CHAPTER ONE

INTRODUCTION

Electricity is said to be the driver of economic development partly because it increases productivity levels not only in the manufacturing sector but also in Information and Communication Technology (ICT) service driven sectors like health and banking. Electricity is crucial in maximising efficiency in the above-mentioned sectors. Most African countries suffer blackouts[1] which have translated into slow economic growth, increase in the cost of living, and low levels of investments due to high production cost and an unsatisfied population which often tend towards protests and consequently, chaos and loss of lives. The inadequate supply of and lack of access to electricity has contributed to an electricity insecure continent considering issues like unevenly distributed energy resources. Electricity security is reached when it becomes available, accessible and affordable by the people. Despite Africa's abundance of natural (energy) resources, only a handful of countries can boast about constant supply of electricity to households; even at that, rural communities in these countries have a different tale to tell. As electricity insecurity[2] is one of the major challenges on the continent, it reinforces the need for states to come together in an effort to mitigate this problem. Electricity is generated using energy resources like coal, natural gas and traditional biomass. Hereon, the term 'electricity' will be used interchangeably with 'energy'.

Linking Electricity to Economic Development

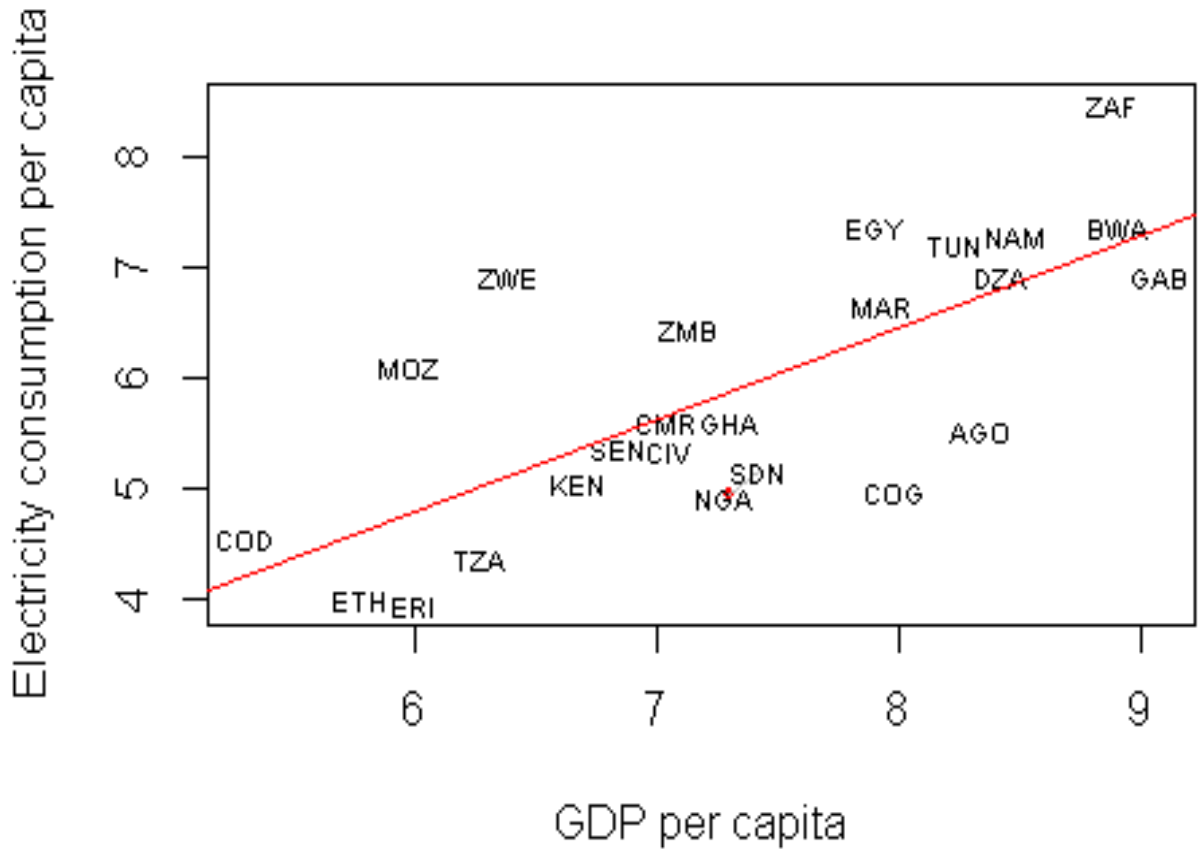
Development in Africa cannot occur without a constant, uninterrupted and affordable supply of electric power. This is because electricity is required in powering urbanisation, industrial growth and service delivery which improves standards of living. For instance, cutting-edge banking is based on Information and Communication Technologies (ICTs) and electric power is needed to keep such functional. Other crucial goods and service delivery sectors like hospitals, schools and the manufacturing industry require electricity to operate. This does not imply that an undisrupted supply of electricity alone is required to facilitate economic

[1] Black-out is a term used to describe power outages.

[2] Electricity insecurity here means the fear, doubt and uncertainty people have on the supply of electricity for their domestic use.

development. However, it plays an important role. The manufacturing industry can only be functional when there is efficient hands on-deck but a constant supply of electric power reduces cost of production of goods and services. The work force can only be productive when they have access to affordable basic social amenities, good working conditions and constant inflow of income. In a nutshell, electricity plays a vital role in facilitating both human and economic development.

