



IGAD REGIONAL INFRASTRUCTURE MASTER PLAN

Final IRIMP Report – Energy Sector Report



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Foreword by Executive Secretary of IGAD

The Intergovernmental Authority on Development (IGAD) Regional Infrastructure Master Plan (IRIMP) is an ambitious plan, the implementation of which will accelerate the region's growth and structural transformation. The IRIMP consists of policy initiatives and infrastructure investments that will significantly strengthen the process of regional economic cooperation and integration. The IRIMP is aligned with, and furthers the aims of, the Abuja Treaty, the Constitutive Act of the African Union, Agenda 2063, and the national development plans of IGAD Member States.

This Energy Sector Report is part of four sector reports picked from the overall IRIMP Report. The other three reports are for transport, ICT and transboundary water resources. The Sector Reports are intended to be used by IGAD Member States, and in particular the relevant line Ministries, Departments and Agencies responsible for sector development, and their development partners to guide future planning, investment decision-making and funding and financing arrangements.

The process of preparing IRIMP began in March 2006 when the 11th IGAD Summit of the Heads of State and Government, held in Nairobi, recognised the importance of infrastructure projects as a vehicle for the integration of the IGAD region and as a catalyst for the economic growth and development of IGAD Member States.

The following year experts from the European Union (EU), IGAD Member States, and the IGAD Secretariat met in Mombasa (Kenya) to prepare the Horn of Africa Initiative (HOAI). HOAI priority areas were: (i) interconnectivity in transport (focus on transport and trade facilitation) priority road corridors linking region to seaports; (ii) energy; (iii) ICT; and (iv) water resources for food security.

Subsequently, the IGAD Secretariat organised a meeting of Member States, held in Nairobi during December 2010, at which was prepared a comprehensive roadmap for the Minimum Integration Plan which would create a Free Trade Area (FTA) in the IGAD region. The roadmap recommended the preparation of IRIMP, which was cited as crucial to achieving the FTA. The preparation of the IRIMP is very timely as the African Continental Free Area (AfCFTA) has recently been established and all IGAD Member States have signed the Agreement. AfCFTA seeks to accelerate intra-African trade and to boost Africa's trading position in the global market by strengthening Africa's common voice and unified position in global trade negotiations.

In June 2013, IGAD requested support from the African Development Bank (AfDB) to develop the IRIMP. The positive AfDB response culminated in the commencement of the preparation of the IRIMP in May 2018. Support from the AfDB for IGAD initiatives is substantial and includes the Kampala–Djibouti Corridor Studies, and the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI). The AfDB is also supporting a number of regional projects that are connecting the Member States including the construction of Isiolo–Moyale Highway in Kenya and the rehabilitation of Awassa–Moyale Highway in Ethiopia.





The IRIMP covers infrastructure in Transport, ICT, Energy and Transboundary Water Resources. The IGAD region is unfortunately characterised by the low stock of infrastructure, particularly in transport and energy, and the inadequate development of the ICT sector and digital economy. Coupled with the increasingly severe strain placed on water resources the region's productivity and growth, and regional integration, has fallen short of expectations. Studies have shown that inadequate infrastructure shaves off at least 2% of Africa's annual economic growth. Adequate infrastructure would lead to productivity gains by African firms of up to 40%.

The IRIMP will help facilitate regional integration by bridging the gap in national and regional policies and strategies and addressing infrastructure needs in vital areas, including in remote and pastoralist areas. The IRIMP will guide the process of implementation of priority regional infrastructure projects – constituting the basis for IGAD Member States commitment to a common infrastructure development programme, in the form of a Declaration, as well as the basis for regular review of its implementation. The IRIMP will be implemented over three phases; in the short term (2020-2024); the medium term (2025-2030); and over the long term (2031-2050).

There is an urgent need to scale up regional infrastructure development to accelerate regional integration and development. The IRIMP will help address key regional infrastructure deficits. This includes projects that will address transport and energy needs of the region in a manner that ensures accessible and affordable access by the region's population, and the sustainable development of energy and water resources with a special emphasis on renewable sources. The IRIMP will help to enhance the equitable sharing of water resources amongst competing uses. The IRIMP will also further help the region to make necessary steps to expand and deepen the access to modern, affordable, and reliable ICT technologies and services.

The IRIMP focuses on effective implementation of projects by identifying preferable and practical financing strategies, and by proposing policy and institutional frameworks that will ensure the unfettered and seamless implementation of identified projects and interventions.

H.E. Dr. Workneh Gebeyehu

Executive Secretary





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The IGAD Regional Infrastructure Master Plan (IRIMP) was prepared by a team from IPE Global and Africon Universal Consulting. Preparation was a collective effort that involved the IGAD Member States, and their respective ministries, departments, and agencies responsible for infrastructure planning, finance, and delivery. The Member States, through the Joint Steering Committee, provided valuable feedback on the IRIMP as it progressed through the preparation process and the reporting milestones.

The support and contributions of the African Development Bank team, led by Mr. Mtchera Chirwa, were invaluable in ensuring the IRIMP was firmly focused on delivering sound infrastructure investments that supported wider continental ambitions of inclusive, resilient, and sustainable growth.

IPE Global and Africon Universal Consulting are grateful to the many officials and experts that shared their time and knowledge with us in order to improve the quality of the evidence, review the findings, and to sharpen the recommendations.

The IGAD Secretariat, under the stewardship of Mr. Elsadig Abdalla (Director Economic Cooperation and Social Development) and Mr. Zacharia King'ori (Project Coordinator), ensured that the interests of the Member States were at the forefront of the analysis and prioritisation processes shaping the direction and recommendations of the IRIMP. Mr. Zacharia King'ori provided much valued day-to-day guidance on project management matters. He was a reliable sounding board on technical issues and how they can best be communicated to ensure the IRIMP can be acted on by Member States.

Throughout the IRIMP preparation process, the driving philosophy was 'plan to implement' and to build on the positive infrastructure initiatives that the IGAD Member States were already developing and implementing. The policy and project recommendations reflect this philosophy.





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List of Acronyms

AEEP	Africa-EU Energy Partnership
AfDB	African Development Bank
AfCFTA	African Continental Free Trade Area
AFD	Agence Française de Développement (French Development Agency)
AIIM	Africa Infrastructure Investment Managers
AEG	Autonomous Energy Grids
AU	African Union
CAGR	Compound Annual Growth Rate
CBET	Cross Border Energy Trade
CMI	Corridor Management Institute
CRGE	Climate Resilient Green Economy
CSA	Central Statistical Authority, Ethiopia
CFA	Cooperative Framework Agreement
EAC	East African Community
EAPP	East Africa Power Pool
EDC	Economic Development Corridor
EE&C	Energy Efficiency and Conservation
ENTRO	Eastern Nile Technical Regional Office
EEPCo	Ethiopian Electric Power Corporation
EPA	Environmental Protection Authority
ESIA	Environmental Social Impact Assessment
EU	European Union
FDI	Foreign Direct Investment
GDI	Gross Domestic Income
GDP	Gross Domestic Product
GERD	Grand Ethiopian Renaissance Dam
GHG	Green House Gases
GoK	Government of Kenya
GTP	Growth and Transformation Plan (Ethiopia)
HVA	High Value Added
HOAI	Horn of Africa Initiative
IGAD	Intergovernmental Authority on Development
IDP	Infrastructure Development Programme
IPP	Independent Power Provider
IMF	International Monetary Fund
IRIMP	IGAD Regional Infrastructure Master Plan
KOSAP	Kenya Off-Grid Solar Access Project
LAPSSET	Lamu Port-South Sudan-Ethiopia-Transport Corridor
LCDA	LAPSSET Corridor Development Authority
MEL	Monitoring Evaluation and Learning
MDG	Millennium Development Goals
NBI	Nile Basin Initiative
NREL	National Renewable Energy Laboratory





NEPAD	New Partnership for Africa’s Development
Nile-SEC	Nile Basin Initiative Secretariat
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NDP	National Development Plan
OECD	Organisation for Economic Co-operation and Development
O&M	Operation and Maintenance
PIDA	Programme for Infrastructure Development in Africa
PAP	Priority Action Plan
PPA	Power Purchasing Agreements
PPP	Public Private Partnership
PSO	Private Sector Organisation
REC	Regional Economic Community
RISE	Regulatory Indicators for Sustainable Energy
SAPP	South Africa Power Pool
SADC	Southern African Development Community
SDI	Spatial Development Initiative
SDPRP	Sustainable Development and Poverty Reduction Plan
SHS	Solar Home Systems
SREP	Sustainable Energy for All
SREP	Scaling Up Renewable Energy Programme
VRE	Variable Renewable Energy
WB	World Bank
WAPP	West Africa Power Pool



Executive Summary

IRIMP Energy Sector

Energy Sector Vision

A system that is interconnected, harnessing the abundant renewable resources available within the region; affordable, utilizing least cost principles for development and operation within and beyond national boundaries; and reliable, providing a strong foundation for the continued economic and social development of the region.

