unintended consequence and for its supposed deficiency to recognize that loyalties and identities tend to be multiple (Niemann, 2009).

Neo-functionalism assumption integration in low politics will led to political integration and the idea of spill over effect may somehow explain integration schemes in hydropower development as it may foster interdependence in one another. However, from the peculiar features of the region where borders are artificial, little social cohesions, lack of common social fabrics, bad historical records, and diversified socio cultural set up coupled with authoritarian governments do not give a window of opportunity to form political unification. It is difficult to

think the government of horn Africa with militant background loyalty to certain supranational institution.

Concrete ongoing practices also show how this theory is not applicable for this case. The example of Ethio-Eretria relation and South Sudan secession asserts how the government of the region are sponsoring disintegration rather than political unification. The case of Ethio-Eretria situation shows the two countries were achieved integration in low politics where the two people live together for centuries with similar social cultural fabrics. However, these countries are now enemies let alone integration. The recent cessation of South Sudan also shows the one nation that state with common resources and socio cultural background disintegrated other than fostering the nation's integration with other countries.

The region is also known with its nature where one country sponsor terrorist and insurgence group to destabilize the other. In this regard, Ethiopian government claims as Eritrean government still provides sanctuary, financial, moral and material support to Ethiopian opposition armed groups. Furthermore, Uganda claims as Khartoum government sponsor Lord Resistance Army (LRA) to destabilize the region. The region is also a safe haven for terrorist groups as it serve as transition between Africa and Asia. The al-Qaida wing Alshebab is one aspect of it where uses terrorist activities to create mistrust between people to government and people-to-people interaction.

### **Inter- governmentalism**

This theory rejects the idea of neo functionalist's spill over effect and suggested as government control the speed and depth of state integration. Any increase in power at a supra national level results from a direct decision by government (Cassaneda, 2006). It shares the idea of classical realists as the community emerged from the self-help based international system and emphasizes the continuing central role of member states. Moreover, inter-governmentalism is conceptually founded on a state centered and static approach to institutions and cannot accept integration as a process of development over time. Moreover, it does not accommodate the role of non- state actors within the community system (Ghering, 1996).

Inter- governmentalism argues that integration is the result of series of agreement and bargains between the heads of governments of leading states of the given region. Integration takes place within domestic politics and entirely the result of inter-governmentalism negotiations with no role of supra national institutions in the process. (Moravsik in Andi, 2005). This theory views integration as state's action to maximize power rather than the role to of integration to solve societal problems. For inter- governmentalist integration is a process well controlled by the member states, where they delegate just as much authority as needed for institutions to meet their interests. This theory is criticized because of it gives much emphasize on the heads of states as a role player of integration without giving attention to events that takes place before interstate bargaining.

Inter-governmentalism, which is a static approach to regional integration, dictates more emphasis on the role of government to speed up or slow down the integration process. It is indeed governments, are the key actors to foster regional integration and determine the foreign relation of a state. However, without prior formation of regional communities who are dependent on one another through means and factors of production, agreement will only have paper value. Agreements, treaties and negotiations are also exclusively dependent on the willingness and consent of government. There is no supranational or international body supervise or follow up the implementation of such agreements to form regional integrations. Furthermore, such treaties will have a value as long as there is smooth relationship among governments and parties in power. However, regional experience shows when one government replaced by the other, it changes not only agreements and treaties but also foreign policy objective and political structures. In this regard inter-governmentalism will have little applicability to explain regional integration through hydropower among the members of IGAD.

#### **2.4 New Approaches to regional Integration**

Since the last decade, African countries and regional economies search alternatives modalities for regional integration. African Development Bank (2000) identified two new viable alternative approaches to regional integration.

## **Regional infrastructural Development**

The importance of infrastructural development for regional integration has been duly recognized particularly African governments admitted effective infrastructure development as a tool for regional integration. A conference on African Ministers held on July 14- 18/2014 in Swaziland identifies infrastructural development as a core means to boost regional integration. In this regard infrastructural stimulates integration through bringing together economies space, reduce, physical barriers and upscale and facilitates relation between countries. Development of hard infrastructure like telecommunication, transport, and energy and information technology are key prerequisite for fostering regional integration (Bassole, 2014), such development help to promote regional trade, attracting investment, provide reliability of supply, reduce regional uncertainties, promote people to people communication and promotes to develop cooperation in regional commons (African Development Bank 2000).

As Africa's economic geography is challenging regional integration is the best way for Africa to realize its growth potential, participate effectively to global economy and share the benefit of globalization. Integration through infrastructure development approach is beneficial to make possible the formation of large competitive markets in place to the present connection of small isolated and inefficient ones. Infrastructural development does this by slashing transport costs, establishing connectivity, lowering energy costs, exchange information and protect the continent's natural environment (African Infrastructure Synthesis Report 2012). In line with this particularly since 1980 several initiatives were put in place like the Lagos plan of action (1980), the Abuja Treaty (1991) identified infrastructural development as a priority area for regional integration. New Economic Partnership for African Development (NEPAD) (2001) reaffirmed the issue and the program for infrastructural development in Africa was established in 2009 as an integrated continental vision. Furthermore, the African Union Summit in 2010 approved a program for infrastructural development schemes covering from the period 2010 to 2040.

This approach seen as best explains regional integration schemes among the members of IGAD. The major barriers for integration in the region are lack of hard

and soft infrastructural developments. The hard infrastructural factor hinders the formation of one regional community while the soft infrastructural factor provides a fuel to restrict integration schemes. In this regard, the hard infrastructure lack of access to electricity, energy transportations telecommunication services are the measure restrictive factors for free mobilization of factors and means of production among the regional communities. In line with this, it has no question that expanding such infrastructural developments will promote regional linkage and interaction. When these interactions supported by harmonised policies, standard and norms, it will ultimately lead the formation of regional community.

### **Regional policy harmonisation**

Regional policy harmonisation initiatives are regarded as key integrating factors. Such policy harmonisation be in the area of trade, investment, transit regulation, taxation, company law and custom administration. For instance, the East African Clearing House under COMESA, established by member countries to maintain strict exchange control and manage cross border intra-regional trade. According to African Development Bank under (2000) monetary integration policies, exchange rate coordination policies may facilitate regional integration schemes. Harmonisation of continental and regional policies is fundamentally important for regional integration if they are consistently written into national legislations and enforced well. Thus, consistent national policies regulation, norms, standards, will facilitate a process of financing and planning vital regional projects and cross border economic activities (African Infrustrucure Synthesis Report 2012).

Policy harmonisation is the soft infrastructure to facilitate regional integration. Hard infrastructures never put in place unless supported by harmonised regional policies. In this respect, common regional policies supplemented by inclusion in national legislation will support the process of regional integration in the IGAD region.

Generally, even though it is difficult to get a comprehensive theory to explain regional integration in IGAD region, it seems in regional infrastructure development followed by policy harmonisation is applicable to foster regional integration. Given the unique geographic and political history of the region and its members, integration could be achieved through developing soft and hard infrastructural developments,

which further promote democratisation. Regional integration among the members of an IGAD could not be seen in isolated with the development of democracy. Living together in democratic societies is much simpler than in undemocratic states. In this regard facilitating democratic values and promoting regional interconnection through infrastructure developments as a capacity to bring regional integration in the long term.

## **2.5 The Concept of Hydropower Development**

Hydropower is a renewable energy sources where power is derived from the energy of water moving from higher to lower elevations. Prior to the widespread availability of commercial electric power, hydropower was used for irrigation and operation of various machines, such as watermills, textile machines and sawmills. By using water of power generation, people have worked with nature to achieve a better life style. The mechanical power of falling water is an old resource used for services and productive uses. It was used by Greeks to turn water wheels for grinding wheat in to flour more than 2,000 years ago (Kumar & Schei 2011). The first hydroelectric power plant was installed in England in 1870. It is proven, mature, and predictable and typically price- competitive technology. It requires relatively high initial investment, but has long lifespan with very low operation and maintenance costs. Hydropower Plants (HPP) today span a very large scales, from a few watts to several giga watt(GW).

With the asymmetric distribution of rivers suitable for hydropower development power integration and trade has been began. 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 state, 2007). In South America, hydropower plants helped the integration of cross-countries interconnection between Venezuela, Colombia and Brazil with more than 15 interconnection lines. In Europe too, interconnection between 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 (European Union Commission, 2015).

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 ECOWAS, EAC and SADC are already working on regionally integrated power pooling, policy planning and developmental and energy access programs. In line with this, there are primarily five power tools 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 border power trading (World Bank, 2009). According to African Development Bank Infrastructure Consortium for African Division (2012) report, the northern African region is connected to 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 connection between Algeria-Tunisia-Libya-Egypt. Furthermore, in central Africa, Congo and Zambia; Congo to Burundi is interconnected through grid lines.

## **2.6 Experience and Benefits of Integration through Hydropower**

International interconnections generate a series of advantages within those countries that area connected. The most significant of these is the contribution to the security and continuity of the electric supply within those interconnected systems. According to IEA Africa Energy Outlook (2014), energy integration is a mechanism by which a fight against poverty can be advanced and thereby improving the living standards of the people. It further explains that when access to electricity is not available people subscribe to other disastrous, incompetent ways of food preparation, in which women and children suffer highly. In the meantime, access to modern energy also

necessitates a very expensive price that is deficient and undependable. Moreover, United Nations Social and Economic Affairs (2006) distinguished the following technical justification for grid interconnections.

Ameliorating dependability and pooling reserves: interconnected networks could provide a sharing mechanism where the amount of reserve capacity that should be set up by individual network to ascertain dependable functioning when supplies are not enough can be slashed.

Investment cut in capacity building: in an interconnected system generating capacity demands can be decreased or the need for new ones can be put to wait.

Economics of scale in new instalments: when the scale gets larger it is generally expected that unit costs of new generation and transmission capacity decreases accordingly until some stage. Thus in an interconnected system instalment of larger undertaking with a lower unit cost becomes feasible.

Diversity in generation mix and supply security: interconnection and cooperation between systems that employ diverse technologies and or fuels to bring forth electricity cater higher security and relief in times when these type of generations are not a possibility.

Economic exchange: the prevalence of interconnected system allows the arrangement of cheaper generating units in the interconnected region, offering a general cost minimizing that can be partitioned between system entities. In lieu of the above price adjustments could be made in cheap and expensive power systems.

Environmental dispatch and new plant sitting: the impact of interconnection could also extend to its usage in environment protection by using generating units with lower environmental repercussions and vice versa. In other words, in areas where establishment of power plants may be restricted by environmental and land appropriation, interconnections could give way to the possibility of new plant installation in rather unrestricted places.

Generally, the energy sector integration aids in bringing improved standard of living through integration from regions of energy copiousness to that of energy scarcity.

## **2.7 The Concept of Energy Hub and Regional Experiences**

A key element in the vision of future energy network project is the concept of energy hub. It refers to a situation where a state serves as the source of energy in a certain region. Potentials in energy market, strategic positions, ability to influence other lead a state to be a power hub of a region (Andersson, 2007). The Turkish experience on energy shows its plan to be energy hub in the region between Asian and Europe. Turkey holds a central position between the hydrocarbon importing European Union (EU) and hydrocarbon exporting near Caspian Sea countries, Middle East and Russia. Thus, the strategic position Turkey holds prove to be an asset in framing its foreign relations with the nations surrounding.