Figure 1: A SCATTER PLOT SHOWING THE CORRELATION BETWEEN ELECTRICITY CONSUMPTION AND ECONOMIC GROWTH



The above scatterplot graph is a representation of the relationship between electricity consumption and economic growth measured in Gross Domestic Product (GDP) per capita in Africa. In making the graph, the level of electricity consumption and the corresponding GDP per capita for the year 2010 were used. The dataset was gotten from the World Bank's

African development indicator[3] and the original sample size was 53 African countries. After excluding those with missing data on either "electricity consumption per capita" or "GDP per capita" or on both, the sample size reduced to 24 observations. The red 'regression' line is an upward slope showing a positive relationship between electricity consumption and economic development measured in GDP per capita. It shows that the higher the level of electricity consumption, the better GDP figures become. A closer look at the countries in the scatterplot further explains this correlation. Nigeria is the world's second worst country in terms of access to electricity according to World Bank reports. Its electric power consumption (kilowatt) per capita in 2010 was 136.5 kWh per capita and a corresponding GDP of $1443.2 per capita as opposed to South Africa's 4802.5 kWh per capita and a GDP of $7271.7 per capita.[4] Looking at the two Congo's there is evidently a huge difference in their rankings. While the Democratic Republic of Congo (DRC) electricity consumption was at 95.2 kWh per capita with a corresponding GDP of $198.7 per capita and its counterpart, the Republic of Congo with a 145.4 kWh per capita of electricity consumption and a corresponding GDP of $2970.1 per capita. The variations in these results reiterate the importance of electricity in powering economic development.

Why do states enter into sub-regional agreements? Conventional wisdom holds that it results in shared costs and higher levels of transparency and accountability. It is also a strategic way to attract aid or investments. Regional cooperation is deemed as one of the effective ways Africa can tackle its many developmental challenges including energy security issues. This allows for division of labour and cost of operation between cooperating members which should in theory, lead to more accountability, transparency and efficiency in reaching set goals. The gain of collective action is envisioned before states sign on to an agreement. The potential for cooperation to produce mutual benefits are high but they often fail to achieve the set goals. The focus of my study is on sub-regional electricity cooperation and the challenges they face. Using two prominent power pools in Africa, the Southern African Power Pool

[3]The dataset was gotten from: http://data.worldbank.org/data-catalog/africa-development-indicators and the respective variables that is, "electricity consumption per capita" and "GDP per capita" were selected, downloaded and cleaned to suit the context of the study. The natural logarithms of both variables were taken to keep the figures smaller and manageable.

[4]The GDP per capita was measured in Current US Dollar rates as of 2010.

(SAPP) and the West African Power Pool (WAPP), my study addresses the issues facing this cooperative initiatives.

In power pooling arrangements, some countries stand more to gain than others because of the inequalities among cooperating states in terms of natural resource endowment, size of population, geographical location and strength of the economy. While this is a good proposition in theory, reality is often characterised by unresponsive members and consequently a constant increase in the target dates. This shows that the real problem here is not that of deciding to cooperate but rather sustaining the cooperation among participating members to reach set goals on set target dates. Considering that managing a sub-regional energy scheme raises a number of complex issues like cross-border issues of distribution and generation of energy, coordination by a number of national governments in a respective region and huge national cost considerations despite the potential it poses, political will and commitment from all participants is of the essence. Using the Southern African Power Pool (SAPP) and the West African Power Pool (WAPP), this research report seeks to understand the challenges of cooperation. There are huge potential benefits to sub-regional power pool arrangements but despite this there are temptations for individual national utilities to pursue national projects instead of regional ones as a result, commitment to cooperation becomes minimal. The analytical tool this report uses is the Stag Hunt game theory. It exposes the main concerns of actors in a joint-venture initiative.

The lack of trust among collaborating states is a major impediment to a successful regional cooperative arrangement. Where collaboration is involved, the behaviour of one state is dependent on the collective action of others. Individual strategic interests can negatively influence cooperation outcomes. This explanation offers a fresh perspective from the conventional assumption that African governments lack the political will and commitments to execute cooperative initiatives coupled with poor enforcement mechanisms and weak institutions. This report does not argue that these explanations are invalid rather it asserts that if the strategic interests of actors are not aligned, cooperation will not take place even if there are strong institutions and enforcement mechanisms in place.

The methodological approach to answering my research questions will comparatively assess two prominent power pools in Africa – the Southern African Power Pool (SAPP) and the West African Power Pool (WAPP). An assessment of the generation capacity and the resource profiles of the respective power pools provide an insight into their design and dynamics. Initiatives such as the Western Corridor Project (WESTCOR) and the Coastal Transmission Line Backbone project (CTB). This improves understanding of the bargaining chips states bring to the table in negotiating a cooperative arrangement.

The case study method allows for the exploration and understanding of complex issues, it allows the researcher to closely examine a concept, theory or hypothesis within a specific context.[5] This approach is often accused of lacking rigour, allowing biased views to influence the direction of findings and conclusions. It is also criticised for depending on a single case exploration which makes it challenging to generalise findings.[6] To make up for these limitations, I use two case studies to carry out a comparative analysis in order to broaden the representation of my findings.

To assess the levels of cooperation within both institutions and to understand the challenges they are currently facing, I will consult policy documents from the respective pools, scholarly articles, news articles, statistical data and archival records. While the first has information on the dynamics of the institutions, the second are interpretations made by experts in the field of energy security in Africa through regional cooperation. The news articles, statistical data and archival records are usually kept by the pools which provide updates on meetings, progress and challenges faced. An example of such document is the SAPP Sustainability Bulletin found on the SAPP website.

The next chapter will discuss the Stag Hunt Game theory as the analytical tool for assessing (sub) regional cooperation. Chapter three will give a background to the establishment of the

[5] Zainal, Z., "Case Study as a Research Method", http://eprints.utm.my/8221/l/ZZainal2007-Case_study_as_a_Researcher.pdf, 2007, p. 1.