Energy Sector Drivers

- Initial primary focus on the provision of trans-border power transmission interconnectors and creation of the regional power grid.
- Strategic shift over the long term to emerging technologies to achieving universal access to electricity may be better served through alternative solutions.
- Strong climate change mitigation emphasis and risk reduction.

Infrastructure Development Plan & Action: 2020-2030 Interventions

Table ES 1. 1: Short Term Plan (2020 - 2024)

ID	Project	Value (USD million)	Corridor	Energy Sub-Sector
EPIMo03	Ethiopia – Somalia Interconnector (500kV) (Horn of Africa Initiative)	1188	Mogadishu Corridor	Power Interconnector
EPIP06	Ethiopia-Sudan (500kV) Transmission Interconnector (Eastern Africa Green Power Transmission Network Project 6 – Guba (Ethiopia)- Khartoum (Sudan))	514	Port Sudan Corridor	Power Interconnector
EPIM07	Sudan - Eritrea 66kv power interconnector (Eritrea Section)	8	Massawa Corridor	Energy
EPILO8	Multiple 220kV Power Transmission Interconnectors to power the LAPSSET corridor	232	LAPSSET Corridor	Power Interconnector
EPID12	Second Ethiopia – Djibouti 230kV Power Transmission Interconnector	100	Djibouti Corridor	Power Interconnector
EPIN15	Uganda – South Sudan Interconnector (400kV)	300	Northern Corridor	Power Interconnector





Table ES 1. 2: Medium Term Plan (2025 - 2030)

ID	Project	Value (USD million)	Corridor	Energy Sub-Sector
EPID19	Ethiopia – South Sudan Interconnector (400kV)	235	Djibouti Corridor	Power Interconnector
EPID20	Ethiopia – South Sudan Interconnector (230kV)	100	Djibouti Corridor	Power Interconnector
EPIL15	Kenya – South Sudan Interconnector (220kV)	85	LAPSSET Corridor	Power Interconnector
EPIB06	Ethiopia – Somalia Interconnector (230kV) (Horn of Africa Initiative)	40	Berbera Corridor	Power Interconnector
EPIM09	Eritrea – Sudan Interconnector (230kV)	140	Massawa Corridor	Power Interconnector
EPIM10	Eritrea – Ethiopia Interconnector (230kV) (Horn of Africa Initiative)	75	Massawa Corridor	Power Interconnector



Chapter One: Introduction to the IRIMP Energy Sector



Chapter 1: Introduction to the IRIMP Energy Sector

1.1 Objectives

The objectives of the IGAD Regional Infrastructure Masterplan (IRIMP) are to:

- i. Develop a strategic framework for infrastructure development and investment in the transport, energy, ICT and water resources sectors;
- ii. Facilitate intra-regional and inter-continental trade, and the flow of goods, services, and the movement of people across borders of the region;
- iii. Support regional economic growth that is inclusive, resilient, and sustainable; and
- iv. Reduce isolation and promote regional integration and stability.

The IRIMP aims to catalyse investments in infrastructure in the IGAD region, as outlined in the Terms of Reference (TOR): “[the] infrastructure master plan will provide an opportunity for Member States, development partners, investors and other stakeholders to **pick regionally accepted and bankable infrastructure projects to fund, invest and support.**”

The IRIMP not only focuses on projects but, equally important, highlights the need to invest in building sustainable institutional capacity to improve the delivery and management of investments in the long-term. The IRIMP is also about improving the *quality of growth and investment* by ensuring climate change, social inclusion (bringing vulnerable groups, women, and youth into the development process from design to implementation) and conflict sensitive investment choices are mainstreamed in decision-making and project execution.

The focus of this report is to outline the energy sector plans and investments that form an integral part of the IRIMP and the balanced development of the nine corridors in the IGAD region.

1.2 The IRIMP Strategic Framework

The key institutional and policy drivers of the IRIMP Strategic Framework are:

- The IRIMP is a key tool to *operationalise* the African Continental Free Trade Area (AfCFTA) and Vision 2063 through the Regional Economic Communities (REC) institutional arrangements;
- The IRIMP will contribute to the PIDA-PAP 2 planning process, the underlying concept of which is: “*To promote an integrated, multi-sectorial corridor approach that is employment-oriented, gender-sensitive, and climate-friendly and that connects urban/industrial hubs with rural areas*”; and critically,
- The expression of IGAD Member State priorities as expressed through *National Development Plans*.

The IRIMP maps out the provision of trans-border physical infrastructure and the implementation of related policy, regulatory and institutional strengthening (economic infrastructure) initiatives over the 2020-2050 period, with three phases of development:

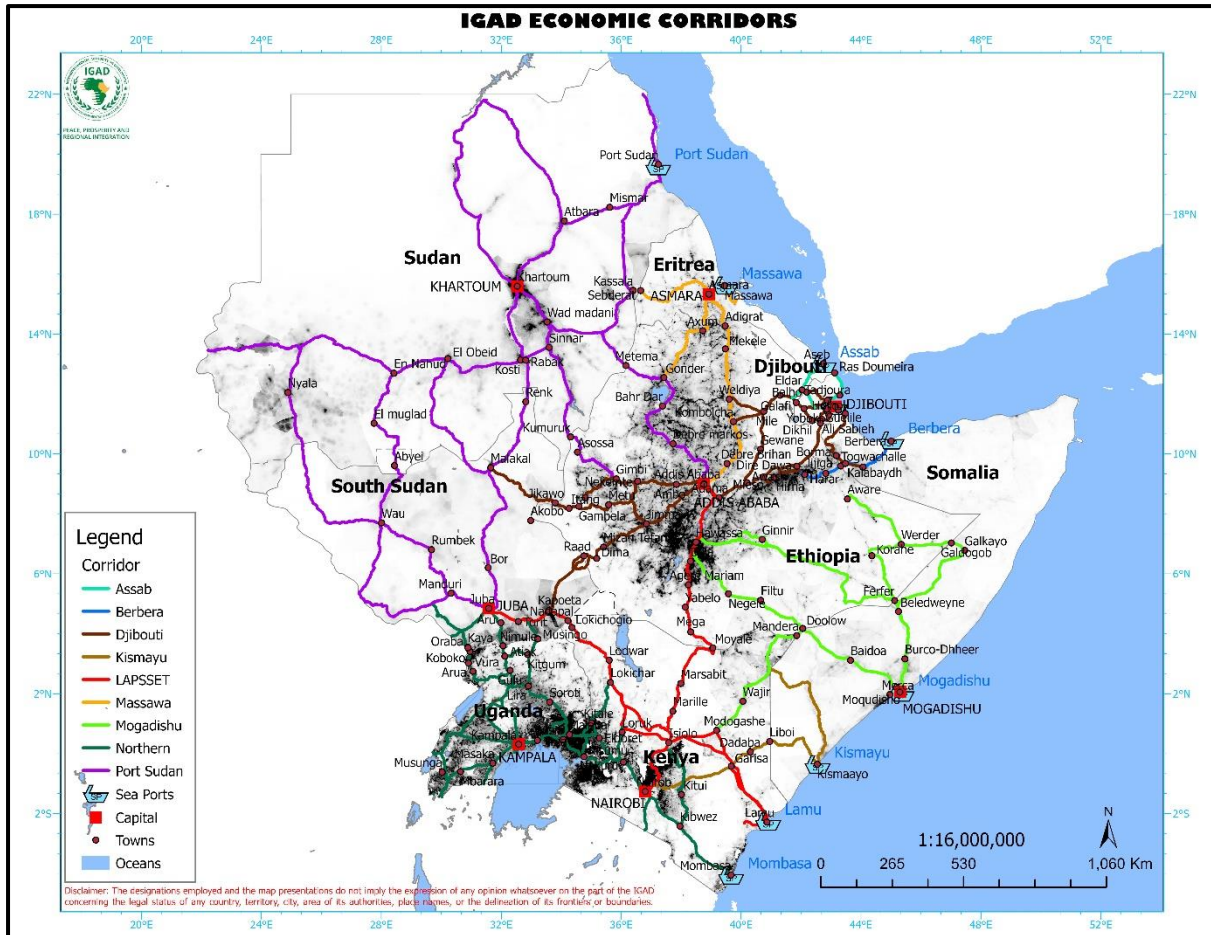




- Short term: 2020-2024
- Medium term: 2025-2030
- Long term: 2031 - 2050

The primary principle guiding the selection of trans-border infrastructure projects for the IRIMP is the degree to which a project promotes the development of the nine economic development corridors that traverse the IGAD region – Figure 1.1.