The central location Turkey holds carries a strategic advantage both geographically and politically and it is used as a mechanism for attaining its foreign policy goals. Consequently, Turkey with its command of regional energy dynamics accompanied by its aspiration to be an active player in the region leads it to the appropriation of its energy transit position as a tool to achieve its political aims visa- a- visa neighbouring (Krauer & Pacheco, 2011). Series of major infrastructure projects that will certainly make Turkey the corridor for the supply of gas in to the EU for the coming decades seems make Turkey the hub of energy in Europe. Particularly, the 63 billion cubic meter/year south Stream gas project to the Turkish – Greek border has prompted a debate on the role of Turkey as a power hub of the region. A study conducted by Mert Bilgin (2010) on the Turkish role as a power hub in Europe argued the following point must be fulfilled a state to be a power hub.

Extensive actual or potential influence on energy market- a state must influence other states in its production and distribution on actual and potential of its power sector.

Compatibility on international agreement with domestic energy mix- the power that is being generated by a state must be in accordance with international agreement standards.

Massive investment in the sector- there must be massive investment in the production and distribution of energy sources.

Sustainable energy mix- an accumulation of temporal energy sources is not regarded as a power hub for a certain region. There must be a sustainable energy production and mix. There must be different sources of energy that makes a state not to be dependent on a single source of energy.



### **3. THE NEED FOR REGIONAL ENERGY INTEGRATION, INTEGRATION REGIMES AND INTEGRATION SCHEMES THROUGH HYDROPOWER DEVELOPMENT IN IGAD REGION**

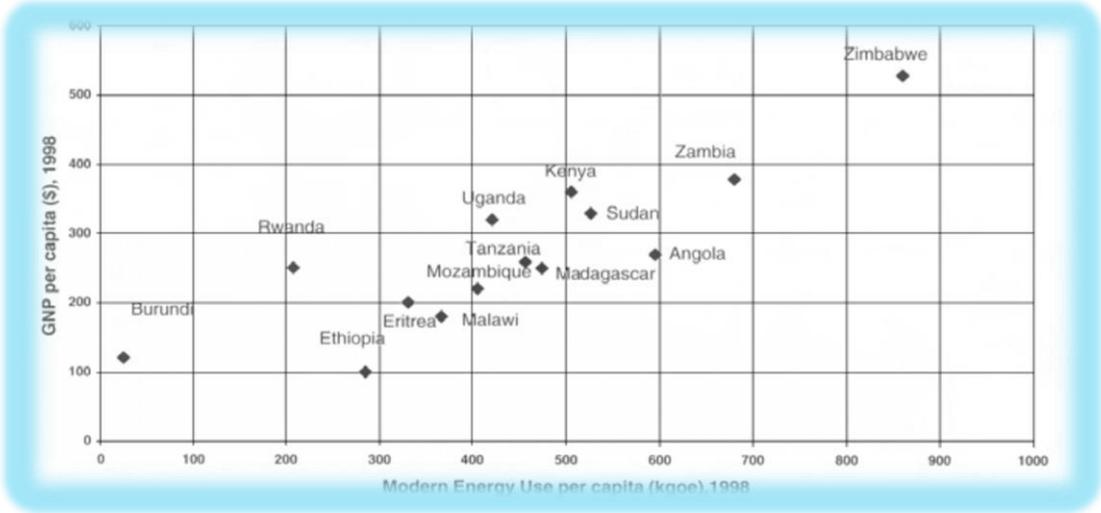
It is evident that efficient and clean energy supplies are needed to fuel Africa's development and fight against poverty. Energy is a significant part of the total infrastructure that allows rural and urban poor to grow beyond subsistence activity, to generate individual savings and increase their demand for modern energy services. Access to modern energy services is also critical for socio-economic development. Figure (3.1) illustrates there is a strong and positive correlation between gross national product (GNP) per capita and modern energy use per capita. Energy underpins the provision of clean water, health services, education and communication. However, most proportion of African societies still dependent on traditional, inefficient and polluting energy sources which is higher than any other continent (World Energy Report, p 10, 2005).

The development of energy markets on a regional basis offers significant benefits, as the linking of electricity industries can help mobilize private and domestic investments by expanding size. Whilst interconnection create export opportunities for countries with comparative advantage, in terms of resource or energy supply, secondary benefits such as increased and cheaper energy supply options, will be available to smaller markets and countries (Nile basin Capacity Building Network, Hydropower Development Research Clusters, p. 78, 2008).

The gross theoretical capability of hydro resources in Africa is estimated to be 3876 TWh/yr at the end of 1999, concentrated almost totally in sub-Saharan Africa, with 49% considered technically exploitable. However, Africa's share of the world's hydroelectricity generated in 2001 was only 3% (IHA, 2010). Although there is strong evidence that Africa is beginning to reap the benefits of regionally integrated energy development, there is still a long way to go. Recently there are robust

evidences entailing Africa will continue to be the area of the world where hydropower has the potential to play the greatest role in future economic development. Several countries describe their hydro potential as one of their most valuable resources, or as the backbone to future development.

Integration regime refers to institutions, policy regulations and rules for the facilitation of integration and cooperation. Integration process in Africa started under the auspices of OAU in the aftermath of independence from colonialism. Since then a number of initiatives have taken place including the Lagos plan of Action and the Abuja Treaty as leading ones. The two major initiatives declared the formation and recognition of different regional economic communities (RECs) (AU, 2013).



**Figure. 3.1:** Modern Energy use per capita (kgoe) vs GNP per capita (\$)

**Source:** IEA, World Energy Outlook

**3. 1 Energy Situation in Africa: Overview**

The most significant challenge facing the African energy sector today is energy access. Nevertheless, Africa’s energy resources are more than adequate to meet its short and medium-term requirements, taking into account the main drivers such as population growth and economic development. There is an enormous exploitable hydropower potential in Africa, particularly in the sub-Saharan countries. The hydropower resources in sub-Saharan countries account for about 12% of the world’s

hydropower potential, but only 17.6% of these resources had been harnessed - one of the world's lowest figures (World Energy Report, p. 64, 2005).

Reliance on traditional biomass, as the main source of energy, is particularly high in sub-Saharan Africa, where biomass accounts in some countries for 70-90% of primary energy supply and up to 95% of total consumption. The pattern of commercial energy consumption in Africa mirrors energy resource availability and per capita income. Commercial energy consumption, particularly the oil and gas sectors, is highly concentrated in the northern and southern parts of the continent (World Energy Report, p.11, 2005).

Electricity consumption in most African countries is very low, demand is mostly confined to the energy-intensive industries, commercial enterprises, and load centres in urban locations. Joint energy projects are usually based on both domestic and international market demand. This demand is driven by the ability to pay and thus allows investors to hedge risk exposure with future revenue. However, at the local level, the provision of energy services through regional integration and cooperation faces certain challenges (World Energy Report, p.11, 2005).

### **3.2 Regional Diversity**

Oil and gas reserves are concentrated in North and West Africa, hydroelectric potential in Central and Eastern Africa and coal in Southern Africa. Many of these resources are monetised through their trade with external markets. North Africa, with its gas pipelines to Europe, is an example of more advanced forms of regional cooperation, but it also demonstrates that market availability is the ultimate driving force of energy cooperation and integration (World Energy Report, p. 10, 2005).

The current geographic Distribution of hydropower in Africa demonstrates the following pattern: North Africa (23%), West Africa (25%) and South/Central/Eastern Africa (51%). Technically exploitable hydropower capability amounted to more than 1,917/yr in 2003, representing about 12% of the global total (World Energy Report, p. 10, 2005).

### **3.3 Hydropower: an Engine for Africa's Energy Integration**

Africa's huge hydropower potential could be developed for the benefit of the vast majority of Africa's population, in particular as regional integration projects. While some African countries and/or regions have excess generation capacity, others are experiencing shortages, with serious consequences for their economic and social development. Although it is technically feasible for each country to develop sufficient energy resources to meet their needs in the medium to longer-term, the economic and environmental efficiencies through regional co-operation would not materialize. Such cooperation would allow under-supplied regions, or countries over-dependent on hydroelectricity, where supply can vary during drought seasons, to have immediate access to a pool of electricity, and to contribute to such a pool when water levels are high. This would facilitate uninterrupted power supply throughout Africa (World Energy Report, 2008).

### **3.4 Advantages of Integration through Hydropower Development in IGAD Region**

Integration through clean energy has strong co- relation with environmental protection and poverty reduction. According to Eastern highway integration project appraisal document by the World Bank (2012) estimate, power trade at full potential can save the East African region an estimated 1\$ billion in annual cost of power system operation and development. The pooling of technical expertise, the development of coordinated electricity market, and the strengthening of environmental regulations are essential to foster sustainable and environmentally favourable energy resources for power generation (US department of sustainable development, 2007).

Regional integrated systems within the countries of certain region have the potential to achieve multiple environmental benefits through the optimization of the use of the energy. Imported power from the integrated system will improve the resilience of countries that are adversely affected by climate change. In addition, the increased the share of renewable energy could reduce carbon emission by an estimated 20 million tons per year, or about eight percent of Sub- Saharan Africa's anticipated emission (US department of sustainable development, 2007).

In regional context integrating the members of IGAD through hydropower have generally economic, environmental, political and security benefits.

### **Economic Benefits**

Energy sector development is a milestone for economic development (US department of sustainable development, 2007). International community has recognized that increasing access to electricity is strategic way of improving quality of life. Regional Integration fosters market competition, reduces investment costs, increase the quality of services and secure freedom of choice for consumers. The International Energy Agency (2011) stipulates, to meet millennium development goals, developing clean energy is a prerequisite and the correlation between the two is positive in that countries seek energy resources to improve health, clean water supply , education, food production, and generation of income (ECA, 2011).

Particular to the horn of Africa, hydropower development among the members of IGAD helps to avoid fluctuation of power supply and promotes transformation from agricultural to industrialized economies. According to Ethio-Kenya Transmission Line Feasibility Study (2011), regional integration through electricity provides skilled and non-skilled job opportunities for the countries of integrating. It helps to create jobs by facilitating industrial and commercial activities. The fact that the transmission lines have a higher possibility to pass through rural areas helps to develop ICT hubs that in turn assist improvement in quality of schools and health centres. Such integration also helps to expand electrification throughout region that helps to reduce equality gaps by formation of knowledge and information based integrated communities (UNDIO, 2013).

### **Environmental Benefits**

Environmental provision to support clean energy generation appears as grand and relevant motivation for regional cooperation and integration. Integrating clean energy from areas of abundance to the area of scarce will allow great opportunity to develop energy sector at a local level, reduce the dependence on fossil fuel, which further help to reach more people in energy supply chain and reduce carbon dioxide emission (ECA, 2011).

In relation with IGAD region, the environmental benefit of integration through hydropower can be seen from the peculiar nature of region itself. IGAD is a region characterized by arid and warm climate that is prone to drought and climate change. The region is also excessively dependent on climate sensitive means of production i.e. Agriculture. Given these peculiar environmental problems, hydropower development in the region will help to mitigate environmental hurdles through, reducing primary energy sources consumption, reduction of deforestation for energy consumption and employing environmental protection measures.

### **Political and Security Benefits**

Socio economic disparities, social heterogeneities and boundary problems are the bottlenecks for IGAD region lack of security and stability. In such situations, integration will help countries pursue policies that transcend national borders with harmonized regional interests. Integration provides insurance against any hazards, external interventions, and natural and manmade calamities. It promotes bargaining power at international arena that is particularly relevant for poor and fractioned states to develop common position as a group rather than country on regional basis (World Bank 2005). In relation with security too, it fosters the link between countries in a web of positive interactions and interdependency. It builds trust and reduces the risk of conflict between countries.