[6] Ibid. p. 5.

respective power pools, an energy profile of the two sub-regions and a discussion of the above-mentioned projects. This will further understanding of the challenges of pooling resources together. Chapter four applies the Stag Hunt Game theory to the power pool initiative. It discusses the obstacles the pools had to face in implementing the respective projects. Issues around funds, infrastructure development and institutions will also be discussed. Chapter five will offer a general discussion on the subject-matter and conclusions.

CHAPTER TWO

ANALYTICAL FRAMEWORK – THE STAG HUNT OR 'ASSURANCE' GAME

Blackouts as a result of shortage in electricity supply have emerged as a real threat to the steady economic growth experienced by African countries in recent years. This threat and the various constraints facing individual national power utilities coupled with the unequal distribution of natural (energy) resources has provided a strong rationale away from national self-sufficiency in favour of collective or regional approaches to energy security issues. As a result, power generation and transmission projects are increasingly pursued collectively in the context of sub-regional joint ventures through a number of African regional arrangements known as sub-regional power pools. Power pools are multinational organisations, dealing with grand projects but the operation and management of these power pools present new challenges in this sector.

The success of a power pool initiative is dependent on the strength of cooperation among collaborating member states. But cooperative initiatives are not clear-cut: it involves the signing of agreements which require the political will and commitments of states and the necessary financial and human resources to see the projects to completion. In any type of cooperative agreement, a country's behaviour is influenced by its socio-political structure, the structure and flexibility of its economy as well as its strategic (national or self) interest.[7] For these reasons, states tend to go for the best possible outcome in their interest. The fact is that in cooperative agreements, stakes are high. Some states have more to gain and others more to lose, the ability to harmonise these two conflicting outcomes is prerequisite to achieving cooperation. The collective management of resources are challenging and each player's behaviour is dependent on the cost and benefit evaluation of the various available outcomes as well as on the expectations regarding the choices of other actors.[8] In this chapter, I focus on the challenges individual member states encounter in an attempt to reach a successful

[7] Aggarwal, V. K. and Dupont, C. "Collaboration and Co-Ordination in the Global Political Economy", in Ravenhill, J., Global Political Economy (2nd ed.), Oxford University Press: New York, 2008, p.69.

[8] Ibid. p.73.

cooperative agreement. To do so, I use game theory, the Stag Hunt game, as the analytical tool.

Game theory is very essential in analysing issues around interdependence in international relations. It has a predictive aim and also aids in explaining and investigating complex issues to guide the researcher in prescribing solutions.[9] However, it has its weaknesses. Game theory has been criticised for being too emphatic on the concept of rationality – this implies that the theory assumes that actors have access to information or have high computational skills which enable them to consistently evaluate their options before making decisions.[10] Although this is not always the case, I argue that in strategic cooperative initiatives (like electricity) actors are obliged to weigh their options. States do not just sign cooperative agreements for the purpose of being a part of the region; cooperative agreements cause states to relinquish a part of their sovereignty to other states whose decisions impact on the functioning of their states. Hence, it is important that actors evaluate the cost and benefits of joining a regional joint-venture. States would not participate in cooperation if the cost is more than the benefit. Game theory has also been criticised for being unable to fill the gap between abstract theoretical concepts and real life phenomena.[11] I make up for this weakness by applying the game to case studies to analyse the behaviour of states in sub-regional electricity cooperation in the Southern and the West African regions.

According to the game theory, the challenges of cooperation are inherently grouped into three categories: temptation to free-ride, fear of abuse and a point at which to coordinate.[12] The main point of the free-riding temptation also known as the Prisoner's Dilemma game is that actors may encounter a situation which prevents them from reaching a cooperative solution even though that solution will be beneficial to all parties involved. For example, when a group of actors collaborate to reach a certain goal, the cost and benefit accrued to such targets

[9] Loc cit.

[10] Loc cit.

[11] Loc cit.

[12] Loc cit.

are not evenly distributed. As a result, some actors feel that they can maximise their benefits by 'free-riding' on the cooperative activities of others. Free riding implies that some states do not put in the required efforts but enjoy the benefits of others committing to the initiative.[13] Cooperation reaches deadlock because other actors feel cheated and therefore quit. The 'where-to-meet' or coordination game is about actors choosing mutually beneficial options which will benefit all parties involved but actors often tend to do what is in their individual best interest.[14] Here, actors struggle to find the best strategy to help them reach their target because everyone wants to be better off than the others. As a result, there is conflict of interests and collaboration collapses. Both games highlight the challenge(s) of individual rationality versus mutual benefits – the failure of actors to align individual interests with the regional one.[15] The Stag hunt game captures another different challenge to cooperation – this will be the focus of this chapter.

The Stag Hunt game is also known as the 'Trust Dilemma' or the 'Assurance' game.[16] This theory got its name from a story of two hunters pursuing a stag.[17] These hunters are faced with two options: hunt the stag – they would both have huge portions of the meat for food – or hunt the hare, and have a smaller portion of meat. The catch here is that their cooperation in this hunting game ensures collective gains which leave them better off. Hunting the stag together will fetch them bigger portions of meat than the hare. If one of the hunters defects and chases a hare instead, he reduces the chance of the other getting that huge piece of meat as the stag will escape. The defector will at least have a hare for his meal while the other party will starve (because having shot the hare, the other hares and the stag ran away). If both chase hares, they would each have smaller portions of meat compared to what they would have enjoyed if they cooperated to hunt the stag. As the day grows old, both hunters are starting to think that going home with a hare is better than going home with nothing but each

[13]Pasour, E. C. Jr., "The Free Rider as a Basis for Government Intervention" in The Journal of Libertarian Studies, Vol. V, No. 4., Fall 1981, p. 453.