Figure 1. 1: Potential IGAD Economic Corridors



The objective of the IRIMP is to develop these potential economic development corridors to maximise job creation, are resilient to climate change, are people-driven and strengthen the role of women through gender-sensitive infrastructure development. A balanced and inclusive approach adopted, with all countries and corridors included in the Infrastructure Development Plan and Action Plan. The sector profile of the IRIMP / Infrastructure Development Programme is given in Table 1.1.

The contribution of the energy sector to development of the respective economic development corridors is subject of this report. The rationale, investment priorities, financing, implementation and safeguards of the energy sector are described in the sections that followed.





Table 1. 1: Summary of Infrastructure Development Programme Projects: Sector Portfolio Breakdown by Implementation Phase

Sector	Subsector	Short-term (2024)		Medium-term (2030)		Long-term (2050)		Total	
		Projects	Cost \$m	Projects	Cost \$m	Projects	Cost \$m	Projects	Cost \$m
Transport	Roads	23	9,312	23	13,179	7	8,224	53	30,715
	Railways	4	8,442	5	9,668	21	47,960	30	66,070
	Inland Container Depots (ICDs)	3	209	2	200	0	0	5	409
	Border Posts	11	129	2	14	2	40	15	183
	Inland Waterways	4	61	6	3,337	0	0	10	3,398
	Sea Ports	6	5,041	4	4,200	5	4,680	15	13,921
	Aviation	11	4,737	10	2,734	1	600	22	8,071
	Subtotal	62	27,931	52	33,331	36	61,504	150	122,766
Energy	Petroleum/Gas Pipeline	3	5,214	5	7,235	0	0	8	12,449
	Power Interconnector	6	2,342	6	675	6	2267.5	18	5,285
	Subtotal	9	7,556	11	7,910	6	2267.5	26	17,734
ICT	Fibre Optic Links	10	396	4	264	0	0	14	660
	Data Centre	1	173	1	70	0	0	2	243
	Internet Exchange Point (IXP)	2	7	0	0	0	0	2	7
	Subtotal	13	576	5	334	0	0	18	910
Transboundary Water	Multi-purpose Reservoir	4	662.65	1	2,000	0	0	5	2,663
	Water Aquifer Management	1	2.7	0	0	0	0	1	2.7
	Subtotal	5	665.35	1	2,000	0	0	6	2,665
Grand Total		89	36,728	69	43,575	42	63,772	200	144,075





1.3 Scope

The Sector Reports *complement* the IRIMP Strategic Framework and Infrastructure Development Plans which are centred around the core economic development corridors in the IGAD region. The sector plan and related investments have been developed in collaboration with the Member States to ensure alignment with national development plans. In parallel, the sector investments have been developed to align with the African Union PIDA PAP II process. The sector plans and risks have been “tested” through consultations with the IGAD Joint Steering Committee and consultations with civil society and private sector organisations through a series of workshops to ensure inclusion, resilience and environmental and social safeguards are fully considered and incorporated into the IRIMP.

1.4 Users

The Sector Reports are intended to be used by IGAD Member States, and in particular the relevant line Ministries, Departments and Agencies responsible for sector development, and their development partners to guide future planning, investment decision-making and funding and financing arrangements.



Chapter Two: Strategic Context and Situational Analysis



Chapter 2: Strategic Context and Situational Analysis

2.1 Sector Development Drivers

It is well established that access to affordable modern energy, especially electricity, is a fundamental driver for economic growth, and many aspects of human welfare, e.g. employment creation, raised education standards, gender, etc. etc. Electorates and MLAs are pressing the case for accelerated access to affordable forms of modern energy, especially in rural and remote areas.

The diversity of energy sources across the region, together with the fact that some countries are better endowed with indigenous energy resources than others, is such that cross-border trade in electricity has the potential to generate significant benefits and has been of interest to policy makers for the past three decades.

The Eastern Africa Power Pool (EAPP) was established in 2005 by seven Eastern Africa countries, namely: Burundi, Democratic Republic of Congo (DRC), Egypt, Ethiopia, Kenya, Rwanda and Sudan. Later signatories are Tanzania, Libya and Uganda, who joined in March 2010. South Sudan and Egypt are now also members. EAPP is mandated to facilitate the optimum development of energy resources in the region and to ease the access to electricity power supply to all people of the countries in the Eastern Africa Region through the regional power interconnections. The establishment of new interconnectors is therefore vital to ensure that EAPP can fulfil its mandate.

The majority of IGAD member states are members of the EAPP, which also includes potentially significant players such as Egypt, the DRC and Tanzania, that are not IGAD members. Although the EAPP has made progress in building institutional capacity, progress with facilitating actual energy trade through the Power Pool has been slow. The issues obstructing progress in energy trading in the region include:

- Lack of interconnections.
- Weak alignment of national development plans with the regional Master Plan;
- Weak incentives for private sector participation; and
- Inadequate and unreliable data.

The EAPP Master Plan of 2014 identified and prioritised several transmission interconnections across the region, but although consumer demand has continued to grow strongly since that time, many of the large projects upon which these interconnections were predicated have been delayed, often by several years. Consequently, implementation of the various interconnectors has been deferred. The maximisation of the benefits from the interconnectors will be achieved when power is wheeled across the region. This will require the agreement of wheeling charges (essentially rental for the use of third-party transmission assets), and ideally unification of standards and regulatory practices. Regional regulators have already been established across Africa, but this is still at an early stage of development.





The IGAD region currently has three power transmission interconnectors, with two further lines of significant capacity under construction and scheduled for completion in late-2020 or 2021. Distribution lines, which are at lower voltages of 33kV and below, are often used to supply areas across international borders in the IGAD region that are isolated from the national grid of the country in which they are located. These are not classed as interconnectors, however, as they do not connect the national grids of the countries. The current status of transmission interconnection infrastructure thus falls well short of that required for significant volumes of cross-border trade in electricity, hence the prominence of energy in the IRIMP.

Costs in the energy sector are constantly changing. Oil and gas prices continue to be volatile, as they have been for over four decades. The cost of renewable energy (RE) technologies such as wind and solar have dropped precipitously in recent years and are, broadly, competitive with many forms of conventional energy sources. RE also yields benefits in terms of reduced GHG emissions and impacts on climate change, and almost all governments have made international commitments to play their part in reducing emissions and mitigating climate change. Although the development of grid-scale and off-grid RE projects are less common in Africa than in most other parts of the world, the trend is upwards and financing—both public and private—is typically more forthcoming for RE generation than it is for conventional forms of generation.

From the conclusion of bilateral contractual arrangements, financing, environmental and social clearances, and land purchase or wayleaves, the implementation of transmission interconnection projects is typically much shorter than for large, conventional generation projects such as hydro or coal. However, it is these preliminary issues that have the potential to present lengthy obstacles to major transmission projects. It is therefore advantageous for planners to have a well-defined pipeline of interconnection projects so that the potential obstacles can be cleared within a suitable timescale.

Supply and demand projections, upon which interconnection projects are predicated, are not 'cast in stone', and change over time. They need to be revisited periodically, which may require modifications to project details such as routings, voltages, and the number and location of step-down substations.

The various advantages of interconnecting power systems between countries are widely recognised and underpin the move towards the establishment of regional power pools such as the EAPP. A long-term goal may be to plan power systems on a regional basis—as opposed to nationally—to reduce costs to end users and to optimise system security. Before then, however, incremental benefits can be realised in a gradual manner, as cooperation increases, and as network infrastructure becomes more expansive and more sophisticated.