IGAD is a region characterized by internal dissidence, sponsorship of neighbouring country's insurgent groups and interstate conflict for centuries. Most of the conflicts in the region have common roots in which most causes are economic underdevelopment, environmental hazards, fragmented nature of society and competition over natural resources (Wasara, 2002). With such backgrounds, integrating the region with cost effective and environmentally friendly means of hydropower will promote mutual trust and people-to-people relation. Besides, it helps countries interdependence to be on mutual basis. Win-win relationship between countries based on mutual trust will form integrated political and economic community with relative peace and secured political atmosphere.

### **3.5 Integration Regimes in IGAD Region**

Integration regime refers to institutions, policy regulations and rules for the facilitation of integration and cooperation. At institutional level, the integration process in Africa started under the auspices of OAU in the aftermath of independence from colonialism. Since then a number of initiatives have taken place including the Lagos plan of Action and the Abuja Treaty as leading ones. The two major initiatives declared the formation and recognition of different regional economic communities (RECs) (AU, 2013). Particular to infrastructural development as a tool for regional integration, various initiatives such as NEPAD were established. In line with this, AUC, NEPAD and African development bank jointly took an initiative for infrastructure development in Africa called “Program of Infrastructure Development in Africa (PIDA)”.

Regional Economic Unions that are recognized by African union took their own initiatives and strategies for the development of regional infrastructure to foster integration processes. The institutions such as; Intergovernmental Authority on Development (IGAD), East African Power Pool (EAPP), African Union Commission (AUC) and member countries at individual level took various initiatives for the integration schemes in horn of Africa through hydropower development.

#### **Intergovernmental Authority on Development**

With a membership comprising all the East African nations but Tanzania, IGAD - Inter-Governmental Authority on Development, is a regional organization in operation for more than 5 decades as a crucial nerve center for member countries to foster a closer political and economic cooperation and tackle the most pressing issues facing the horn of Africa. It was preceded by the Intergovernmental Authority on Drought and Development (IGADD) established in 1986 with an aim of tackling the drought of the 1980s that left many people in the region particularly Ethiopia starving. With a new name-IGAD came with a renewed political will and commitment to foster a closer economic ties among member countries, promote peace, trade and boost the infrastructure of the region.

Since its establishment, IGAD has launched a wide range of projects and programs aimed at boosting regional trade, infrastructural development and enchaining the

energy supply of the region. In 2011, IGAD in partnership with COMESA and SADC embarked on a monumentally ambitious agreement to stimulate regional trade, promote infrastructural development and protect the environment. Recently, a Memorandum of Understanding was signed between IGAD and the East Africa Power Pool to put actions on renewable energy, a project to be funded by the African Union. However, there is no framework of regional regulatory on energy to coordinate interconnection among projects in the IGAD. Majority of the energy project agreements are on a bilateral level between member countries and Ethiopia is the biggest mover and shaker in this area. Ethiopia has recently signed energy agreement with both Djibouti and Sudan and another is to build a pipeline with Kenya.

### **East African Power Pool**

History is full of examples particularly in Europe and the United States when cooperation and interconnections established through power pooling arrangements have been evolving from fulfilling demand for simple utilities and cooperation during emergencies into more refined and formal legal arrangements to facilitate energy operation and power market regulation (World Energy Report, p. 56, 2005). In Africa, cooperation through cross-border interconnections and concomitant electricity exchange dated back to the early 1950s when Algeria and Tunisia first linked their electricity networks to exchange power in emergency cases. This was then followed by construction of power supply line between Nseke in Democratic Republic of Congo and Kitwe in Zambia to supply electricity to Zambia's copper mining industry (World Energy Report, p. 56, 2005).

In contrast to the other parts of the continent cooperation through interconnections of power pools among East African countries is a recent phenomenon. In 2005, seven East African countries signed an intergovernmental memorandum of understanding and officially establish Eastern Africa Power pool (EAPP) to enable cooperation among member states through energy and power pooling in the region. Three more nations (1 2 3) joined the pool and increased the tale of member states to ten in 2011 and 2012. Current member states of the pool are; Burundi, Congo, Egypt, Ethiopia, Kenya, Libya, Rwanda, Sudan, Tanzania, and Uganda are current official members

of the pool. Countries like Djibouti, Eritrea, South Sudan and Somalia are expected to join the pool in the near future (EAPP, 2013).

The mission of EAPP is interconnecting all East African member nations by generation and transmission of infrastructure to meet the ever-increasing demand of power in the region with significant investment at lowest possible cost. It aims to provide environmental friendly supply of power for affordable price. With respect to integration schemes, it seeks to foster power interconnection and exchanges between and among eastern African countries by financing power generating projects and transmission lines.

To increase generation capacities, the power pool prepares a master plan on hydropower projects to be completed in 2028. The pool identified the following hydropower projects providing surplus available for export.

**Table 3.1:** Hydropower Projects Identified With Surplus for Export

NO.	Country of Location	Project and Capacity (MW)
1	Ethiopia	GERD (6000MW), Mandaya (2000), Karadobi (1600), Border (1200), Baro I&II (500), Genji (200) plus under construction projects : Gibe III, Halele Worebesa
2	Uganda	Karuma (700), Murchinson Falls (750) Ayago (550)
3	Brundi, Rwanda, Tanzania	Rusumo Falls (63)
4	Tanzania	Stieglers Gorge (I,II & III – 1200), Ruhudji (358), Rumakli (222), Mnazi Bay (300)
5	Kenya	Large Geothermal Projects

**Source:** EAPP, 2013

Moreover, to foster regional cooperation and integration with clean energy, East African Power Pool identified the following interconnection projects to be completed before 2018.

**Table 3.2:** Interconnection Projects completed or to be completed before 2018

NO.	Connecting Countries	Voltage (kv)	Capacity (MW)
1	Uganda-Kenya	220	300
2	Uganda-Rwanda	220	250
3	Rwanda- Burundi	220	330
4	Burundi- DRC	220	330
5	Tanzania- Kenya	400	1520
6	Ethiopia- Kenya	500	2000
7	Ethiopia- Sudan	500	2 x1600
8	Egypt- Sudan	600	2000

**Source:** EAPP, 2013

### **African Union Commission**

The Maputo declaration in 2010 on Africa's strategic energy vision affirms African union's determination on developing hydropower for regional integration. Parallel to this, numbers of programs and initiatives underway at a continental level. One of the initiatives is program for infrastructure development in Africa (PIDA) that prepares a priority master plan on hydropower development. The master plan constitutes major hydropower projects and four regional transmission lines to foster regional integration (Mahmood, 2014). Besides, hydropower 2020 initiative was launched by AUC to stimulate and accelerate major hydropower projects and integration schemes in the continent. European Union-Africa partnership program also aims to develop additional 10,000 MW hydro plants by 2020.

African Union is also implementing and providing support to various energy sector developments, which mainly includes:

- ❖ The program for infrastructural development in Africa (PIDA) - dedicated to facilitate continental integration, socio economic development and trade thorough improved infrastructural development.

- ❖ 2020 hydropower development initiative- aimed at harnessing the hydropower potential in the major river basins in the continent.
- ❖ Africa-EU energy partnership on energy - planned at the implementation of political targets to be achieved by 2020 and fostering renewable energy cooperation
- ❖ The sustainable energy for all initiative - aimed at ensuring universal energy access as well as doubling the use of renewable energy access by 2030.

The gradual and progressive success of these regional and continental initiatives implies that regional and cross border infrastructures got a great attention by AU to facilitate regional integration program. Under PIDA hydropower initiative, Grand Ethiopian Renaissance Dam, Gibe II, and Gibe III are priority projects under consideration. The four transmission lines in Africa covers: Central African Transmission, the North-South transmissions and the last corridor covers the IGAD region. AUC and New partnership for African Development (NEPAD) supports a North South transmission corridor, which covers 8,000km line starting from Egypt passes through Sudan, South Sudan, Ethiopia, Kenya, Malawi, Mozambique, Zambia, Zimbabwe and ends to South Africa, which is part of the vision for continental integration by the year 2063. AU also supports the IGAD region transmission line that covers 8000 km extends to Egypt, Sudan, South Sudan, Ethiopia, Kenya, Malawi, Mozambique, Zambia, South Africa (African Union Report, 2014).

Integration regimes in IGAD regions involve multiple actors that include international organization, regional organizations, individual countries and programs. Accordingly, African Union, NEPAD, African Development Bank, the East African Power Pool, EU-African Partnership Programs, and the United Nations Energy Program in Africa plays a significant role in building capacity to generate sufficient hydro power and building interconnection infrastructure corridors among member state.

### **3.6 Integration Schemes through Hydropower Development in IGAD Region**

Eastern Africa is a contested region given different classification schemes by different literatures. For some, it consists two traditionally recognized regions: the

horn of Africa (the easternmost elongation of Mainland of Africa), and the East Africa. While some other scholars argues the notion of smaller and bigger Eastern Africa. Looking in to the United Nation geoscheme<sup>2</sup> (2013), it constitutes the eastern portion of the African continent variably defines by geography or geopolitics. As such, eastern Africa comprises 20 sovereign territorial states of today's Africa. These are Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Reunion, Rwanda, Seychelles, Somalia, South Sudan, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe. However, for the purpose of this research only members of Intra – Governmental Authority on Development (IGAD) namely: Ethiopia, Kenya, Sudan, South Sudan, Eritrea, Somalia and Uganda are explored ([www.http://millenniumindicators.un.org/unsd/methods/m49/m49regin.htm](http://millenniumindicators.un.org/unsd/methods/m49/m49regin.htm). Accessed on 29/03/2016).

### **Geopolitical Description of IGAD**

Over the past few decades globalization has increased the call for interdependence among nation states, concomitantly, the need for establishing intergovernmental organizations in the global political arena and global governance has increased dramatically. According to Cliffe (2005) the term intergovernmental organization (IGO) refers to “an entity created by treaty or based on an agreement, involving two or more nations to work in good faith, on issues of common socio- economic and political interests.”

Inter-Governmental Authority on Development is one of the recognized eight Regional Economic Communities (RECs) of Africa comprising of Djibouti, Ethiopia, Eritrea, Kenya, Uganda, South Sudan, Sudan and Somalia. As one of Intergovernmental organizations “Intergovernmental Authority on Development” (IGAD) has been operating as are vital regional organization in the horn of Africa since 1996. It replaced the Intergovernmental Authority on Drought and

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<sup>2</sup> United Nations geoscheme is a system devised by the United Nations Statistics Division (UNSD) to divide countries of the world into macro-geographical region and sub regional groups.

Development (IGADD) established in 1986 by then drought afflicted six Eastern African countries.

IGAD is an association of states in eastern Africa. However, it is an institution in the area that comprises states can be seen together as a region. Geographically, IGAD region is impressive and scenic. It is home for African tallest peaks and one of world largest fresh water lakes. It occurred because of globally noticeable plate tectonics that become a reason for existence of East African Rift valley, the rift valley giving rise to different geographical features and climate. The climate varies from tropical, subtropical, temperate, to arid.

Since the end of colonialism, the region has been continued to endure internal and external political conflicts. The region has extreme deficient of infrastructural developments including unreliability in energy supply (UN, 2013). Most of the countries' energy sources in the region depend on hydropower generations. Particularly, Ethiopia produces a significant amount of hydropower where 95 % of its consumption is depending on hydroelectricity. On the contrary, in Djibouti, Eritrea, and Somalia arid climates with recurrent drought discourages hydropower development. While in Sudan political and social crisis coupled with inefficient labor, regulatory and policy problems hinder development of hydropower (UN, 2013).