[14]Aggarwal, V. K. and Dupont, C. Op. Cit. p. 76.

[15]Skyrms, B.: "The Stag Hunt" in American Philosophical Association, Vol. 75, No. 2, Nov. 2001, p. 32.

[16]Aggarwal, V. K. and Dupont, C., Op. Cit., p. 75.

[17]Ibid.p. 75.

of them thinks the other will yield to the temptation of shooting a hare first. Both hunters have a mutual preference for the stag but as the day goes dark, both are tempted to go for the worse off outcome – a hare each (compared to the stag) rather than go home empty handed (which is worse than having the hare).[18] Yet, no one is willing to make the first move until the other party does so. In a Stag Hunt game therefore, the action of one party is dependent on the behaviour of others in the collaboration. According to this game theory, maximum gains are possible through collective action; any other type of action (unilateral defection) produces sub-optimal gains.[19]

As strategically rational actors, each hunter chooses the option that yields the most preferred outcome for each of them. In this game, the best option for each of them is to hunt the stag. By repeatedly interacting with each other, the assurance that both will put in commensurate effort to get the stag is improved. A scenario wherein one government blatantly reneges on meeting its commitment puts the rest of the party in a dilemma. In the Prisoner Dilemma theory, punishments like sanctions or expulsion from the cooperative initiative is viable but in the stag hunt game theory, expulsion is unfavourable. For example, regional infrastructure development requires all collaborating states to be committed with their capital and other necessary resources contributed by a monthly quota to complete the project. In a case where one states defects to pay the monthly quota, expulsion is unnecessary except another state is willing to cover the cost which the defecting country failed to pay. Here, the other states in the joint-venture program have the following options: assure the defecting state that cooperating with them is in its best interest; find an alternative means to getting the funds (aid or loans); or completely abandon the project. The threat of the third option occurring in regional cooperation is imminent in joint efforts and can be costly to other states who have already contributed their resources into the project. No state wants to be in the dilemma of the third option so commitment to a regional project becomes insecure.

[18]Poundstone, W., "Stag Hunt" in Excerpts from Prisoner's Dilemmma. Accessed in July 29, 2013, http://www.heretical.com/pound/staghunt.html

[19] Moshoeshoe, M. L. "Multiple Logics of Collective Action: A Comparative Study of Cooperation in the Southern African Development Community", *Thesis submitted in partial fulfilment for a Degree of Doctor of Philosophy*, March 2012, p. 134.

Figure 2: The payoff matrix for the Stag Hunt Game

Government 2

Government 1	Hunt Stag	Chase Hare
Hunt Stag	3, 3	1, 2
Chase Hare	2, 1	2, 2

The payoff matrix above illustrates the various outcomes and consequences in a cooperative initiative. The optimal outcome is when there is mutual cooperation as in (Hunt Stag, Hunt Stag) with the output of (3, 3). This is where both hunters get bigger portions of meat from the Stag. The better outcome is unilateral defection (Chase Hare, Hunt Stag) with an output of (2, 1). Here, the player who defects in chasing a Stag but opts for a Hare at least gets a meal while the other is left with nothing as his chances of hunting the Stag is reduced. Mutual defection (Chase Hare, Chase Hare) with the output of (2, 2) leaves both parties worse off compared to the benefits of mutual cooperation seen in (3, 3). This is also known as the Nash Equilibrium. A Nash Equilibrium is a situation where each player cannot improve his or her gains by changing his or her individual strategy.[20] As both have opted for a Hare, they cannot add on to the quantity of meat they have because the Stag ran away while they chased after the Hare. Hence, each actor has a smaller portion of meat opposed to the quantity they would have if they cooperated to hunt the Stag. In this game, there is no incentive to defect because all actors can be better off if mutual cooperation is successfully achieved. In a case of mutual defection, the outcome is still preferable to that of unilateral defection – all actors at least have 'meat'. Unlike the Prisoner's Dilemma theory, the dominant strategy in the Stag Hunt game is not to defect but to cooperate as gains are higher.[21]

[20]Aggarwal, V. K. and Dupont, C. Op. Cit. p. 75.

[21]Steinacker, A.: Game-Theoretic Models of Metropolitan Cooperation in Feiock, R. C., "Metropolitan Governance: Conflict, Competition, and Cooperation", Georgetown University Press, Washington, D.C., 2004, p. 54.

From the above analysis, a hunter's decision to defect and chase after a Hare was dependent on the action of the other hunter. Assurance from each hunter was crucial to them cooperating to hunt the Stag (if the agreement was to Hunt Stag). To reach the end goal of killing a Stag for food, both hunters had to trust or have confidence in each other. Trust or confidence in collaborating actors poses a huge challenge to successful (regional) joint-venture initiatives. To give a hypothetical example, supposed three friends agreed to start a *'goods'* transport company. This requires a truck to transport both consumer and perishable goods from one place to another. The cost of buying a brand new truck is R15000 (fifteen thousand rand) and each was to contribute R5000 (five thousand rand) to purchase the truck. Alternatively, they have the option of buying a second-hand truck for R8000 for which they are allowed to pay in instalments. Two out of the three friends contribute R5000 each to get R10000 and paid for the truck but the third defaults in making payments because of serious financial constraints. Each of them would have been better off having a brand new truck to service their business which translates into huge capital gains because the truck is new and efficient. As one party defected in paying for the truck, the two friends have lost their initial investment of R10000 without the truck. On another level, they could be self-sufficient if they had invested in the second-hand truck – this would have earned them some income but they would have to cater for the cost of fixing the truck to improve its efficiency. Although, the second-hand truck might not have the same life-span as the brand new truck, they would have had something to recover the cost of purchase and profits.