Currently, the energy surpluses that would facilitate trade in electricity across the IGAD member countries (and beyond) is largely predicated on the substantial hydropower capacity in the region, much of which has yet to be exploited. It should be recognised, however, that regional hydropower is subject to the inherent variability of hydrology. In drought situations, thermal energy might be imported from neighbours and, in wetter than normal situations,





surplus hydro energy may be exported to the same neighbours. Also, climate change is a reality and there must be a degree of uncertainty to average annual hydropower energy output in the longer term.

Governments and planners also need to recognise that integrated network expansion and densification may not be the most expedient nor the most economic approach for delivering access to affordable electricity to remote rural communities. A large proportion of the regional population lives in rural areas, and few of these have access to mains electricity. The disruptive ‘new’ technologies of wind, solar, batteries, etc., combined with innovative financing and business models from the private sector—often harnessed through public-private partnership (PPP) arrangements—are increasingly showing that mini-grids are a better solution for these remote rural communities.

The wide range of benefits from interconnecting systems across the region remain valid and generally they should facilitate cheaper and more reliable supplies to customers and to therefore help accelerate the electrification of unserved areas. Most IGAD countries have electrification targets and Ethiopia and Kenya have ambitious targets for universal access to modern energy. However, whilst both countries recognise that achieving the target will require that a significant proportion of households – those in locations that are remote from the existing grid – will be served by mini-grids or other solutions such as solar lanterns, this is viewed as a very temporary measure in Ethiopia and will be closely followed by grid extension/densification. Kenya views mini-grids as a longer-term solution. This subject is highly relevant to the other IGAD countries and touches acutely on the future development of power systems.

Most of the IGAD countries recognise that off-grid solutions such as mini-grids, Solar Home Systems (SHS), solar lanterns (that also facilitate mobile phone charging) are a key element, alongside grid expansion and densification, to achieve universal access to modern energy systems and to thus reduce poverty and improve life-chances. Whereas diesel-based mini-grids are the most common approach to supplying electricity to remote commercial centres in sub-Saharan Africa (SSA), the rapid decline in the cost of wind energy, solar energy and energy storage, has forced a revolution in the approach to the provision of off-grid solutions. These technologies, including mobile phone-based payment systems, when combined with entrepreneurship, eager sources of private finance for renewable energy technologies, and the support of national governments, the donor community, and NGOs, are providing considerably more affordable electricity than diesel-based systems. Kenya is one of the leaders in adopting this approach.

Looking beyond the immediate future, the National Renewable Energy Laboratory (NREL) in the USA has a vision of a decentralised, renewable-powered electricity grid. A project currently under development – Autonomous Energy Grids (AEG) – envisions the electricity grid of the future, where output from many decentralised energy sources is managed simultaneously to ensure a secure and consistent energy supply. The concept focuses on smart technology and autonomous communication, based on a series of interconnected microgrids, which communicate with each other and make use of algorithms to continually find the best operating condition in response to constantly shifting energy demand,





availability, and pricing. This project is currently mostly theoretical and NREL considers that applications may be more than 10 years away.

A homogenous approach to energy access in the IGAD countries is unlikely in the short- and medium-term. The penetration rate of access provision is also likely to vary appreciably from one IGAD country to another. With the track record of technology leapfrogging in countries such as Kenya, the adoption of rapidly emerging disruptive technologies in the long-term vision for the region should be considered.

2.2 Current projections and trends: Demand and Supply Analysis

Most countries in the IGAD region have supply capability that falls short of ‘unconstrained’ demand, which typically results in ‘brown-outs’ from time-to-time. Currently, Ethiopia and Uganda may be exceptions, due to the recent commissioning of major hydropower capacity. These projects, and others in the generation expansion pipeline, are typically predicated on the export of relatively low-cost energy to neighbours that, at the margin, depend on high-cost thermal generation. Ethiopia has ambitions to supply power across the immediate region and—longer-term—well beyond. This is seen as a major source of income for the Ethiopian economy. Several of Ethiopia’s neighbours, such as Sudan and Egypt, are dependent on fossil fuelled generation, which is costly, polluting and a major contributor of greenhouse gas (GHG) emissions. It is unsurprising, therefore, that Ethiopia is exploiting the export earning potential of its hydropower resources.

South Sudan is blessed with oil resources and currently unexploited hydropower resources along the Nile river. Developing low-cost generation in the country, together with the transmission and distribution networks to deliver electricity to end-users, will require considerable resources, including time. In the interim therefore, South Sudan welcomes imports from low-cost exporters such as Uganda and Ethiopia.

The mix and spread of indigenous energy resources across the IGAD region is varied and includes hydropower, oil, geothermal, biomass, etc. Wind energy is potentially available, perhaps most viable in coastal areas and in the Rift Valley. Kenya has installed around 300MW of wind capacity near Lake Turkana, for example, and Ethiopia has plans for at least as much. One energy source that is widespread, however, is solar energy, with most countries in the region having good to particularly good insolation characteristics. Large-scale solar installations are on the increase, although grid-scale projects with export potential are not yet in evidence in the region. As the cost of solar energy continues to decrease, such projects are likely to feature more prominently in national generation expansion plans.

Although there are other benefits from interconnection projects, such as system stability and security, the potential for large-scale energy trade with countries is essential for the project’s economic viability. The availability of surplus capacity in one or more countries is therefore a prerequisite. Uganda has a surplus for at least the short- to medium-term, and Ethiopia plans to have large surpluses for a great many years. Hydropower energy from large schemes is currently appreciably cheaper than most of the other energy sources in the region, which suggests that the other countries are potential importers from Ethiopia and, to a lesser extent,





Uganda. A caveat to this presumption would be if the cost of solar energy continues to decline to a level where it becomes competitive with large hydropower. In this event, individual nations may become less dependent on imports.

The rapid swing in the economic case for electrifying remote rural communities, away from grid expansion and towards mini-grids based principally on solar energy and batteries, brought about by the precipitous fall in the cost of those technologies over the past decade, inevitably has an impact on supply and demand balances. Planners need to establish spatial and temporal lines between grid connection and mini-grids, and to estimate demand in each sub-sector accordingly. Otherwise, grid demand may be over-estimated, leading to surplus investment that results in higher electricity tariffs to end-users.

The focus of the IRIMP is on projects with a transboundary emphasis, rather than generation projects in one or another country. Nevertheless, it is clear from international experience in recent years that solar energy is set to make a marked increase in its contribution to the energy mix in the IGAD member nations, particularly the more northerly nations, where the insolation characteristics are particularly good. Reflecting the major shift in focus in generation options, within the past couple of years the African Development Bank (AfDB) has been prominent in major initiatives to promote large-scale solar capacity in the north of Africa. The potential impact of solar energy is so radical that a brief outline of these initiatives is warranted.

AfDB is aware that in addition to the access and affordability benefits that should flow from solar energy development across the north of Africa, the upscaling of solar will appreciably diversify the energy mix in the region and thus contribute towards climate change adaptation. The Horn of Africa Initiative (HoAI) launched in early-2019 aims to realise the collective desire of countries in the sub-region (a sub-set of the IGAD member countries, namely: Djibouti, Ethiopia, Eritrea, Kenya and Somalia) to deepen regional integration and promote regional cooperation. In the IRIMP context, if—for reasons of solar resource characteristics, logistics, financing, etc.—solar energy projects under the HoAI are concentrated in just one or two countries, such projects could support the case for additional interconnections in the IGAD region. However, the HoAI is currently in the early stages of implementation and projects under the scheme have not—so far—been at a scale that would impact noticeably on cross-border interconnections. The HoAI is, however, consistent with the broad recommendations of the IRIMP.