Together with the member of states effort to integrate the region, different regional bodies could play vital role in creating conducive soft and hard infrastructures. For example, IGAD has a main objective of expanding regional cooperation increase members' dependency on one another, and promote climate of peace in the region to achieve sustainable development. (Adeniji & Agaba, 2014). East African Power Pool (EAPP) is the other regional organization arm playing an important role in the future energy within the region with the main objectives of shared grid connections to enable the flow of power from areas of abundance to areas of deficit (EAPP, 2014).

### **Hydropower Development in IGAD: Regional Overview**

Hydropower is a renewable energy sources based on the natural water cycle. It is the most mature, reliable, cost effective, and environmentally friendly energy sources available. Hydropower is the largest renewable energy source producing 16% of the

world energy demand (Brown in IRENA, 2012). 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 region's in hydropower potential Eastern Africa ranked second next to Central Africa with the potential to generate 578 TWH<sup>3</sup>/ year. Currently the major source of electricity in eastern Africa is hydropower generation where 95% of East African countries current consumption is depend on (AUC, 2013). Identified regional generation projects up to 2025 in Eastern Africa have a total capacity of 1087MW; Hydropower represents 97% of it where Ethiopia alone expected to contribute 64% of all it is from hydropower sources. The remaining shares contributed by: Uganda 18%, Tanzania 11, DRC 4%, and Rwanda 3% (Infrastructural Consortium for Africa, 2011).

### **Ethiopia**

Ethiopia has exploitable capacity of 45,000 MW hydropower potentials. Large potential for small hydropower projects are 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 neighbouring countries.

### **Kenya**

The overall hydropower generation capacity of Kenya is estimated 6,000 MW installing capacity, over half of it is attribute from scale hydropower developments (UNIDO<sup>4</sup> and ICSHP<sup>5</sup>, 2013). According to Kenyan Minister of Energy (2006), the major potential of Kenyan hydropower development is concentrated small-scale sites. Kenya lacks large river basin to build mega projects. Its large-scale hydropower development potential is found in its five river basins where lake Victoria accounted 355 MW, Tana River, 570 MW, Rift Valley, 345MW, Emason'gro north river, 155MW and Sabaki River, 84MW.

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<sup>3</sup> 1 TWH/year = terawatt = 114 MW

<sup>4</sup> UNIDO- United Nations Industrial Development Organization

<sup>5</sup> ICSHP- International Center for Small Hydropower

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) (2030) Kenya's demand will increase from 1,302 MW in 2011 to 15,026 in 2030 MW. To meet these demands, there are targets to build 5,110 MW from geothermal, 1,039 MW from hydropower, 2036 from wind, and 2,000 from imports.

### **Sudan**

Sudan's energy consumption mix is dominated by oil. The new law on Energy in the year of 2000 gives priority for the expansions of energy sector. Sudan has an overall estimated potential of 49201 MW hydropower generation capacities where 10% of its currently utilized. However, due to political unrest, social problems, regulatory and policy constraints Sudan's hydropower development is still at its lowest stage (UNIDO, 2013).

### **South Sudan**

South Sudan has a potential to generate 5583 MW hydropower development that can satisfy domestic need. However, political and social unrest, lack of renewable energy policy, poor institutional and technical capacity, hinder the growth of hydropower development. According to UNIDO (2012) report, the current total installed capacity is 62 MW in contrast to the total electric requirement of 450 MW. Plants to be built along the river Nimuri to Juba may take decades to be commissioned. The current population with access to electric is only 1%. Therefore, these situations left South Sudan either developing small-scale hydropower developments or importing from neighbouring countries where Ethiopia and Uganda will be a viable options.

### **Djibouti, Eritrea and Somalia**

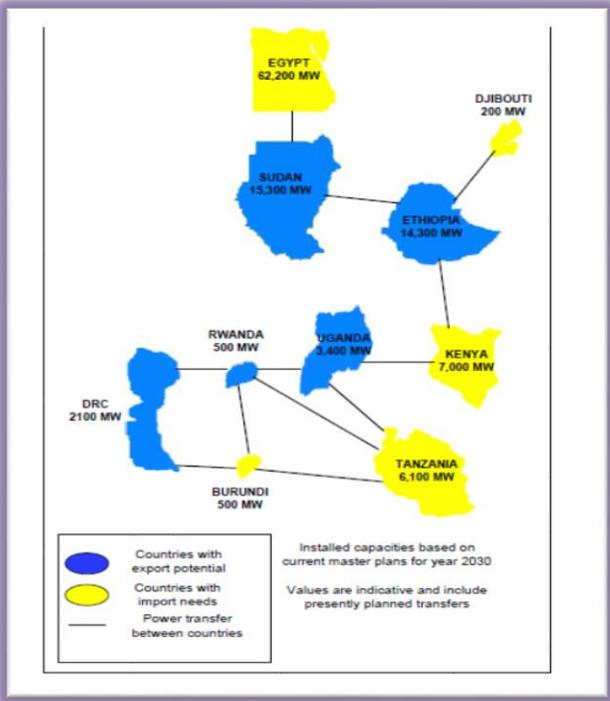
These countries are satisfying their needs from imports. However, studies show as these countries have a potential to produce wind and solar energy, still they are at the lowest rank of energy production (AU statistics, 2013). The United Nation Energy Development organization (2013) stated the complete or part desert climate coupled with recurrent drought hinder the development of hydropower generation, thus as those factors are rampant on mentioned countries, aggravate for poor ranking of

hydropower development, left them with only option of importing from neighboured countries at least for temporary demands.

**Current Integration Schemes through Hydropower Development in IGAD**

Energy security has become a top priority for both Africa and the rest of the world. Rising oil prices and fear of future resource shortages combined with a greater awareness of climate change and the need to diversify energy sources have brought the issue of power trade to general attention. Energy interconnectivity in the eastern Africa and increased power production using renewable energy sources have been identified as action areas for consideration. The actions proposed will facilitate regional integration by strengthening the regional energy network and eventually facilitating power sharing between/among the countries of the region.

Energy resources in East Africa concentrated in few countries where Ethiopia takes the lion share. Burundi, Zambia, Mozambique, and Malawi have a significant potential in hydropower while there is a limited potential in Tanzania, Djibouti, Kenya, Eritrea and Sudan (UNIDO, 2013). Figure 4-1 below offer explanation of potential in-country resources as of year 2028.



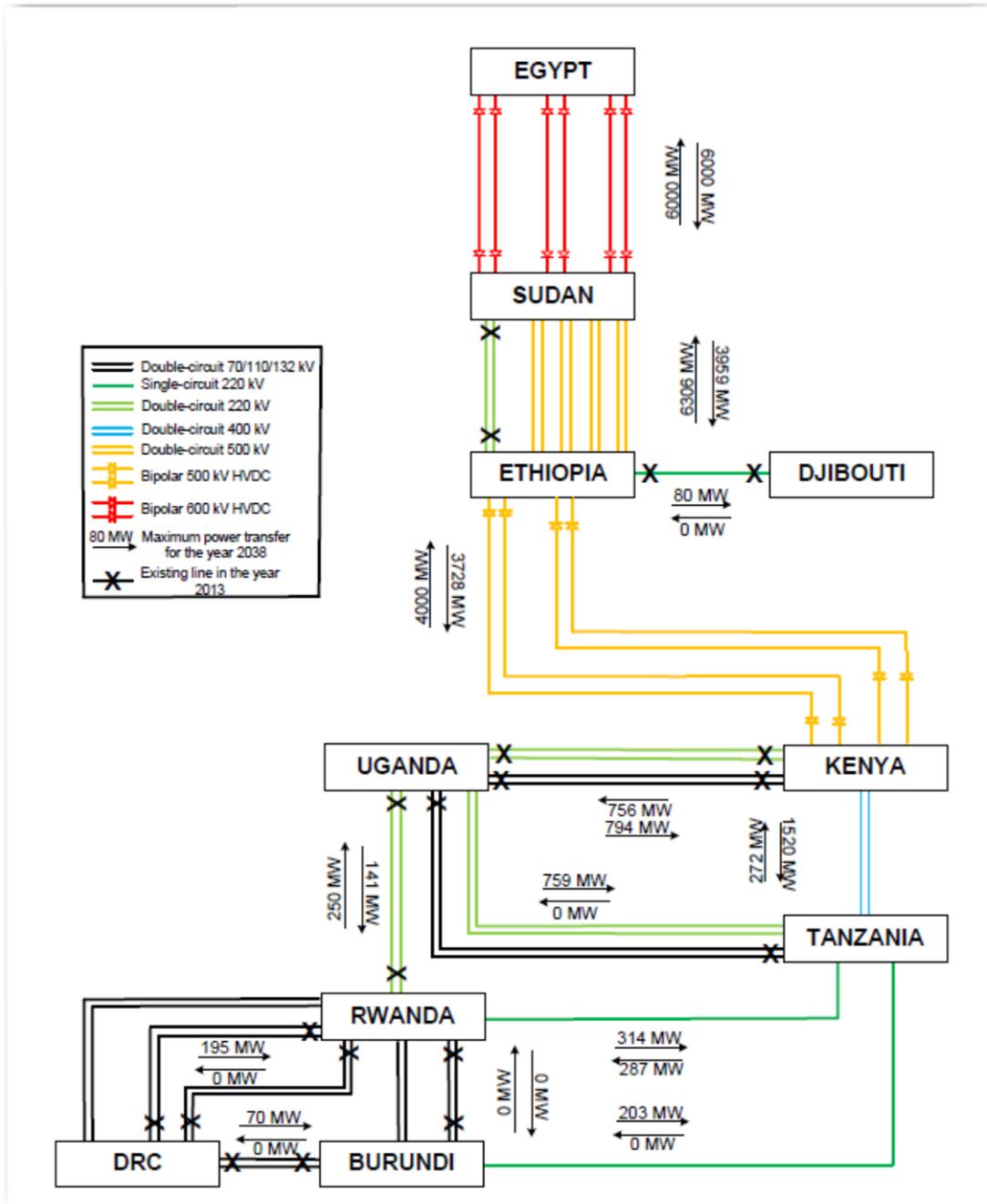
**Figure 3.2** Countries Resources and Export Potentials

**Source:** EAPP Final Master Plan Report, 2012

In this variability of supply and demand among the countries of the region energy trade and interconnection is a feasible solution. According to World Bank (2012), importing low cost power from neighbouring makes economic sense for countries with major supply constraints. It also benefits countries heavily depend on imported petroleum like Djibouti and Sudan. In pursuant with this, currently integration schemes are taking place in the region through different integration grids. With supervision of East African Power Pool,<sup>6</sup> 30 years integration roadmaps have been identified, and they will be feasible in 2028. Chart 4.1 illustrates existing and planned interconnection lines.

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<sup>6</sup> Eastern Africa Power Pool (EAPP) is a regional organization adopted as specialized institution of COMESA for the electric power sector.



**Figure 3.3:** EAPP integration scheme plan 2028

**Source:** EAPP Final Master Plan, 2012

Based on East African Power Pool transmission plan 2028, numbers of projects are underway among countries of the region. The following table shows existing and underway interconnecting projects in east Africa.

**Table 3.3:** Current Interconnection completed and existing projects

NO.	Interconnections	Voltage	Capacity (MW)	Status
1	Uganda-Kenya	132	118	Existing
2	Tanzania- Uganda	132	59	Existing
3	Ethiopia- Djibouti	220	180	Existing
4	Ethiopia- Sudan	220	200	Existing
5	Uganda- Kenya	220	300	Completed
6	Uganda- Rwanda	220	250	Completed

**Source:** World Bank, 2012 infrastructure report

Furthermore, various studies and projects have been initiated in the region for further promotion of regional integration. In this regard, EAPP final master plan (2011) identified the following ongoing and planned interconnection priority projects.