This hypothetical story exposes the challenge of how collaborating parties can be assured that everyone will follow through with the respective agreement. Signing an agreement is not a basis to tell whether or not that agreement will be successfully honoured in states' cooperation. In fact, cooperation is on a voluntary basis, and this is why the collaborating parties need the assurance that each participating member will be actively involved until the set goals are realised. Assurance in a cooperative environment is enhanced when collaborating parties have a good record of reliability.[22] Regional agreements have a medium to long-term life span, so trust can be strengthened when parties continually meet their obligations to the (regional) agreement. In a situation where a good history of reliability and

[22]Moshoeshoe, M. Op. Cit. p. 138.

accountability is unavailable, there is a legal framework guiding the activities of such agreement. This provides the 'assurance' necessary to begin cooperative processes but sustaining it remains complex. The reason is, some states face real constraints and cannot meet their obligations to regional cooperation. These constraints can range from internal political instability to economic recession and other pressing issues like poverty and pandemic natural disaster. Considering this, defecting is not a choice but an option for them so that resources can be utilised in addressing more important national issues.

In a joint infrastructure development initiative like railways, road networks or intra-region electricity transmission, states are required to 'share' the cost of establishing, operating and maintaining this infrastructure trusting that once the project is complete, they will get returns on their investments. Returns here imply that the states begin to enjoy the benefit of having that infrastructure in place. Collective action to achieving success in intra-region road network will be beneficial to all parties involved. It fosters the ease of moving goods and services from one place to another. The price of goods will be cheaper because the cost of transporting the goods from the exporting state to the importing state becomes lower. In terms of regional energy cooperation, erecting a regional grid will mean that energy dependent countries can have access electricity for a much lower price and producing countries gets to sell their surplus in the regional electricity market. Also, such initiative allows for the diversification of energy sources. Countries with hydropower potential can be tapped into and in cases of shortages because of drought, there are thermal or gas-fired power generating countries to buy electricity from.

In spite of these ideals, the stark reality remains that everyone is trying to protect their national interests while participating in the collective initiative. There is a clash of interest here, and at what points do states completely trust that others will put in the same amount of 'total' commitment to ensure that collective goal is being achieved? The problem of 'what if' influences the behaviours of actors in such collaborating scheme. For example, constructing an intra-regional road network for the purpose of transporting goods and services can have an adverse effect. When there are internal problems in one country, good roads make mass migration easier. An influx of too many people into another country stretches their domestic

budget and also results in a rapid wear-and-tear of existing infrastructure among other things. Also, an internal instability in one region could result in a blockade, and goods and services in transit can be ceased or forcefully taken. Investing in building an electricity generating capacity in another country gives that country the leverage to conceivably turn off supply when sources become short.[23] Considering all of these issues, what guarantee(s) can collaborating states offer to see a project to its successful completion? Where a government hosts the infrastructure, there may not be a certain assurance that it will not renege on its commitment to build the necessary infrastructure to allow access to other states. This is the classic problem of cooperation – where strategic interests collide with regional public good. These are important issues to contemplate, and the Stag Hunt Game employed here contributes to the understanding of the complex nature of cooperation in the electricity sector in sub-Saharan Africa.

In applying this theory to the issue of the electricity sector in sub-Saharan Africa, it can be argued that cooperation from all member states will leave the region with the best possible outcome which is access to electricity supply. Unilateral defection, which is defection by one or more states, negatively influences the results of the initiative especially when projects are incomplete or a host government experiences problems in supplying electricity to the rest of the region as promised. Mutual defection will mean that all member states abandon the regional project and rather focus on building and strengthening national ones. The fear is that a unilateral defection by one state affects the progress of collective action because the behaviour of one state is dependent on the action of others. When one country, especially the host country fails to meet commitments, it leaves the others in the worse possible situation, with an incomplete project into which huge capital and labour investments have been made. In such circumstances, national self-sufficiency is preferred over collective action.

This is paradoxical because when states meet to discuss the possibility and potential for collaboration, everyone tends to prefer collective action for collective goal over national self-

[23] There remains also the issue of consumption patterns across the respective sub-regions as some have larger populations and are land-locked while others are not.

sufficiency. After signing the agreement, states are now obliged to meet their end of the deal. Fear, uncertainty and doubt of the assuredness that all parties will make equal contributions and strategic concerns as discussed above begin to manifest in states behaviour towards the respective initiative(s). This is because each state is sure that the project will reach completion when they are nationally self-sufficient except if or when internal issues cause disruptions. But the satisfaction that the project is planned, established and managed within their jurisdiction provides surety. For these reasons, I propose that regional electricity projects should not be preferred over national ones instead; they should complement each other so that states have a source to fall back on when regional efforts fail.

When assurance among states becomes an issue, the regulatory framework guiding the regional cooperative initiative should provide the assurance that states need to motivate investment in such joint-ventures. However, states are sovereign and cannot be held accountable for decisions which would benefit their national goals. These are the complex issues facing cooperation for which the Stag Hunt Game helps in identifying and explaining. These explanations go further than the conventional explanations of blaming African governments for having no political will and commitment, lack of investments, corruption and lack of transparency and accountability. The stag hunt theory shifts priority from the political structure of collaborating governments to the bargaining chips these governments present at the point of negotiation and implementation of joint-venture projects.

The stag hunt game theory exposes the notion that regional cooperation has the potential to yield optimal outcomes and states are fully aware of this. But this knowledge alone is insufficient to get states to actually achieve those benefits through cooperation because of the strategic concerns and interests they have, and justifiably so. This theory explains the reasons for the acute failures of regional joint-venture initiatives in Africa. The pattern following these failures have aimed at establishing numerous such cooperative initiatives which incurs more cost and man-power, without reaching the respective set goals. To gain more insights into this theory, the next chapter will provide a background to regional electricity cooperation in Africa using the Southern African Power Pool and the West African Power Pool.