Broadly contemporaneously with the launch of the HoAI, the AfDB outlined its “Desert to Power Initiative” (DPI) during the Paris Agreement climate change talks at COP24 in Katowice, Poland, in 2018. The DPI focuses on solar energy in the Sahel region, which includes four of the IGAD member countries (Sudan, Ethiopia, Djibouti and Eritrea) and is expected to connect 250 million people with electricity by exploiting the region’s abundant solar resource. AfDB recognises that 64% of the Sahel’s population lives without electricity, and is a major barrier to development, with consequences for education, health and business. The DPI aims to develop 10 GW of solar energy by 2025 and supply 250 million people with green electricity including in some of the world’s poorest countries. At least 90 million people will be connected to electricity for the first time, thus helping to lift them out of energy poverty. The





DPI has been launched in collaboration with the Green Climate Fund, a global financial resource created by the 194 countries who are party to the UN Framework Convention on Climate Change (UNFCCC), to support developing countries adapt to and mitigate climate change. The programme is designed to combine private sector capital with blended finance.

In northwest Africa, a separate element of the AfDB's DPI is being applied: the Sahel-G5 Desert to Power Initiative. The Sahel-G5 DPI applies to 5 countries at the western extremity of North Africa, rather than the IGAD countries at the opposite extremity, but has relevance to the power sector aspects of the IRIMP. The objectives and priorities of the Sahel-G5 DPI are broadly consistent with work to-date under the IRIMP but is more detailed in terms of recommendations on institutional arrangements. One of the five Priorities in the Sahel-G5 DPI is the "Deployment of Decentralised Energy Solutions at Scale", to improve energy access in rural areas, which was covered in the IRIMP Draft Final Report. Other Priorities, however, focus on "utility scale" solar energy capacity, including projects with a transboundary dimension to support WAPP initiatives.

The Sahel-G5 DPI highlights the importance of establishing an enabling environment for private sector participation in solar energy projects, and it is noteworthy that Kenya is perhaps the only IGAD country that has performing well in this respect. The Sahel-G5 DPI, however, is vocal on requiring government commitment to improve the financial viability of public utilities, and for making available resources for technical assistance in the solar energy field. The Sahel-G5 DPI also requires the commitment of governments—together with the mobilisation of financial and human resources—to the establishment of transparent and robust policy and regulatory frameworks relating to private sector participation in solar energy. These recommendations are all endorsed in the IRIMP Draft Final Report.

The Sahel-G5 DPI does not, by itself, provide the significant funding that grid-scale solar energy projects would require. It does, however, offer considerably detailed proposals in areas such as establishing the policy, frameworks and revitalised and self-supporting national power utilities that are a prerequisite for the flow of the required financing. In so doing, a roadmap for the key preliminaries to the roll-out of major solar projects is provided.

A note of caution in respect of solar energy and other 'variable' renewable energy (VRE) sources such as wind, is that beyond VRE concentrations of around 10% in the overall plant mix of a system, network instability can become an issue for the system operator. Some national systems (e.g. Denmark) have around 50% VRE capacity, which operates satisfactorily due to appropriate investment in network infrastructure, control systems, and enhancement of operator skills. Since there is a strong likelihood of rising VRE concentrations in some countries in the region, there is a role for IGAD to promote an understanding of the measures required to safeguard system stability.

2.3 Gap analysis/assessment

Within the context of the IRIMP it is clear that there is a sub-optimum number of cross-border interconnections in the IGAD region, and the few that currently exist do not have the capacity





to fulfil the broad ambitions of the IGAD nations, principally trading across borders to deliver more abundant, more reliable, and lower cost energy to consumers.

Carefully designed interconnections need to be integrated with strong national networks. The infrastructure needs to be supported, however, by robust legal and institutional arrangements to ensure that transactions between participants is on a fair and predictable basis.

Strengthening off-grid and mini-grid services in the IGAD region is another pathway to energy self-sufficiency. IGAD member states need to address a number of issues including: i) where to draw the line between grid expansion and the development of off-grid solutions; and, ii) whether a national government should limit itself to the regulation of off-grid services, or to also develop and operate these grids. Kenya has elected to maximise the role of the private sector in the development of mini-grids, whilst Ethiopia aims to press for grid expansion, and sees off-grid solutions developed by government institutions as a stopgap measure. A route as adopted by Kenya requires an enabling framework extending beyond the power sector, providing comfort to private sector investors – including entrepreneurial international businesses – that projects will be ‘bankable’.

2.4 Intervention Priorities

Short-term

A key priority in the immediate short-term is for new power transmission interconnectors to be developed on the priority corridors so that IGAD member states are connected to at least one neighbour for bilateral energy trading.

To facilitate smooth trading between member states, IGAD needs to establish a Roadmap for progressive integration of the regional power system, together with associated interventions to ensure adequate harmonisation at each step in the integration process. This harmonisation will need to be consistent with EAPP arrangements and therefore it would be advisable for IGAD to request observer status at EAPP meetings. From experience in power pools such as the Southern Africa Power Pool (SAPP), in Southern Africa, harmonisation needs to focus on areas that will facilitate system synchronisation, such as regulations, grid codes, technical standards and operational procedures.

In recognition of the point made earlier that mini-grids are an increasingly viable option for remote rural communities, IGAD needs to develop and implement policies recognising that a significant proportion of the population will only gain access to modern energy in the short-, medium- or long-term through off-grid rather than on-grid solutions. Also, since off-grid solutions, as well as on-grid components, are likely to involve significant RE capacity, IGAD should encourage member countries to prepare Renewable Energy policies. Moreover, IGAD should encourage the approaches and policy instruments adopted successfully by Kenya for off-grid energy solutions.





Medium-term

Over time, and where clear surplus capacity is available or other interconnection merits have a strong business case, additional trans-border power transmission interconnectors need to be developed, and IGAD has a role in promoting and facilitating these. Thus, the beginnings of a regional power grid are created:

- Most IGAD member states will be able to trade with most of the others;
- A cooperative power pool will be formed; and,
- An independent cross-border energy regulator at the regional level will be established.

Harmonisation of planning across the IGAD regional power system should be undertaken to realise the full opportunities afforded by a more integrated regional transmission network.

The technologies and delivery arrangements for interconnecting microgrids are likely to become ever more sophisticated in the coming years. Consequently, IGAD should monitor international progress with such interconnection using smart technology and autonomous communication and encourage this approach in the more remote parts of the IGAD region.

Long-term

During the period 2031-2050, any remaining IGAD member countries should be added to the interconnected system, and this should be a long-term goal for IGAD.

The aim should be for the regional power pool to evolve from cooperative to competitive. As a consequence:

- Energy costs in the region will be reduced;
- Planning for investment in generation and transmission will be undertaken at the regional level;
- The IGAD power pool will be integrated fully in the EAPP.

From the evidence available in 2020, adoption of off-grid and leapfrogging technologies—such as Autonomous Energy Grids—may fill the gaps in the regional power grid and achieve universal access to electricity in the IGAD region. It will therefore be a role for IGAD to monitor progress in this field and, to the degree that it appears viable, encourage and promote its implementation.



Chapter Three: Strategic Framework

Chapter Three: Strategic Framework

3.1 Sector Vision and Strategy

The energy sector vision for 2050 is a system that is interconnected, harnessing the abundant renewable resources available within the region; affordable, utilizing least cost principles for development and operation within and beyond national boundaries; and reliable, providing a strong foundation for the continued economic and social development of the region. The IRIMP is primarily focussed on the provision of trans-border power transmission interconnectors and creation of the regional power grid.

The strategic objectives should, however, also recognise that a substantial proportion of households in the IGAD region live in areas that are not served by an interconnected grid. Although grid extension and grid densification should continue to be the aim, particularly in the medium-term, in the long-term emerging technologies mean that achieving universal access to electricity may be better served through alternative solutions.