**Table 3.4:** Planned Interconnection Priority projects

No.	Interconnections	Voltage	Capacity MW
1	Tanzania- Kenya	400kv	1520
2	Ethiopia- Sudan	500kv	3200
3	Ethiopia- Kenya	500kv	2000
4	Egypt –Sudan	600kv	2000
5	Tanzania- Uganda	220kv	700
6	Uganda- Kenya	220kv	440
7	South Sudan- Uganda	220kv	Under Feasibility Study

**Source:** EAPP Final Master Plan



#### **4. ETHIOPIA'S ROLE OF REGIONAL INTEGRATION AND REGIONAL CHALLENGES IN IGAD REGION INTEGRATION**

Eastern part of Africa where IGAD is functioning as sub - regional organization has long been described as most conflicted regions in the world. However, in the past few years countries of this region made a significant progress in improving peace and stability of the region. This headway is intern helping them to focus on fighting poverty and underdevelopment, which have been persistent and devastating in the modern history of countries in the region. The relative stability and progress augmented by economic diplomacy is making the region attractive destination for investment on trade, agriculture, livestock, agro-processing, manufacturing, tourism, industry, construction. However, the effort made by countries in the region to fully unlock their economic potentials is highly stifled by their inability to generate sufficient power for reliable energy supply. Moreover, in addition to demand for supply of energy created by economic growth, growing population and expansion of industrialization has increased the demand for energy in the region. Climate change has also the increasing demand for clean energy; as a result, the role of hydropower is gaining importance in becoming sustainable source in the region (EAPP, 2010).

Eastern Africa energy mix varies from country to country. In the sub region of IGAD, the largest potential of hydropower production is concentrated in Ethiopia; followed by Sudan, Uganda and Kenya. Ethiopia takes the lead in production and distribution of hydropower with various huge projects to export power in the region. The energy to be generated will not only supply the increasingly growing demand for energy in the country but will also have a surplus production to be marketed to neighbouring countries. According to Ethiopian Water Resources Policy (1994), the hydropower resource is estimated to have a potential to generate 161,000 Gwh/year. Ethiopia is exporting around 220KV to Djibouti and 220KV to Sudan. Besides, 500 KV power will be underway in the future interconnection plans.

Ethiopia's suitable geography with large number of rivers makes a country suitable for hydropower development. Its relative political stability also assists Ethiopian to be center of power sector in eastern Africa given an enormous potential in the sector. According to USAID (2009), Ethiopia has limited range of natural resources; the country's only economically exploitable resource is hydropower. Ethiopia has Africa's largest hydropower potential next to the Democratic Republic of Congo with the potential to generate more than 45,000MW. As the water tower of Africa, Ethiopia offers a great deal of opportunity for clean energy production, which has become vital in the current global environment. Most of Ethiopia's rivers originate in the highlands and cascade down steep slopes to the surrounding lowlands. Ethiopia's physical geographical nature and endowment in water resources are natural assets that facilitate the generation of power with a relatively lower production cost.

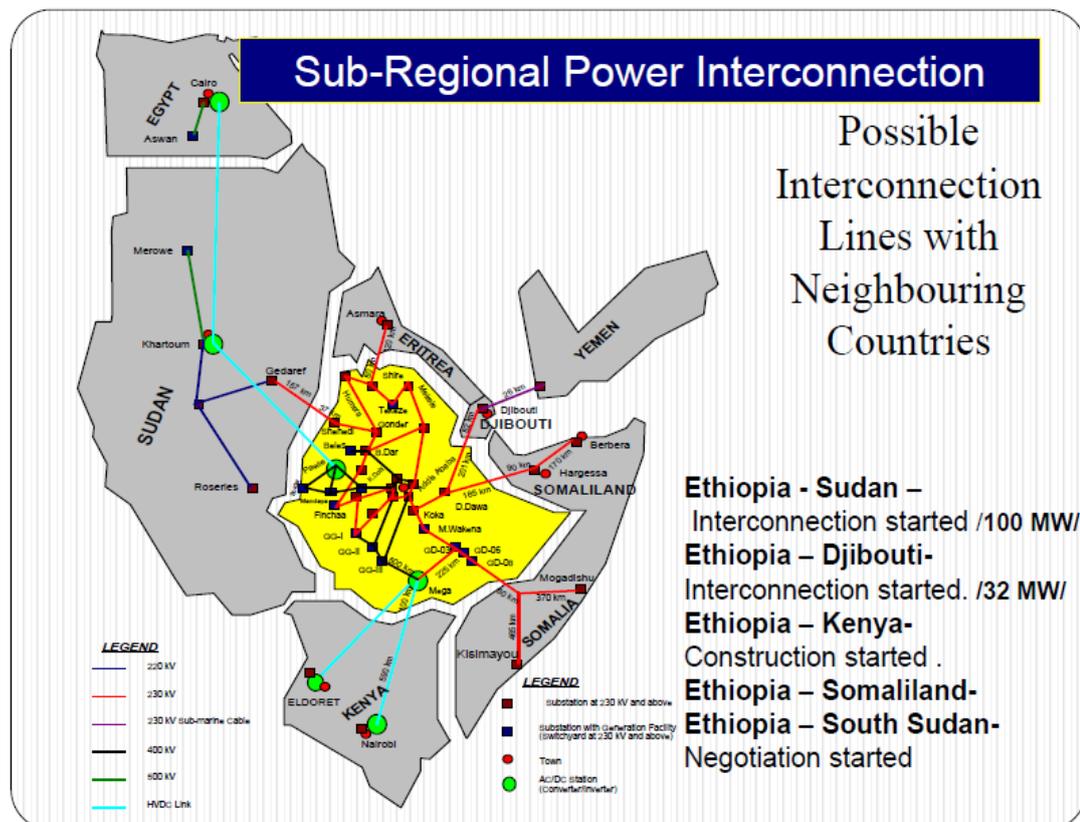
#### **4. 1 Ethiopia's Role In Regional Integration Through Hydropower**

The development and expansion of regional integration vis-à-vis with acceleration of "Globalization" and international competitiveness over the last 50 years has been quite unprecedented. In the IGAD region, approaches to regional integration may be seen in three different approaches. First, the market approach shows countries intention to eliminate restrictions and trade barriers, all the way to an economic union. Second, the production or project directed approach that focuses on the coordination of planning and implementation of common projects. Third, development approach that combines market and production with additional emphasis on compensatory and corrective measures during previous disputes (Abdi and Seid, 2013).

In the market, production and development approaches, as the water tower of Africa, Ethiopia offers a great deal of opportunity for clean energy production and distribution. Ethiopia has a capacity of generating more than 45,000MW power from hydro plants, 10,000MW from wind and more than 5000MW from geothermal energy. Furthermore, Ethiopia boasts a regional comparative advantage in hydropower production and distribution both in terms of ecology and economy. Ethiopia has the potential to export energy even beyond the region. Ethiopia's hydroelectric potential of 45,000 MW is enough to meet most of sub-Saharan

Africa's current demand. 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 mission would transform the perception of Ethiopia from that of a poor country, dependent on outside assistance, to that of leading state with resources that are valuable to the entire region (Verhoeven, 2011).

By stretching its capacity of exporting power to its neighbours and beyond, Ethiopia tries to influence others. Ethiopian foreign policy objectives also clearly outlined regional cooperation as one strategic objective of the nation, stressing out hydropower integration believed to bring the nations of the region 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 4.1 map below illustrates interconnection plans that are already started and plan to be started in IGAD region.



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

**Figure 4.1 – Possible Interconnection lines in IGAD region**

**Source:** Ministry of water and energy (2013)

#### **4.2 Dependence verses Interdependence Interpretation**

This issue of integration often raises the question of whether it results dependence or interdependence among the member states. While integration schemes are designed to the way that fosters interdependence, some countries may be reluctant to rely on imports for a large part of their power supply and, lack political will to cooperate with neighbours. Besides, importation of power may deter the existing plans for expanding domestic generation; increase the competition on private sector participation. The case of East African Community good example as it was failed in the past due to the most industrialized Kenya uses Tanzania and Uganda to dump its products, which raised resentment among the members.

Integrations that are not on the bases of interdependence will automatically fail. On the other hand, if the integration scheme is based on interdependence, it benefits both parties. Accordingly, power integration, importing lower-cost power from neighbours makes economic advantageous for countries currently facing major power supply constraints and load shedding such as Burundi, Kenya, Rwanda, Tanzania and Uganda. Increased reliance on power imports also will benefit countries that depend heavily on imported petroleum for power generation such as Djibouti and Sudan. According to Kenya's Least-Cost Power Development Plan (LCPDP), prepared by the Minister of energy (MOE) recognizes power imports from Ethiopia as one of the priority source of base load capacity in the medium- to long-term. Kenya's energy mix imports will complement large scale geothermal and wind projects existed domestically. Beyond diversification of energy mix, it also assists Kenya challenges from unpredictable domestic hydropower supplies and fuel price-sensitive thermal power.

Besides, Exports will provide energy- rich countries with the opportunity to monetize their surplus capacity. Hard- currency revenues from power exports can help to achieve a better macroeconomic balance in countries such as Ethiopia, which has faced double- digit inflation (World Bank Appraisal Document, 2012).

In general, regional integration in Eastern Africa with particular emphasis to IGAD region, promotes interdependence rather than dependence due to the following major reasons.

Hydropower integration promotes mutual benefit to all countries of the region. This is because all countries in the region are dependent on each other. There is surplus demand links; Ethiopia has an absolute comparative advantage of trading hydropower in the region while other member states of the region have also comparative advantage in production of certain goods and services. In this regard, the following analysis based on country-by-country level can confirm the hypothesis.

### **Sudan's Oil –Ethiopia's Hydropower 'Black Gold with Blue Gold'**

Sudan, a well-known east African country for its greater oil reserve in the continent, Ethiopia on the other hand, is a source of reliable hydropower with estimated capacity of generating 45,000 megawatts. A Joint energy initiatives between these two countries will obviously be reliable power supply for both countries, exchanging Sudanese Oil for Ethiopian electricity will also provide a new framework for political relation. It has been well noted by Harry Verhoeven (2011) countries can build strong regional interdependence and economic ties through energy deal. Regional integration through energy linkages with oil and hydropower exchange between Sudan and Ethiopia would not only assist the two countries in fulfilling their respective energy demand their economy, but also significantly help the region as a whole to keep political stability in the equilibrium. Furthermore, if they will be managed with an explicitly regional perspective, energy linkage between the two countries will foster mutual trade, political cooperation, sustainable growth, harmonious relation between the two countries and people-to-people relations.

### **Ethiopia's Power – Djibouti's Port**

Ethiopia is one of the landlocked countries in the region. After Eritrea seceded from Ethiopia in 1998, land locked Ethiopia has had to depend on access to ports through Sudan and Djibouti for its oil and other valuable imports. Thus, it needs the consent of its neighbouring to get access to the sea. Besides, the fact that the relation with Eritrea sours, makes the port of Djibouti as the first viable option.

Djibouti is a country with lowest rank of energy production, and satisfies its needs of energy from import. According to the United Nations Energy Development Organization (2013), the complete or part desert climate coupled with recurrent drought hinders the development of hydropower generation in Djibouti, which left the country with only the option of importing from neighbouring countries.

Therefore, the two countries needed each other on their ways of national interest. Therefore, Ethio-Djibouti, power integration will help to promote deep political and economic integrations. As a power sector development helps to expand investments in both countries, this will help in further promoting other infrastructural developments like road, railway, building of huge industries and agricultural investments. More importantly, port Djibouti will be a significant part of Ethiopia's aspiration of exporting power to the Middle East.