Understanding the design and mode of operation of these power pools will further expose the challenges of achieving a successful cooperation.

In conclusion, the Stag Hunt game explains the challenges actors face in a collaborative venture. The behaviour of one actor is dependent on the behaviour of others in the same agreement. While optimal gains are possible on collective action, unilateral defection undermines the chances of other players. The challenges of cooperation transcend finding a consensual strategy in reaching a set goal to include the assuredness that collaborating parties will meet their obligation to the agreement.

CHAPTER THREE

BACKGROUND TO THE SOUTHERN AFRICAN POWER POOL (SAPP) AND THE WEST AFRICAN POWER POOL (WAPP)

Africa's energy consumption is the lowest compared to any other continent in the world yet it houses about 13% of the global population.[24] The discourse around electricity supply in sub-Saharan Africa is characterised by power shortages, inaccessibility and poor physical electricity infrastructures. Considering that natural (energy) resources and the wealth of nations are unevenly distributed, national utilities have struggled to effectively manage their power sectors to serve the domestic population for household use or production purposes. An ideal way to defeat the challenges of unequal resource potentialities is to 'pool' resources together for the benefit of a particular region or cooperating member-states. This is a strong rationale for the construction of regional power pools. A power pool is a group of two or more electric national utilities cooperating and coordinating their generation and transmission activities for the purpose of having access to, and sustaining electricity supply.[25]

There are a number of technical issues actors need to consider such as connecting transmission lines to electricity generating facility and constructing new electricity generating facilities and lines.[26] Despite this and the huge capital and labour investments required of participating national governments, the interconnection of electric power systems remains a growing practice in the world today.[27]

[24]Department of Economic and Social Affairs, Population Division, "World Population to 2300", United Nations: New York, 2004, p. 4.

[25]Gegax, D. and Tschirhart, J.: "An Analysis of Interfirm Cooperation: Theory and Evidence from Electric Power Pools" in Southern Economic Journal, Vol. 50, No. 4, April 1984, p. 1077.

[26]Loc cit.

[27] Hammons, T. J.: "Status, Plans of Action, Further Developments, and Recommendations for Power Pools in Africa" in IEEE Transactions on Power Systems, Vol. 21, No. 2, May 2006, p. 673.

In this chapter, I discuss the types of power pools and provide a historical background to the formation of the Southern African Power Pool (SAPP) and the West African Power Pool (WAPP). To understand the dynamics of each power pool, I discuss their design and characteristics.

Rationale for Power Pooling and Cross-border Electricity Exchange

Access to electricity can only be achieved when electricity moves from the generation facility to the end users. For this to occur, the electricity generating facility, transmission and distribution lines need to be adequate and reliable. Electricity producing systems particularly regional grids are very delicate and need constant maintenance. Supply could be disrupted if transmission lines cannot house the capacity of electricity production. For example, transformers could explode because the generation output of the regional grid is higher than the transmission lines can accommodate.

The rationale behind establishing power pools is to have access to a more reliable electricity supply, away from national self-sufficiency which has proven inefficient in most parts of sub-Saharan Africa. The act of power pooling involves an agreement from national electric utilities to join the required resources to interconnect their generating, transmitting and distribution capacities.[28] Pooling resources together promotes savings in operating costs and economies of scale – where electricity can be produced on a larger (regional) scale with less input costs. These economies of scale include: participating members sharing access to the energy reserves of the region (which is naturally unevenly distributed), having better electricity quality at a lower cost and the ability to attract investments into the regional energy sector. Also, individual power systems need to be updated to benefit from regional generating capacity. For instance, power plants in cooperating countries need to be upgraded to adequately deliver electricity to end-users without damage to the infrastructure because of explosion.

[28] United Nations Economic Commission for Africa (UNECA), "Assessment of Power-Pooling Arrangements in Africa", UNECA, Addis Ababa, October 2004, p. 21.

Types of power pools

Power-pooling arrangements have consistently evolved from mere interconnections between neighbouring countries to creating a competitive market space for energy trade.[29] As postulated in the study carried out by UNECA (2004b), there are four main types of power pools with each capturing a different level of integration among collaborating states. The table below depicts the types of power pool arrangements:

Table 1: Types of Power-Pooling Arrangements

	Interconnection	**Loose Pool**	**Tight Pool**	**"New" Pool**
Operational System	Synchronised Neighbouring Utilities	Coordinated Dispatch	Centralised Dispatch	Independent System Operators
Capacity Trades	Bulk Power Contracts between neighbouring utilities	Power Purchase Agreements and wheeling agreements	Power Purchase Agreements and wheeling agreements	Forward contracts
Energy sales	Emergency support	Split savings	Split savings	Spot market
Cost savings	Economies of scale	Reserve sharing	Least-cost planning and merit order dispatch	Competition
Regulation of price	Tariffs set by regulators	Price caps set by regulators	Price caps set by regulators	Market price

Source: UNECA (2004b)[30]

The power interconnection system is at the low-end of the integration process. It involves a simple synchronising of electricity transmission and distribution units without particular coordination of their respective electricity systems. Under this type of power pool

[29] Ibid. p. 27.