The strategic objectives for the three time-periods are given below:

Table 3. 1: Energy Sector Strategic Objectives

Short term (2020-2024) Strategic Objectives	Medium term (2025-2030) Strategic Objectives	Long term (2031-2050) Strategic Objectives
<p>New power transmission interconnectors developed on the priority corridors so that IGAD member states are connected to at least one neighbour for bilateral energy trading, although Eritrea and Somalia are likely to be exceptions to this in the short-term</p> <p>Surplus capacity is essential for significant trade and timely implementation of projects is essential; IGAD to promote good IPP procurement practices, high levels of transparency, and standardised PPAs</p> <p>IGAD establishes a Roadmap for progressive integration of the regional power system, together with associated interventions to ensure adequate harmonisation at each step in the integration process</p> <p>Harmonisation to be consistent with EAPP, and therefore IGAD to request observer status at EAPP meetings</p> <p>Harmonisation to focus on regulations, grid codes, technical standards and operational procedures, that will facilitate system synchronisation</p> <p>IGAD develops and implements policies recognising that a significant proportion of</p>	<p>Other trans-border power transmission interconnectors are completed, where clear surplus capacity is available or other interconnection merits have a strong business case</p> <p>The beginnings of a regional power grid are thus created; most IGAD member states can trade with most of the others; a cooperative power pool is formed; independent cross-border energy regulator at the regional level is established</p> <p>IGAD to monitor international progress with interconnecting microgrids using smart technology and autonomous communication, and encourage this approach in the more remote parts of the IGAD region</p> <p>Harmonisation of planning across the IGAD regional power system</p>	<p>Any remaining IGAD member countries are added to the interconnected system</p> <p>The power pool evolves from cooperative to competitive, reducing energy costs in the region; planning for investment in generation and transmission is undertaken at the regional level; the IGAD power pool is integrated fully in the EAPP</p> <p>Adoption of off-grid and leapfrogging technologies, such as Autonomous Energy Grids, to fill the gaps in the regional power grid and achieve universal access to electricity in the IGAD region</p>



<p>the population will only gain access to modern energy in the short-, medium- or long-term through off-grid rather than on-grid solutions</p> <p>Off-grid solutions, as well as on-grid components, likely to involve significant Renewable Energy capacity, so IGAD to encourage member countries to prepare Renewable Energy policies</p> <p>IGAD to encourage the approaches and policy instruments adopted successfully by Kenya for off-grid energy solutions</p>		
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3.2 Funding Requirements and Financing

Many lending agencies are favourably disposed towards major transmission projects. Unlike large hydropower projects, for instance, they do not have long construction periods and extensive uncertainties and risk factors (geotechnical, hydrological, displaced populations, etc.), and unlike generation projects based on fossil fuel they do not produce adverse contributions towards global warming. Once constructed, the lines have long economic lives, require little maintenance, and face few risks to their serviceability that cannot readily be rectified quite inexpensively. The lending agencies also favour cross-border projects for reasons such as the promotion of trade, the stimulation of cooperation, and mutual economic benefits. On the other hand, however, some of the projects in the Action Plan are over 1,000km long, and some pass-through regions with recent histories of civil unrest on a major scale. In these instances, lenders may seek to manage and mitigate risks through a range of measures. A consortium of lenders may be employed, to spread the risk for any single lender. The consortium may include private sector lenders. National governments may be required to contribute towards the cost, although most IGAD member countries may find such a requirement quite challenging. Private sector participation is not unknown for large transmission lines, but neither is it commonplace. Private lenders charge higher, risk-weighted rates of interest, which increases the borrowing costs. In many cases the private sector is squeezed-out by the major lending agencies who, for the reasons presented above, take a positive view of transmission projects, generally.

The total funding requirements for the 17 projects in the Action Plan through to 2050 is less than US\$6 billion. Three projects account for more than half of this sum, and two of these involve countries—South Sudan and Somalia—that may be considered as having higher than average political risk factors.

3.3 ESIA, Climate Resilience and Safeguards

Most of the transmission interconnection projects identified for implementation in the short-term have had feasibility studies and ESIA's undertaken. Typically, these identify and assess environmental and social impacts of projects, develop and cost any mitigation measures, quantify compensation measures when mitigation is not possible, etc. Power interconnectors





are linear projects, with some of those prioritised in the IRIMP over 1,000km in length, and it is not surprising that projects of this nature encounter challenge from special interest groups, for one reason or another. The projects identified include several that are predominantly through sparsely populated parts of the region. It is inevitable, however, that sections of the routes may impinge on urban areas, farmland, and areas of outstanding natural beauty or nature reserves. Routes need to be established using sensitivity since international experience shows that such projects can be delayed by years, due to cases being taken through the courts.

Most governments and most lenders have safeguarding policies relating to major infrastructure projects. Generally, lenders will not support major projects without a thorough ESIA that has been placed in the public domain for public scrutiny. It is when these studies fail to fully identify impacts, or to press ahead with contentious routings, that challenges are brought. There is perhaps a role for IGAD to ensure that safeguarding in member countries accords with best practice in the industry, otherwise there is a risk of projects being delayed due to strong objections on environmental and/or social grounds. These objections may arise in one country but impact on the partner nations. Major generation projects predicated on significant energy export may be financially exposed if that project is completed but the evacuating transmission line is delayed due to challenges through the courts.

Generally, power interconnector projects in the IGAD region will have significantly positive impacts from a climate change perspective. Most notably, these will facilitate the export of hydropower surpluses in the years ahead, and quite possibly diurnal trade in solar energy if one or more-member country manages to develop substantial grid-scale solar energy capacity.

Power interconnection projects themselves are not particularly exposed to climate resilience concerns. Nevertheless, as already noted, some of the generation projects—most notably hydropower—upon which these lines are predicated, are most certainly subject to the risk of extended dry periods due to climate change

3.4 Risk

Major infrastructure projects in the IGAD region are accompanied by a wide range of risk factors. Power interconnection projects are no exception. SAPP provides experience that is instructive. Whilst that organisation is exemplary in many ways—it is well-managed, has excellent trading platforms, and is built on a substantial transmission network that is integrated across the region—its critical failing is that, in most ordinary circumstances, none of the member countries has surplus power to export. The volume of energy traded through SAPP is a miniscule proportion of the total energy generated in the region. In theory, this failing ought not to be replicated in the IGAD region because both Ethiopia and Uganda are scheduled to have significant surpluses for several years ahead. However, these surpluses arise from major hydropower projects, and, in common with all such projects, are subject to hydrological variations: wet years, dry years, droughts extending over multiple years, etc. Based on historical hydrological records, however, the ‘firm’ and average energy output of





these hydropower projects are well-established, and these form the basis for the plans to export large volumes of surplus energy. Global evidence over the past three decades, however, indicates that historical records cannot be relied upon to predict the future, due to the climate change caused by global warming.

Political risk is present in the IGAD region, which is a negative factor for stakeholders. At the same time, however, this is also one of the attractions of power interconnection projects for the major MLAs. It is widely considered that nations which cooperate for trade, to mutual economic benefit, are less likely to have significant cross-border conflicts. Also, since interconnection projects should serve to lower electricity tariffs and improve access and affordability, these benefits ought to help mitigate the risk of civil disturbances within national borders.

As remarked above, there is a possibility that the burgeoning penetration of the disruptive technologies such as solar energy and storage will accelerate the use of mini/microgrids, at the expense of grid expansion and densification, thus reducing opportunities for cross-border trade. Looking further ahead, interconnecting these microgrids may add to this situation. A more likely scenario in the event of continued decrease in the cost of these technologies, and principally solar energy, some of the IGAD member countries may develop grid-scale solar farms with cost advantages over hydropower imports. Heightened self-sufficiency would diminish the volume of cross-border trade. It would not eliminate the advantages of interconnection, however, since solar (and wind) energy is subject to high levels of variability, and this variability can be mitigated through geographical diversity across the region, provided an interconnected network enables this diversity.



Chapter Four: Action Plan

Chapter Four: Action Plan

4.1 Implementation Plan

The IRIMP study has identified a total of 17 projects to enhance regional energy interconnection in the region for the period 2020 to 2050, which have been assessed in greater detail as part of the prioritisation process for inclusion in the Action Plan. The key risks to implementing power transmission interconnector projects are: the financing and/or construction of major projects suffer delays; and economic downturns or civil disturbances slow the growth in demand. Consequently, interconnection plans need to be reviewed regularly, and with a higher degree of rigour than some of the regional studies that have advocated major transmission links.