### **Ethio- Eritrea Perspectives**

Even though Ethio-Eritrea relations are not good politically speaking, it is regarded that the two countries still have an opportunity to reverse their relations. While Eritrea gets a number of benefits from Ethiopia which include importing crops, and power Ethiopia too will be benefiting from Eritrea's ports. Furthermore, the two countries' relation is highly appreciated on its historical people-to-people relations. Even though, politically the two countries are not in good terms, Eritrea agreed to get electric power from Ethiopia via Sudan. Sudan and Eritrea agreed to export 200MW hydropower to Eritrea (Verhoeven 2011). On the deal to energy linkage, the most viable cheap and simple interconnection is between Ethiopia and Eritrea as their historical people-to-people communication and geographic proximity make it much feasible than any other country in the region.

### **Ethio- Kenya Perspective**

Ethiopia and Kenya have ethnic groups shared in common. They have a long history of people-to-people relations. Furthermore, Ethiopia has a potential to use the port of Kenya (Lamu port). In addition, Ethio-Kenya integration will be strong, as Kenya will serve as a transit state to export power via Kenya's to other countries in the region. Based on the East African Power Integration Program Study (2012) that is being conducted, the first phase Ethiopia-Kenya (500KV) interconnection is finalized. In

phase two of the program the interconnection will be done via Kenya-Tanzania double-circuit 400KV 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 both mutually integrated and positively affected by the integration projects in neighbouring countries.

### **Seasonal Demand**

The other major factor of the regional interdependence particular to IGAD region is seasonal demand variability from country to country. Power demands of the countries of the region is conversably varies from season to season. For example, according reports from ministry of water and energy, Ethiopia, which has a significantly strong Orthodox Christian tradition, consumes less power during its weekends, leaving a surplus for export to Muslim neighbours Djibouti and Sudan, where Sunday is a working day. Besides, countries like Sudan, Djibouti, and Somalia have hot climate where they require more energy at night, while Ethiopians need more during the day times.

### **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. Different energy mixes will only be complementary only if the integration process is strengthened. Especially given an increasing energy demand of the region and flux seasonal demands, complementing ones country demand on different energy mix integration becomes the only operable and mandatory solution. For example, Sudan has a huge exploitable actual and potential of fuel energy while Kenya has a good potential of geothermal energy, giving a wider room to complement Sudan's oil, Ethiopia's hydropower and Kenya's geothermal power one another.

### **4.3 Hydropower and Sustainable Development**

As a matter of fact hydropower play an important role for improving economic conditions, preserve ecosystems and enhance social justice which reflect the sustainability. By taking all measurement the planned, built and operated, hydropower schemes generate better results as a pillars of sustainable development. Nowadays the hydropower supply nearly one-fifth of the world's electricity supply, and later on it will exceeds the capacity of any other renewable energy resource. On the other hand the dominance of fossil fuels, in terms of total electricity generated worldwide, more than 60 countries currently use hydroelectricity for 50% or more of their electricity requirements. The countries in which hydroelectric are mostly installed capacity resides in are North America, Brazil, Russia, China and Europe. On the other side potential hydropower, however prevailed in less developed regions like Asia, South and Central America and Africa (IHA, p. 98, 2013).

There are many advantage of Hydroelectricity over other sources of electrical power, in which a high level of reliability, fairly simple, proven technology, high efficiency, very low operating and maintenance costs and the most important ability to adjust to load changes easily. Tackling with the problem of up and downs in power demand, utilities generally combine diverse power plants, the services of which differ in terms of consistency. The efficiency of Hydropower plants also affects on their design, generate electricity for base or peak demand, or both, as a result the flexibility in energy supply is one of the main technical advantages of hydropower (IHA, 2013, P. 105).

Nowadays the factor of cost is most important especially in poor developing countries as a result the cost of producing electricity is a fundamental criterion for decision-making, and hydropower is one of the best options among all other sources of renewable electricity. Similarly the usual type of price does not include all range of others benefits; for example, through the multi-purpose nature of reservoirs, hydropower has more non-energy benefits than any other energy source like water supply, flood control, navigation, irrigation and recreation. Likewise, in terms of recreation, hydropower projects in the United States generate electricity for the public with more than 47,000 miles of shoreline; 2,000 water access sites; 28,000

tent, trailer, and recreational vehicle sites for camping; 1,100 miles of trails and 1,200 picnic areas (IHA, 2013, P. 105).

#### **4.4 Renewable Energy Options**

Nowadays almost all of the poor countries in Africa spend a large amount of their income on energy and mainly dependent on biomass. Hence, the most of Africa's poor live in remote rural communities, there are no clear economic incentives for grid-extensions or for supplying modern hydrocarbon fuels, for example kerosene and liquefied petroleum gas (LPG). Therefore, these factors make renewable energy as the only option, and most African countries including Ethiopia took the path of installing renewable energy options.

The traditional hydro-based electricity generation was the foundation step for the expansion of electricity networks in many African countries. As a matter of facts, the deployment of other renewable energy technologies should play a very keen complementary role. These important points are also valid for the development of the conventional energy sector in Africa. As it true that energy cooperation and integration are usually based on conventional and centralized energy systems but as a result these require huge capital investments, both from foreign and domestic sources and thus integrating to heavy debt burdens. It is well known that Africa is in competition for investments with the emerging economies of Latin America, Asia and Eastern Europe, as well as energy project development will not happen, unless Africa's energy resources are monetized through market (ECA, 2013).

#### **It's Spill over Effect**

Regional integration through hydropower does not only satisfy energy demand but also it has other spill over effects. It helps to smooth regional conflicts, mitigate climate and drought prone areas to expand consumption of technological products and further promote innovation and advancement of technology. Hydropower development is unique in way that, it is environmental friendly, renewable and relatively fewer disadvantages except its high cost of construction has been reported. The especial nature of hydropower for development regional integration is; it is spill over effect for mitigation of climate change and environmental protection. Therefore, IGAD a region that is affected most by recurrent drought and environmental

challenges has an advantage in fostering hydropower development and interconnection projects so as to mitigate the overly increasing drought, climate change, and conflict and security challenges.

### **Comparative Advantages**

Hydropower is a cheap source of energy compared with other source of energy. The lifespan of hydropower is estimated to be 50 years that is relatively longer than other sources of energy. Ethiopia has absolute comparative advantage of generating hydropower, and therefore the countries of IGAD region have advantage to buy Ethiopian energy in a cheap price than relative advantage of using other sources of energy. For example, Kenya will buy Ethiopian hydropower with 7US cents per KW that is too cheap compared to generating geothermal energy that has a production cost of more than 10 US cent per KW. Those countries with a huge diesel energy potential like Sudan costs them 20 US cents per KW which is too expensive than importing from Ethiopia. Furthermore, the fact that these countries will have a cheap energy access helps to attract foreign investors, as investors will get cheap energy access for their industries (ECA, 2013).

### **4.5 Rational For Ethiopian Hydropower to Serve As a Power Hub in IGAD Region**

The challenges facing IGAD members are mostly similar. All need to address core periphery inequalities, boost food and energy production, develop a new strategy for rural development and stimulate manufacturing while adapting to environmental friendly policies. All have poor infrastructure, turbulent political histories and troublesome neighbours. All these factors have hampered efforts to break out of the cycle of insecurity, underdevelopment and bad governance. A strong case can therefore be made for the countries of the region to work together on infrastructural developments to alleviate such a common problems.

With peculiar nature to the region, the most viable infrastructural development to integrate the region is energy integration. In this regard, Ethiopia is a centre of all countries with relative peace and security. More importantly, Ethiopia has a capacity to produce huge amounts of hydropower potential, which is second in Africa with

capacity estimated to be 45,000 mega watts. Therefore, Ethiopia can serve as a centripetal force or energy hub for eastern African countries.

In the interview to Financial Times (An international daily newspaper based in London (2014), in Addis Ababa Mr. Mihiret Debebe former head of Ethiopia's state power company (EEPCO) who is now the energy advisor to the prime minister said:

*“Energy is a very strategic sector for us- Ethiopia is going to be the renewable energy hub of Africa”.*

Besides, in his exclusive interview with Ethiopian Herald, a government owned English newspaper, Alemayegu Teganu (2013) Minister of Ministry of Water and Energy point out, one of the objectives of the power sector is to make Ethiopia a green renewable energy hub for the East Africa region and the ministry is working to achieve these goals. In addition, the vision statement of Ministry of Water and Energy also consolidate the argument that states:

*“Ethiopia will be a model of excellence in water resource developments, vitalization and renewable energy hub in East Africa by 2015”.*

Critically looking in to such views of state officials and analysing current practices poses to the question and interpretation of, what are the major factors that enable Ethiopia to be the power hub of the region. For a state to be power hub over certain region, certain criteria must be fulfilled. The state must influence other states in its production and distribution on actual and potential of its power sector, the power that is being generated by a state must be in accordance with international agreements and standards. Moreover, there must be a massive investment in production and distribution of energy source and there should be alternative sources of energy that makes a state not to be dependent on a single source of energy (ECA, 2013). Concomitantly, Ethiopia could be considered as energy hub of IGAD region using the above benchmarks.

The following factors could also assert why Ethiopia can serve as a centripetal force or energy hub for eastern African countries.

## Huge Hydropower Potential

The theoretical potential of hydropower in Ethiopia is estimated to be around 45,300MW or (160,000GWh/year). More importantly, large potential for many hydro plants in areas that are remote to the grid but close consumers exist (UNIDO, 2013). Of the total hydropower potential, only less than 5% is exploited (Ministry of Water and Energy, 2014).

Ethiopian government report shows that 299 small hydropower potential sites have been identified within 11 river basins. Ministry of Water and Energy (2014) identified the following hydropower sites (Table, 4.3) that are currently operational and future projects that clearly show the huge potential of Ethiopia in hydropower production.

**Table 4.1** Actual and potential hydropower sites in Ethiopia

No.	Hydropower Plant	Installed Capacity (MW)	Current Status
1	Koka	43.2	Operational
2	Awash II	32	Operational
3	Awash III	32	Operational
4	Fincha	134	Operational
5	Melka Wakana	153	Operational
6	Tis Abay I	11.4	Operational
7	Tis Abay II	73	Operational
8	Gilgel Gibe I	184	Operational
9	Tekeze	300	Operational
10	Gilgel Gibe II	420	Operational
11	Beles	460	Operational

12	Fincha Amerti Neshe	97	Operational
13	Genale III	250	Under Construction
14	Gilgel Gibe III	1870	Under Construction
15	GERD	6000	Under Construction
16	Helele Werebsa	422	Feasibility Study Completed
17	Gilgel Gibe IV	1400	Feasibility Study Completed
18	Chemoga Yeda I & II	280	Feasibility Study Completed
19	Ayisha	300	Feasibility Study Completed
20	Assela and Debrebirhan	200	Feasibility Study Completed
21	Tekeze II	450	Under Feasibility Study
22	Derbu I& II	250+325	Under Feasibility Study
23	Geba I &II	366	Under Feasibility Study
24	Gojeb	153	Under Feasibility Study
25	Genale V	100	Reconnaissance (Under Survey)
26	Beke Abo	1700	Under Feasibility Study

27	Baro I& II and Genji	900	Under Study	Feasibility
28	Mendaye (Blue Nile)	2000	Under Study	Feasibility
29	Tams	1060	Reconnaissance	
30	Dabus	425	Reconnaissance	
31	Birbir R.	467	Reconnaissance	
32	Gibe V	660	Under Study	Feasibility
33	Lower Dedissa	613	Under Study	Feasibility
34	Wabishebelle	87	Under Study	Feasibility
	Total hydro power already at the level of exploitation	22,227.6		

**Source:** Ministry of Water and Energy of Ethiopia Bulletin, 2014

- ❖ **Operational** – currently generating power
- ❖ **Feasibility Study Completed** – a project is ready to be implemented and its waiting funds
- ❖ **Under Feasibility Studies** – a site is selected and study is being conducted
- ❖ **Reconnaissance** - pre- feasibility investigations and inspections are being done
- ❖ **Under Construction** – ongoing activities on the construction of a site is take place

In addition to large hydropower plant potential, studies shows that Ethiopia has a potential of small and micro hydropower developments. A study by United Nations Industrialization Development Organization (2013) stated that Ethiopia has 1,500-3,000 MW (10% of the total hydropower potential) hydropower development

potential from mini and micro plants. With the potential that is ready to be exploited and future hydropower potential expected to be exploited, Ethiopia is likely to be the power hub IGAD region. Moreover, Ethiopian hydropower potential serves as integrating factor not only for eastern Africa but also for the whole of Africa. More plausibility, huge projects to export clean energy to Middle East via Yemen is already underway.