[30] Loc cit.

arrangement, electricity trade is made based on long-term agreements. Prices are set through negotiations between regulatory authorities.[31] In third place is the loose pool arrangement. It is more integrated than the former because resource reserves can be shared and there is a coordinated dispatch between the collaborating power systems. In comparison to the former, short-term electricity exchange occurs here. Tight pools have a centralised dispatch location and operate in accordance to least production cost under transmission capacity constraints.[32] A 'new' competitive pool creates a competitive market for dispatching power – this can be the best outcome in the absence of market failures.[33]

Southern African Development Community (SADC) and the SAPP

The Southern African sub-region is organised by the Southern African Development Community (SADC) consisting of 14 member states namely: Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, the Democratic Republic of Congo, Zambia and Zimbabwe.[34] This region is characterised by a high rate of urbanisation and moderate economic growth with an increase in population of about 2.7% per annum and a regional population of over 250 million.[35] The aim of the SADC organisation is to promote regional integration for the purpose of achieving economic viability, peace and security in the region. In sub-Saharan Africa, the Southern Africa region is fairly stable and economically competitive. However, various socio-political issues have sprung up in the past years.

The Southern Africa region has vast energy reserves in coal, natural gas, petroleum and huge dams with hydroelectricity generation capacity yet struggles to provide reliable and

[31] Pineau, P. "Electricity Sector Integration in West Africa" in Energy Policy, Issue 36, 2008, p. 212.

[32] Loc cit.

[33] Ibid. p. 213.

[34] SouthAfrica.info, *The Southern African Development Community,* http://www.southafrica.info/Africa/sadc.htm#.Ue-8_dIwfj4, Retrieved 24 July, 2013.

[35] Loc cit.

affordable electricity to its population. Most of the region's hydro-power generation capacity is concentrated in Central Africa on the Zambezi and the Zaire Rivers; Namibia and Angola have no exploitable coal reserves as their South African and Mozambique counterparts do, but they have natural gas reserves. With the potential to electrify the whole region while exporting electricity to other sub-region in the continent, electricity access and affordability should be a non-issue but this is not the case. An overview of the energy resources in each country in the SADC shows that coal is mainly found in Botswana, Mozambique, South Africa, Swaziland, Tanzania and Zimbabwe representing some of the world's largest reserves estimated at 95 billion tonnes.[36] The hydroelectricity generation capacity of the region is vast and mainly concentrated in rivers such as Zambezi, Cunene, Kafue, Kwanza, Linyathi, Lake Malawi and the Zaire River.[37] The estimated hydroelectric potential of the Inga dam in Zaire is about 40,000MW and the full potential of the river is well over 100,000MW which is more than the whole of Africa's current consumption. Natural gas in the SADC region is found in Angola, Mozambique, Namibia, South Africa and Tanzania but it is generally under-explored.[38] Traditional biomass fuels such as wood fuel, charcoal and agriculture residues are heavily relied on as energy sources in the region. Although these are cheap energy sources, they have grave implications on the environment.

Regional electricity demand is constantly outstripping supply; new capacity is required to sustain this increasing demand. Electricity is the second most important source of commercial energy in the Southern African region and contributes between 5 to 26% of the total energy demand in the various countries and is the highest in South Africa.[39] The region is heavily dependent on non-renewable energy sources in producing electricity but needs to explore their renewable options especially hydropower. By doing so, depleting non-renewable energy resources can be complemented. As much of this clean and renewable energy source lies

[36]Horvei, T.: "The Integration of the Southern African Electricity Sector" in Special Southern African, February 1997, p. 37.

[37]Loc cit.

[38]Loc cit.

[39] Loc cit.

outside South Africa which is so far the largest generator of electricity, cooperation is essential in minimising this gap.

Cooperation in the SADC electricity sector dates back to the 1950's with power interconnections between Zambia and Zaire with the line between Zambia and Zimbabwe following suite.[40] This was achieved through bilateral or tripartite agreements. Energy, specifically electricity supply, is a strategic and prioritised sector in the SADC development agenda and a number of projects have been put forward to bridge the electricity deficit in the region. This agenda is being pushed forward by the SADC Energy Activity Plan, the Regional Indicative Strategic Development Plan (RISDP) and the SADC Energy Protocol to achieve the overall objective of an available, reliable, least cost energy services that will help in achieving economic efficiency and eradicate poverty whilst ensuring that (energy) resources are used in a way that sustains the environment.[41] Projects conceived so far include: the SAPP plan; the Western Corridor Project (WESTCOR); the implementation of the Transmission Expansion Plans; SADC Regional Energy Planning Network Project (REPN); the creation of the Regional Electricity Regulatory Association (RERA) and the Regional Petroleum and Gas Association (REPGA).[42]

The SAPP: History

The Southern African Power Pool (SAPP) was established in August 1995 at a SADC summit held in Kempton Park, South Africa, when member-states (excluding Mauritius) signed an Inter-Governmental Memorandum of Understanding (IGMOU) for the formation of an electricity power pool in the region.[43] It was created with the primary aim of providing electricity supply to consumers in the region that is reliable and economical by utilising the

[40] Ibid. p. 38.

[41] SADC, "SADC Energy Programmes and Projects" , Gaborone, Botswana, 2006, p. 1.

[42] Ibid. p. 1-5.

[43] Southern African Power Pool (SAPP) "Developing a Regional Competitive and Sustainable Electricity Market" in Annual Report, 2009, p. 4.

available natural resources while having consideration for the environment.[44] Through this initiative, projects aimed at improving existing electricity infrastructures, completing short-term generation plans and executing regional electricity interconnectivity were uttermost.[45] However, this IGMOU was reviewed and signed by the SADC Energy Ministers in March 23, 2006. The review accommodated independent power producers and placers in the electricity sector in the SADC region.