Table 4. 1: Potential power transmission Interconnectors in the IGAD region

Member states	Voltage / Construction	Horizon	Comment
Uganda-South Sudan	400kV / double circuit	Short	No feasibility studies have been undertaken for this interconnector, though both governments signed an MoU in 2015 committing themselves to the project
Sudan - Eritrea	66kV	Short	Development of 66KV power interconnector in Eritrea – an extension of the 66kv power line from Kassala to Aligider. New feasibility studies to be undertaken on the Eritrean side for this interconnector
Ethiopia-Sudan (Eastern Africa Green Power Transmission Network Project 6 – Guba (Ethiopia)-Khartoum (Sudan))	500kV / double circuit	Short	A feasibility study 2016 confirmed the viability of a 500kV double circuit interconnector, which would complement the existing 230kV interconnector. The new line would run from the Grand Ethiopian Renaissance Dam (GERD) and would have a capacity of 3,000 MW
Sudan-South Sudan	220kV / double circuit	Medium - Long	According to EAPP 2014 Master Plan, was to be completed before 2025 with 300 MW capacity. However, little progress in developing project in the intervening five years
Ethiopia-Somalia	230kV	Medium	Connecting Jijiga, Ethiopia to Hargeisa and Berbera, Somalia, project was included in the Horn of Africa Initiative, but little progress has been made to develop the concept. Interconnections between Ethiopia and Somalia remain a priority for the HOAI, and they have highlighted the need for a feasibility study.
Kenya-South Sudan	400kV / double circuit 220kV	Medium	Would connect a 100MW hydro power plan at Turkwel to Kapoeta and Juba in South Sudan. Interconnection between Kenya and South Sudan was discussed at a recently meeting between the Presidents of Kenya and South Sudan. At present no MoU exists between the countries.
Ethiopia-Djibouti	230kV	Short	The differential between the marginal cost of hydropower energy from Ethiopia and thermal capacity in Djibouti is such that further transmission capacity may be required in the medium term. This second interconnector between the two countries has been identified as a priority by the HOAI.
Ethiopia-South Sudan (two projects)	230kV and 400kV	Medium	Two interconnectors are proposed: 230kV from Gambella, Ethiopia to Malakal, South Sudan and 400kV from Dedesa Tepi, Ethiopia to Bor and Juba, South Sudan





Ethiopia-Eritrea	230kV	Medium	No progress on implementing the project beyond concept in EAPP 2014 Master Plan. However, HOAI has identified the need for a feasibility study for this interconnector.
Eritrea-Sudan	230kV	Medium / Long	No progress on implementing the project beyond concept in EAPP 2014 Master Plan
Kenya – Somalia	220kV	Long	Feasibility study to be undertaken on the Somalia section. HOAI has identified the need for a feasibility study for this interconnector. The timescale for implementation remains uncertain.
Djibouti-Somalia	230kV	Long	HOAI has identified the need for a feasibility study for this interconnector. The timescale for implementation remains uncertain.
Kenya-Ethiopia	400kV	Medium / Long	HOAI has identified the need for a feasibility study for this second interconnector between the two countries. The timescale for implementation remains uncertain. The routing is uncertain at this stage, but likely to be to the west of Lake Turkana.
Multiple 220kV Power Transmission Interconnectors to power the LAPSSET	220kV	Short	These projects are in the 2015 KETRACO development plan and are needed to facilitate interconnections with Kenya's neighbouring countries in the LAPSSET corridor.
Garissa – Wajir – Mandera 220KV power transmission line	220kV	Long	This project is also in the 2015 KETRACO development plan and is needed to facilitate the interconnection with Somalia in the Mogadishu corridor, from Mandera.
Upgrade to 400kV on Kenya-Uganda interconnector Tororo - Kampala	400kV	Long	This line is entirely in Uganda, and completes an upgrade to the Kenya-Uganda interconnector.
Ethiopia-Somalia	500kV	Short	This interconnector is a Horn of Africa Initiative project and is understood to run from near Addis Ababa to Mogadishu. Although a short-term priority, no feasibility study has been conducted.

These projects—differentiated into short-term (2020-2024), medium-term (2025-2030) and long-term (2031-2050)—are tabulated below:





Table 4. 2:Infrastructure Development Programme: Short-term Plan (2020-2024)

Project	Value (in million USD)	Corridor	Sector	Sub-Sector	
EPIMo03	Ethiopia – Somalia Interconnector (500kV) (Horn of Africa Initiative)	1188	Mogadishu Corridor	Energy	Power Interconnector
EPIPO6	Ethiopia-Sudan (500kV) Transmission Interconnector (Eastern Africa Green Power Transmission Network Project 6 – Guba (Ethiopia)- Khartoum (Sudan))	514	Port Sudan Corridor	Energy	Power Interconnector
EPIM07	Sudan - Eritrea 66kv power interconnector (Eritrea Section)	8	Massawa Corridor	Energy	Power Interconnector
EPIL08	Multiple 220kV Power Transmission Interconnectors to power the LAPSSET corridor	232	LAPSSET Corridor	Energy	Power Interconnector
EPID12	Second Ethiopia – Djibouti 230kV Power Transmission Interconnector	100	Djibouti Corridor	Energy	Power Interconnector
EPIN15	Uganda – South Sudan Interconnector (400kV)	300	Northern Corridor	Energy	Power Interconnector

Table 4. 3:Infrastructure Development Programme: Medium-term Plan (2025-2030)

Project	Value (in million USD)	Corridor	Sector	Sub-Sector	
EPID23	Ethiopia – South Sudan Interconnector (400kV)	235	Djibouti Corridor	Energy	Power Interconnector
EPID24	Ethiopia – South Sudan Interconnector (230kV)	100	Djibouti Corridor	Energy	Power Interconnector
EPIL16	Kenya – South Sudan Interconnector (220kV)	85	LAPSSET Corridor	Energy	Power Interconnector
EPIB07	Ethiopia – Somalia Interconnector (230kV) (Horn of Africa Initiative)	40	Berbera Corridor	Energy	Power Interconnector
EPIM09	Eritrea – Sudan Interconnector (230kV)	140	Massawa Corridor	Energy	Power Interconnector
EPIM10	Eritrea – Ethiopia Interconnector (230kV) (Horn of Africa Initiative)	75	Massawa Corridor	Energy	Power Interconnector

Table 4. 4:Infrastructure Development Programme: Long-term Plan (2031-2050)

Project	Value (in million USD)	Corridor	Sector	Sub-Sector	
EPIN34	Kenya – Uganda upgrade on Uganda side to 400kV	520	Northern Corridor	Energy	Power Interconnector
EPID34	Djibouti - Somalia 230kV Power Transmission Interconnector	100	Djibouti Corridor	Energy	Power Interconnector
EPIP32	Sudan – South Sudan high voltage power transmission interconnector (Khartoum – Kosti – Renk – Malakal – Juba high voltage power transmission interconnector)	1152	Port Sudan Corridor	Energy	Power Interconnector
EPIL29	2 nd Kenya – Ethiopia 400kV Power Interconnection (Horn of Africa Initiative)	1115	LAPSSET Corridor	Energy	Power Interconnector
EPIM020	Kenya – Somalia power transmission line (Somalia section) (Horn of Africa Initiative)	192	Mogadishu Corridor	Energy	Power Interconnector
EPIMo21	Garissa – Wajir – Mandera 220kV power transmission line	192	Mogadishu Corridor	Energy	Power Interconnector





4.2 Prioritised projects and PIDA 2 Alignment

The PIDA PAP 2 projects were based on the IRIMP analysis and IGAD Joint Steering Committee priorities:

Table 4. 5: Prioritised IRIMP Action Plan Projects for PIDA PAP 2

Project	Sector	Sub-Sector	Cost (US\$ M)	Corridor	Country(ies)	
EPIN15	Uganda – South Sudan 400kV Power Transmission Interconnector	Energy	Power Interconnector	300	Northern	South Sudan, Uganda
EPID12	Second Ethiopia – Djibouti 230kV Power Transmission Interconnector	Energy	Power Interconnector	100	Djibouti	Djibouti, Ethiopia
EPIPO6	Ethiopia – Sudan 500kV Power Transmission Interconnector	Energy	Power Interconnector	514	Port Sudan	Ethiopia, Sudan
EPIMo03	Ethiopia – Somalia Power Transmission Line ¹	Energy	Power Interconnector	1188	Mogadishu	Ethiopia, Somalia
EPIM07	Sudan - Eritrea 66kv power interconnector (Eritrea Section)	Energy	Power Interconnector	8	Massawa	Sudan, Eritrea
EPIM020	Kenya – Somalia Power Transmission Line	Energy	Power Interconnector	192	Mogadishu	Somalia, Kenya
EPIL08	Multiple 220kV Power Transmission Interconnectors to power the LAPSET corridor	Energy	Power Interconnector	232	LAPSET	Kenya Somalia

Three power interconnector projects were included in the PIDA PAP 2 programmes, as follows:

- Uganda – South Sudan power interconnector (400kV) - Short Term
- Ethiopia – Sudan power interconnector (400kV) - Medium Term
- Ethiopia – Somalia power interconnector (400kV) - Medium Term

All three of these projects are included in the five projects prioritised for the IRIMP.