### **Lower cost of production**

Ethiopia has not only a huge potential of hydropower development prospects but also lower cost of production compared to other East African countries. According to World Bank Eastern Africa Highway Integration Projects Appraisal document (2012), Ethiopia has a vast hydropower potential estimated at 45,000 MW of which less than 4% is currently developed. The long-term marginal cost of developing the generating capacity is between US 0.04 to US 0.05 cents per KW – hour, significantly lower than that of neighbouring countries. Cost of producing hydropower in Ethiopia is also much less costly than producing geothermal energy in Kenya or other East African countries. Ethiopia could have the potential to export more than 55 terawatt hours (TWh) of electricity per year that is one third of the total demand in EAPP countries by 2030 (excluding Egypt) if there were no barriers in developing and trading the sector.

### **Government Commitment**

Ethiopia is well endowed with abundant water resources, found in almost every corner of the country. However, the country has not achieved yet significant progress in the field of water resources development. During the past four decades in particular, the exploitation of hydropower potentials was not noticeably successful. However, there are relative improvements in the current government focusing on energy development as a top national priority sector. The national energy policy of the government in power for the more than 2 decades namely Ethiopian People Revolutionary and Democratic Front (EPRDF) declares energy as the priority and backbone of the country's development strategy.

The policy document clearly stated:

*Hydropower will form the backbone of the country's energy sector development strategy, as it is the country's' most abundant and sustainable energy resource.*

Furthermore, as a top priority sector, Ethiopian water resource management policy clearly stated the policy objectives to enhance efficient and sustainable development of the water resource and meet the national energy demands as well as export for external markets to earn foreign currency.

Specifically through hydropower development, the policy aims:

- ❖ Ensuring that small, medium and large hydropower candidate projects are studied and designed for immediate implementation.
- ❖ Setting out short, medium and long-term hydropower generation programs.
- ❖ Ensuring that hydropower development projects are studied, designed, constructed, operated and utilized on economically viable basis to acceptable technical, environmental and safety standards.
- ❖ Strengthening local human power capacity; for hydropower development, project study, design construction and operation.
- ❖ Conforming that hydropower development on trans-regional rivers is altered based on mutual understanding and cooperation amongst federal and regional concerned parties.
- ❖ Encouraging involvement of private sector in the development of hydropower (Ethiopian Energy Policy, 1994)

As the main pillar of the national economic development agenda, the government is highly committed to the maximum exploitation of indigenous resources and development of the sector. In this regard, in the first Growth and Transformation Plan (GTP), the government engaged to reach 10,000 MW total installed capacities energy plant where the most of it is from hydropower generation (GTP energy sector plant, 2010). In the second part of same policy papers GTP, the government intended to generate 15,000 MW additional powers. To this end, Ethiopian Electric Power Cooperation (EEPC) is assigned to implement the policy objectives of GTP. EEPC is therefore is working on increasing investment in the sector, promoting and increasing access to electricity and expanding electricity exports.

In contradiction, there are certain fears on capability of government to exploit the potentials. More importantly, there are serious question why the government exports power while there is domestic shortage. In response to such claims government commentators argues that shortage is not because of low generation of power rather old and inefficient transmission interconnections that are too old to carry the current power consumption pattern.

### **Strategic Position and Disperse Location of Hydropower Sites**

Together with relative stability, Ethiopia owned the strategic position in the horn of Africa to serves as a bridge between the countries of the horn like Sudan, Kenya, Djibouti, Somali, and South Sudan and the rest of the world. Such a geographical location provides it to play a significant role in the regional integration schemes. The relative stability of Ethiopia in the region also lets Ethiopia to enjoy and to further strengthen investment in the sector and play more leading regional roles.

One unique feature Ethiopian hydropower site distribution possessed compared to with that of DRC is that, Ethiopia hydropower simple for interconnections as most of hydropower plants are distributed in different part of the country. While in DRC, most hydropower sites are concentrated in Western DRC, which makes the distribution more difficult and expensive. Map 4.2 shows the distribution of hydropower Plants throughout the country



**Figure 4.2** Hydropower Site Distribution of Ethiopia (H Represent – Hydropower Sites Of Ethiopia

Source Internet: Available at

[http://www.geni.org/globalenergy/library/national\\_energy\\_grid/ethiopia/ethiopiaelectricitygrid](http://www.geni.org/globalenergy/library/national_energy_grid/ethiopia/ethiopiaelectricitygrid). Accessed on 2/24/2016

## **Environmental Friendly Nature of the Sector**

Hydropower has a massive potential to preserve ecosystems, and it is the least expensive source of renewable electricity. With the dream to promote carbon-free economy, international organizations contribute in support of such sectors worldwide. In this regard, the resource that Ethiopia largely owned is environmentally friendly, and it has support of international organizations. For example, in interview with Financial Times on February 16/2014, a known London based magazine, Donald Kaberuka, president of the African Development Bank (ADB) said, “The ADB and the World Bank are providing finance to help electricity export from Ethiopia to different neighbour states of IGAD region. The most recent one includes \$1.5bn fund for newly opened grid link to Kenya with the capacity to transport up to 2,000MW of power. Kenya has signed a memorandum of understanding to buy about 400MW per year and Ethiopia is in talks with Tanzania for a similar deal. Ethiopia is also in talks with Yemen to export 100MW, via Djibouti under submarine cable, and discussing a link with South Sudan of which all has international organizations support in funding the projects. There are also external supports in terms of conducting researches, feasibility studies and providing loans to the government.

Furthermore, IGAD is mandated to implement the minimum integration plan in negotiation with member countries. It is also initiates the establishment of Development Bank of IGAD to finance hard infrastructural developments among and between the member states. IGAD minimum integration plan is aimed to foster interdependence through the development of hard infrastructure like railway, road and power interconnection. In pursuing its goals, IGAD initiated a household energy projects to help solve major energy and environmental problems confronting the region, by assisting member states in diversifying their energy sources and promoting optimal energy use through transfer of appropriate and efficient technologies. IGAD also follows the proper participation of stakeholders in the issues and involvements of trained decision-makers.

## **Increasing Regional Clean Energy Demand**

Energy is needed for all sectors of the economy; for household, transport, agriculture and industry. Particularly industrialization is unthinkable without sustainable supply

of energy and therefore industry is the major market for energy and development in industry is directly associated with the energy sector. The countries of the horn of Africa have agriculturally dominated economies. However, since the last decade the countries of the region are transforming in to industrialization, a sector that highly consume power. Such transformation and structural shift in the economy of eastern Africa, requires huge sources of energy comply with it. Correspondingly, the availability and cost of energy supplies has a major influence on industrial development of the region. Therefore, the existence of countries like Ethiopia with huge potential of meeting such demands of energy in the region is good opportunity the region has to seize. Simultaneously, as all countries in the region are aspiring to transform their economy in to industrialization and advanced economies, ensuring sustainable power is the first priority, which also facilitates integration schemes.

Furthermore, the expansion of energy sector, be it in the form of electricity or other, will help expansion of utilizing technological equipments, machineries, and even developing one's own invention. This in return alleviates the long existing problem of lagging behind technological innovation and utilization for centuries and help to create a technologically dependent society. Accordingly, improving the quality of life via supporting technological consumer society will help to tackle the roots of poverty and underdevelopment.

#### **4.6 Regional Challenges for Integration in IGAD**

Despite integration through hydropower is the most viable infrastructural tool to bring the region a closer community, a number of factors may hinder furtherance of the integration. Several factors including opposition on the construction of large size projects, relatively weak implementing entities, stakeholders risk aversion, challenges posed by joint implementation and operation of the projects approval and financing and variations in the co-financiers requirements for project approval and financing that could complicate coordination and planning of projects of interconnection (Eastern Africa Power Pool, 2012).

Besides, some countries are suspicious about massive investment by Ethiopian Government on the sector as politically motivated agenda. Ethiopian Foreign Policy of EPRDF, which tries to develop a more positive regional identity is criticized

sometimes as some argues that some of the projects are out of central economic thinking and has intention of dominating the region and creating dependent relationship.

The following actual and potential factor may hinder the dream for formation of closer community.

### **Troubled Past of the Countries of the Region and Risk of Polarization**

The horn of Africa is known to be as the most volatile region in the world. For long time and still the region is described as most conflicted regions of the world. Countries of the region used to had, and still some of them have complex relationships with their neighbouring states. In some of the cases the there are actual confrontation of conventional war and in some other there is mistrust among themselves. According to Verhoeven (2011), the countries of horn experiences a troubled past for centuries due to various factors. Fight over the Blue Nile Basin, shifting alliance, local resource greed, need for political dominance, mutual distrust, thirst for land, and in control of trade routes and slaves has been and continued to be factors for unsmooth relationship between member states.

Moreover, the past process of power and wealth accumulation created strong core-periphery tensions that led to violence inside and outside the territory and still shape societies today. The fight over resource and the confrontations between states have shaped the mindsets of the new generations. Ethio- Eritrean war, South Sudan cessation, Somalia conflict, and insecurity in Sudan are major current challenges where their root cause extend to past. There is also no counterbalancing or countervailing mechanisms to accommodate sub- regional objectives such as 'balanced development', none of the predominant countries is sufficiently wealthy for consideration of introducing outright compensatory mechanisms.

### **Security Challenges**

Security is at a top of regional integration agenda. It is impossible to implement integration projects as well as constructing power-generating dams without insuring sustainable peace. However, most of members states of IGAD torn apart by civil strife, political instability and boarder wars. Even though Ethiopia has a relative stability and capacity to play a more active role in providing hydropower with huge

investments, internal problems of other countries may hinder the process. For example, Sudan is in trouble politically since the secession with South Sudan and there is unstoppable conflict in Darfur. South Sudan is also under civil war since 2011 between Rich Machar's and Salvakir's government. Somalia is safe haven to Al-Qaida wing terrorist group called Al Shebab, the state is collapsed with civil war for centuries since the end of British colonialism. Uganda and Ethiopia are also not free from similar security challenges.

Regional political security has been assuming increasing importance in the regional cooperation of IGAD member states. Internal political insecurity serves as both a driving force and threat for cooperation and integration in sub-region. On the regional level, the mandate of IGAD includes peace and security aspects. Despite the recent laudable sub-regional peacemaking and peace keeping efforts, IGAD yet not achieved regional cooperation on political, security and defence level. Hence, such security challenges remains at the top of challenges for regional integration schemes in IGAD region.

### **Water Vulnerability**

Hydropower resources potential depends on topography, water volume, variability and seasonal distribution of runoff. Kumar & Schei, (2011) argues with a changing climate, this resources potential could change due to changes in river flow that directly affects the resource potential for hydropower generation. More sediment could increase turbine abrasions and decrease efficiency. Increased sediment load could also fill up reservoirs faster and decrease the live storage, reducing the degree of regulation and decreasing storage services. Limited storage, lack of cooperation among shared river basins to take rehabilitation measure to avoid possible river flow fluctuation and poor water management infrastructures affects the development of hydropower.

### **Donors Irregularity (Financial Constraints)**

Donors' pre-conditions to provide financial grants for construction of the dam or any interconnection projects vary significantly. Some donor's pre-conditions are politically driven while others are development oriented. Some external donors bring preconditions that violate sovereignty of a nation and their grant differs according to

their objectives and assumed profit. In this case, countries of recipients become reluctant to get assistance as in one-way or another degrades their national interest. Some of the donors also reluctant to finance big dams especially if the project is on shared river basin. Countries like Egypt also use different mechanism to halt with fear that such project will harm and significantly decrease the volume of water.

Furthermore, according to African Energy Outlook (2013) report, there are also myriad challenges, such as high level of poverty and inequality, a major shortage of infrastructure, poor governance and corruption, relatively low level of productivity and skills, and varying levels of political stability are the major factors, which hinder integration in the region.

### **Resentment on the Huge Investment on the Sector**

Particularly in Ethiopia context, the major power generating power plants are large hydropower dams. The impacts of such large hydro dams are transitional nature, which may be seen as a threat to their national interest by riparian states. The recent dams; Grand Ethiopian Renaissance Dam and Gibbe III are good examples, the former is under construction while the latter is already at operation. In the first case the dam has raises many controversies particularly among riparian states of Ethiopia, Sudan, and Egypt. Egypt and Ethiopia has been in controversies since the inauguration of the construction of the dam, though the current situation seems smoothen. In latter case, Omo river is the tributary of lake Turkana in Kenya in which raises resentment by Kenya government. The government of Kenya raises a claim as the construction of the dam may affect the livelihood of Kenya peasants whose main economic means is directly linked with lake Turkana (International Rivers. 2011)

Environmentalists also repeatedly accused of Ethiopian government as big dams hurts biodiversity and the people living around the dam. For example, according to World Bank Appraisal document on Ethio- Kenya interconnection project, based on a household survey of the eight woredas traversed by the transmission line, the project has a capacity to affect approximately 5, 743 people. Such accusations, opposition's argument on huge investment may hinder the development of hydropower dams. Furthermore, such environmentalist allegations and interpretations may further escalates to community and national wide conflicts that disrupt overall regional

integration schemes to neighbouring countries. There is also threat posed by Ethiopian opposition's armed groups contentious destruction attempt. Particularly, since, the construction phase will require clearing vegetation to prepare the site for construction of transmission towers; it may aggravate tension of conflict.

### **Weak Soft Infrastructures**

Soft infrastructures include policies, regulatory and legal infrastructures. In this respect, legal and regulatory constraint, especially the lack of detail and implementing legislation that sets out regional trade issues and the vast differences in legal regimes and enforceability of contracts seem to stand out. Lacks of regional similar policies are a major hindrance factor for regional electricity trade. If the recipient country has a single buyer regime, and the single buyer is unwilling to purchase to the seller for non-economic factors, no power will flow. Furthermore, countries may follow more inward-focused policies than looking towards own generation from a security of supply perspective.

### **Technical Constraints**

Energy interconnection projects require cooperated management, planning and coordination of tasks and activities. Insuring secure and sustainable commercial renewable energy depends on institutional and human capacities as well as business and market capabilities. Technical knowhow and expertise also require for proper flow of power from place of production to consumption. For sustainable supply of power to regional communities, there must be a technical office to manage operation and maintenance issues. According to African Union (2009) heads of government session held in Addis Ababa in February, the major challenges for clean energy development in sub- Sahara Africa is, in adequate domestic technical skills that account for poor maintenance of imported systems and lack of provision of adequate domestic after-sales service. The public sector also lacks adequate personnel to undertake effective monitoring and evaluation measures. Hence, there is need for high and middle level technical workers in business development, manufacturing and overall management.

## **5. CONCLUSION**

With the advancement of globalization, it seems difficult for countries to exist alone. Regional integration is not only vital for countries to adapt but also become mandatory to implement. More importantly, facilitating regional integration through environmentally friendly means has a paramount importance for the socio economic integration, which further promotes political union. The overall environment at global and regional level is extremely favourable for accelerating hydropower development. There is growing global concern for fostering green energy. Africa is calling on green growth strategy to transform its economy from agrarian to industrial nature where its largest potential on hydropower, solar and geothermal power expected to play huge role.

Regional integration on eastern Africa is at the center of three key issues: economic, security and environment. In the economic aspect, integration of countries becomes crucial to compete in the global market and maximize their benefits. From the security perspective, countries of Eastern Africa integrate because they want to address regional security issues like terrorism, human trafficking, and transitional crimes. Besides, countries aspire to integrate among themselves to administer regional commons like trans-boundary resources, protection of the environment and the tackling common problems. For this end, IGAD member states countries forge to integrate each other for the coordination, implementation and evaluation of regional common programs. As such, regional integration especially through the public goods becomes vital to serve as engine for development and fight against poverty.

The countries of IGAD region have resource gaps, expertise gaps, and technological gaps. Hence, effective regional integration schemes among countries can meet the existing critical gap in basic access and service delivery that promotes development. To fill such gaps, so far, different attempt made to form integrated community through the formation of regional economic communities. The approach to forge

integrated community involved two major perspectives of top down and bottom up. The first approach is mainly a protocols signed by states at top political level. The bottom up approach on the other hand is practicing integration that would take place at lower level aimed at fostering people-to-people and business-to-business relations. In fostering lower level integration schemes, infrastructural developments like telecommunication, road transport, railways transport, and power interconnections become the new mechanisms that advance regional integration.

Countries in the IGAD region face similar challenges in poverty reduction, climate change, population growth and food insecurity. Furthermore, inadequate and poor regional infrastructure network, water scarcity intensified by problems in managing shared water resources, weak institutions, and political instability are the common features of the region. Thus, these problems will only be addressed through mutual trust and increasing well developed regional integration schemes through different mechanisms. Sharing their resource wealth to build better economic relations can help to improve the political instability and address the poverty and ecological pressures confronting their populations. In this respect, regional cooperation through energy plays paramount role in mitigating regional common problems, and suits at the very heart of the sustainable development challenge, internally and regionally. This is because the countries of the region registered continuous economic growth in the last decade and technologically becoming advanced. Growing economy as well as the idea of creating technological dependent society requires sustainable energy supply.

In eastern Africa region that comprises IGAD members, water is becoming the most important domain for future cooperation as it plays fertile ground for both energy and agriculture cooperation. 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 condition of the other, which is more practical and more 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. In line with this, Ethiopia's strategic position in eastern Africa plus its abundant hydropower

potentials, sustainable renewable energy mix, will serve as power hub of not only eastern Africa but also the Middle East.

For hydropower development to serve as the integrating factors among the members of IGAD, it must be supported by other hard infrastructures like road, railways and ICT development. These hard infrastructures are the best complement to hydropower development as a tool for regional integration, in that they have the potential factors to connect people to people, promoting business to business relations, increase cultural interactions and helps to know ones history and societal values. Unless the governments of the region committed themselves to build such hard infrastructures to connect the people, high-level protocols and agreements to bring regional integration will be nightmare.

Ethiopia is increasingly described as a regional power in the horn of Africa. Ethiopia's military power, population size, relative internal stability and diplomatic strength have enabled it to position itself as a regional power and to drive regional peace and security initiatives. Ethiopia has also been able to influence regional security agendas through sub-regional and regional organizations. The convergence of Ethiopia's interest and those of its western allies further give Ethiopia legitimacy in its regional role and status. Ethiopia's increasing engagement in regional peace and security issues further indicates that it has the will to lead and influence the region. Other than these political aspects the obvious core elements to build and perpetuate regional integration is infrastructural development. In this respect, Ethiopia is now involved in multi-billion dollar clement- resilient green energy sector developments that will lead to it becoming one of the main producer and exporter of power in Africa. The government is heavily investing in mega hydro projects, wind farms, solar and geothermal energy to provide the bedrock for the transformation of the political, social and economic landscape of Ethiopia, and for the region. However, the dream of Ethiopia to be a power hub of the region could be constrained by three major factors. The lack of common strategy among the regional countries and regional communities; lack of regulatory frameworks among regional bodies to administer existing and prospective interconnections, and lack of complementary policies on how to develop regional common and infrastructures for collective benefit. Furthermore, member states resistance to free trade area, low level of hard infrastructure developments, financial constraints and security problems are

additional hindering factors for sustainable development of integration among the members of IGAD.

Hence, given that energy access and security are indispensable to economic transformation, member states of the eastern Africa sub region are recommended to consider;

**Developing a common understanding among the members:** mutual trust and common understanding is at the heart of regional integration among members of IGAD. However, such understanding must be supported by regional common strategies, regulatory frameworks, adopting complementary policies on how to develop, and administer regional programs for mutual benefit.

**Developing coordinated planning and operation:** any regional projects, which have a transnational impact, can only be effective if it is managed in coordinated and planned manner. In this respect, governments of the member states must cooperate in the power sector, including both coordinated planning for generation, expansion, investment programs and coordinated system operations. Particularly to ensure security of sustainable power supply, the power generation and transmission network require special attention on the coordination and collective planning.

**Engaging the private sector:** in any sector of the economy private sector is regarded as engine of development. However, until now, the private sector engagement in the production and distribution of the power sector in the region is at lowest level. Therefore, increasing private sector participation, and private- public partnership to enhance investment resources in the energy sector must be strengthened.

**Synthesizing energy planning with that of economic planning:** energy is the motor of industrialization, thus, it is at the center of any economic activities. In this regard pursuing regional opportunities to engage in clean energy, benefit from lower energy cost and undertaking renewable energy initiatives must be strengthened. Furthermore, energy planning must target to attainment of sub regional and country targets set for energy access and striving to achieve the sustainable energy for initiative of 2030 by United Nations.

**Developing soft infrastructure:** the hard infrastructures aspect of integration among the members of IGAD should go consistently with soft infrastructure. Therefore.,

hard infrastructure must be supported by soft infrastructure like developing regulatory frameworks, policy coordination, trade agreement and creating awareness to the beneficiary people of respective countries.

Finally, fostering interdependence through infrastructural developments like power interconnection, road and railway constructions provide a bridge for closer economic community and better people-to-people relations. Energy integration is an important aspect of such interdependence. Energy is a significant part of the total infrastructure as the development of energy markets on a regional basis offers significant benefits, and access to modern energy services is critical for socio-economic development. In this respect, Ethiopia offers a great deal of opportunity for clean energy production, which has become vital in the current global environment. Furthermore, Ethiopia's military power, population size, relative internal stability and diplomatic strength have enabled it to position itself as a regional power and to drive regional peace and security initiatives. Such a role of veritable mission would transform the perception of Ethiopia from that of a poor country, dependent on outside assistance, to that of leading state with resources that are valuable to the entire region.



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## **RESUME**

**Name and Surname:** Anwar Seman Kedir

**Place and Date of Birth:** Arsi, Ethiopia 16/09/1990

**E-mail:**semananwar@yahoo.com

## **EDUCATION**

**Bachelor** : 2012, Hawassa University, Governance and Development Studies

**Masters** : Ongoing, Istanbul Aydin University, Social Science Institute,  
Political Science and International Relation

Ongoing, Marmara University, Social Science Institute, International  
Economics