Two of the five IRIMP priority projects require a degree of qualification. Firstly, although there is understandably great urgency for adequate and affordable electricity supplies in Mogadishu, no feasibility study has been conducted to-date. The route, voltage and capacity of the line have not been subject to the level of investigation consistent with “bankable” status. The cost of the line is estimated to be in the order of US\$1 billion and an investment of this magnitude, however urgent the need, requires thorough and time-consuming investigation. Secondly, although the second Ethiopia-Djibouti interconnector would appear to make sound economic sense, due to the scope for abundant and reasonably-priced Ethiopian hydro energy to displace relatively small-scale thermal generation in Djibouti, in recent times the government of Djibouti appears to have veered towards establishing a high degree of self-sufficiency in electricity, based on new fossil-fuelled generation capacity.

¹ No feasibility available. Route assumed to be from near Addis Ababa (Nazret?) to Mogadishu. 1080km. 500kV DC most likely. Cost estimate based on similar line in region.





4.3 Enabling Environment, Institutional Arrangements and Capacity Development

The physical infrastructure projects that comprise the IRIMP will be implemented by member states, coordinated at the corridor level by a Corridor Management Institution (CMI), with the IGAD Secretariat providing oversight, advocacy and acting as a facilitator for discussions with donors, IFIs and multilateral institutions including other RECs, AU etc. and building consensus among member states.

Capacity building for the relevant agencies and improving the professional skills of agency staff is critical to for the successful implementation of the IRIMP. The IGAD region has access to various institutions and manpower within itself or the rest of the world that can be applied to build capacity for its member states. One of the key functions of the IGAD Secretariat would be coordination in identifying capacity requirements in member states and potential institutions that could provide capacity building.

Some of the key actions that the IGAD Secretariat can undertake to support capacity building in the member state line agencies for successful implementation the plan includes the following:

- Promotion of integration and meaningful participation of key stakeholders in policy formulation, planning and monitoring;
- Promotion of sustainability of key institutional actors for continuity through offering government support; and
- Improvement and bolstering of communication channels for systematic and continuous flow of information to all stakeholders.

Specifically, with respect to power interconnectors, national utilities will require enhanced skills relating to the planning, construction, and operation of the physical infrastructure. In addition, they will need skills in harmonisation of regulations, grid codes, technical standards and operational procedures. Skills in trading electricity through platforms such as power pools will also be extremely important.

Recognising the limited availability of grant and concessional finance, and the already high sovereign debt levels of IGAD member states, private sector sources should be used to finance infrastructure wherever possible. All feasibility studies need to explore options for making a project commercially viable. In contrast with some sectors addressed in the IRIMP, power interconnectors are more likely to meet the hurdle requirements of lenders. Historically, the MLAs have looked favourably on transmission projects, especially those that: promote cross-border trade; promote shared—and hence reduced—investment in reserve generation capacity; and, improve system stability and reliability.

Trading electricity through a regionally interconnected grid provides a range of benefits to end-users in the region, notably due to more reliable and lower cost energy. The benefits are most cost-effective, however, when at least some of the countries have significant energy surpluses with which to trade during the seasonal cycle. A national surplus of supply over demand is more speedily attained and sustained if energy efficiency and conservation (EE&C)





constitutes a key element in that nation's energy policies and planning: suppressing demand through investment in energy efficient technologies and practices. It is therefore recommended that IGAD seeks opportunities to promote EE&C in the member countries.

4.4 Key Success Factors and KPIs

Transboundary projects such as power interconnectors are subject to a wide range of risk factors, as discussed above. Although such projects represent major engineering undertakings, the key factors critical to successful implementation are rarely of a technical nature.

Key success factors include:

- Commitment of the partners
- Clear and equitable legal/contractual arrangements
- Institutional capacity of all key actors
- Skills and human capacity in bilateral trading and in the operation of transboundary assets

The parties to a power interconnector must be committed to the vision that underpins the project. The vision envisaged by IGAD, the EAPP and the IRIMP has been outlined above and, in brief, is a future in which the IGAD member countries plan the regional power system in a manner that is optimal economically and robust to the extant risks and uncertainties. A key element of this vision is therefore trading across borders on a routine basis and, potentially, in both directions. If one party views the role of an interconnector solely to export their energy surpluses, this would demonstrate a lack of commitment to the vision and a potential source of delays to implementation or contractual difficulties post-completion. The Greater Mekong Subregion in Southeast Asia has several major power interconnectors between the six countries in the region, but these are almost entirely dedicated lines to export power to one other country. There is virtually no bilateral trade of the type envisaged by the EAPP.

Equitable arrangements must be established for sharing the costs associated with a power interconnector. Such arrangements are well established in the industry. Except in certain circumstances—for example, where an interconnector is dedicated to evacuating all the power from a project in one country to a utility in another country—each country would be responsible for the capital and O&M costs for the infrastructure in their own country. For energy being 'wheeled' through an intermediary country, a regionally agreed wheeling formula is required, preferably based on a recognised transmission pricing methodology.

The power sector in some IGAD member countries remains state-owned and vertically integrated. In others, the sector has been reformed, unbundled and, in some cases, at least partially privatised. Sectors with private sector participants usually designate a 'single buyer', and this is often the transmission entity. Future participation in the EAPP may require the single buyer to trade through the power pool. This is likely to involve a degree of reorganising institutions, investment in systems, and enhancement of skills. SAPP or WAPP, the West





Africa equivalent of SAPP, may be able to provide capacity building advice and training in this respect, and there is a role for IGAD to coordinate this.

In addition to the critical success factors outlined above, a sound understanding of the technical issues relating to interconnectors is essential from the outset. Ideally, an interconnected network as envisioned by IGAD and the EAPP would be fully synchronised. This would avoid the necessity for AC to DC and DC to AC conversion infrastructure at the border, together with the associated investment cost. Unstable national networks, with large fluctuations in frequency, are unsuited to synchronisation. Such networks would need to be upgraded to conform with a common grid code for the interconnected network. Accordingly, a priority recommendation of the IRIMP is for the IGAD countries to harmonise their regulations, grid codes, technical standards, and operational procedures. This harmonisation needs to be consistent with the equivalents applicable in the EAPP, and hence the IRIMP recommendation that IGAD should request observer status at EAPP meetings.

4.5 The IRIMP Implementation Strategy

The IRIMP energy physical infrastructure projects that comprise the IRIMP will be implemented by member states and coordinated the IGAD Secretariat. Coordination will be essential in interactions with IFIs and multilateral institutions including other cooperating partners and donors. Coordination will also be necessary in building consensus among member states and also with other RECs and the African Union.

Role of IGAD Secretariat

The role of the IGAD Secretariat in implementing the cross-border energy physical projects will be in issues such as marketing of the projects to private sector and IFIs, organising investor forums, proper and harmonised enabling environment, projects bankability, ensure projects included in PIDA etc.

IGAD has to ensure harmonisation of policies and regulations necessary for the energy projects to create a proper and predictable enabling environment to attract private sector investment, technical and management knowledge. It is essential to have a regional regulatory framework which can include cross borders interconnection and agreement. It is important to establish a regional regulatory association to lead the harmonisation process.

IGAD Secretariat has also to play a great role in capacity building to ensure transfer of technology which will reduce the cost of projects development. It is also important to strengthen the energy regulatory authorities and train their technical staff.

IGAD Project Preparation Unit (IPPU) has to enhance the relation with the focal points in the Member States to fast track the implementation of the cross-border energy projects and collect information to update the projects. IPPU has also to mobilise financial resource to implement bankable projects and also do feasibility study for those projects which are not yet ready.





Role of Energy Regulatory Authorities

The energy regulatory authorities in IGAD region have to develop the appropriate regulations necessary for cross-border energy projects and programmes in close cooperation with national energy stakeholders, IGAD, AUC and other regional and continental institutions. The regulations should be developed based on the IGAD ones to ensure harmonisation to attract investment. The regulations have to be predictable and harmonised with regional ones. They have to ensure affordable, reliable, affordable and sustainable cross borders energy interconnection and services.