The constituents of the SAPP are national utilities and not individual power stations. These utilities coordinate and cooperate in the planning and operation of their systems to minimise cost and maintain reliability in accordance to the rights and obligations set out in the SAPP's constitution.[46] The main objective of the Pool is to coordinate and enforce common regional standards of quality of supply, measurement and monitoring of systems performance, increase power accessibility in rural communities and to implement strategies in support of sustainable development priorities, among others.[47] The SAPP is governed by four agreements: the IGMOU which enabled the setup of the organisation; the Inter-Utility Memorandum of Understanding, which established its basic management and operating principles; the Agreement between Operating Members which established the specific rules of operation and pricing; and the Operating Guidelines which provides standards and operating rules and regulations.[48] There are currently fourteen SADC Member state utilities excluding the island of Madagascar and Mauritius. This body is funded by subscriptions paid by the member utilities. The SAPP co-ordination centre is based in Harare, Zimbabwe.

The SAPP operators include:

[44] SAPP-SADC, "Southern African Power Pool", http://www.sapp.co.zw, Retrieved: 29 July 2013, p. 1.

[45] SAPP, "Operational Report: Regional Power Networking for Economic Expansion", (Paper No. R02-06), Harare, February 2006, p. 5.

[46] Eskom, "The Southern African Power Pool", 2003, p. 1.

[47] Southern African Power Pool (SAPP) "Developing a Regional Competitive and Sustainable Electricity Market", Op. Cit. p. 2.

[48] Ibid. p. 4.

Table 2: A TABLE SHOWING PARTICIPATING UTILITIES IN THE SAPP

FULL NAME OF UTILITY	STATUS	ABBREVIATION	COUNTRY
Botswana Power Corporation	OP	BPC	Botswana
Electricidade de Moçambique	OP	EDM	Mozambique
Electricity Supply Commission of Malawi	NP	ESCOM	Malawi
EmpresaNacional de Electricidade	NP	ENE	Angola
Eskom	OP	Eskom	RSA
Lesotho Electricity Corporation	OP	LEC	Lesotho
NamPower	OP	NamPower	Namibia
SocieteNationaled'Electricite	OP	SNEL	DRC
Swaziland Electricity Board	OP	SEB	Swaziland
Tanzania Electricity Supply Company Ltd	NP	TANESCO	Tanzania
ZESCO Limited	OP	ZESCO	Zambia
Zimbabwe Electricity Supply Authority	OP	ZESA	Zimbabwe

OP = Operating member NP = Non-Operating member[49]

Resource potential and installed capacity

The total installed capacity in SAPP is about 53,000 MW (megawatts). South Africa's national utility, Eskom produces about 80% of the total generation in the SAPP of which 74%

[49]SAPP membership is as per the latest revision of the IUMOU open to national power utilities and other Electricity Supply Enterprises (Power Utility, Independent PowerProducer, Independent Transmission Company and/or Service Provider for the electricitymarket), from SADC member countries, Intechopen, Op. Cit., p. 401.

of the total energy produced is from thermal stations.[50] The installed capacity of the SAPP is given in Table 3:

Table 3: SAPP INSTALLED CAPACITY

COUNTRY	COUNTRY UTILITY	INSTALLED CAPACITY (MW)	AVAILABLE CAPACITY
Angola	ENE	1,128	943
Botswana	BPC	132	90
DRC	SNEL	2,442	1,170
Lesotho	LEC	72	70
Malawi	ESCOM	302	246
Mozambique	EDM HCB	233 2,250	174 2,075
Namibia	NamPower	393	360
South Africa	Eskom	43,061	38,764
Swaziland	SEB	71	70
Tanzania	TANESCO	1,186	780
Zambia	ZESCO	1,737	1,200
Zimbabwe	ZESA	2,045	1,125
INTERCONNECTED SAPP		52,146	45,098
TOTAL SAPP		55,052	47,067

Source: the SAPP Website[51]

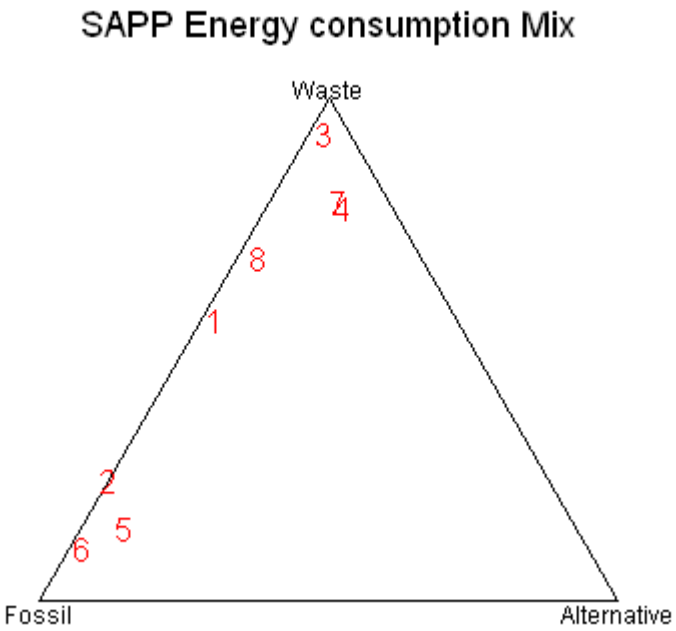
The above table shows that the SADC region is yet to reach its full electricity capacity. Many of the disparities between installed and available capacity can be attributed to the state of national electricity infrastructure. The DRC's power infrastructure is in need of rehabilitation to fully maximise the potential of the available resources.

[50]Hammons, T. J. Op. Cit. p. 673.

[51]SAPP WEBSITE, http://www.sapp.co.zw/tlimits.html

There is also glaring evidence based on the installed capacity table above that the natural (energy) resource endowment in the SADC region is unevenly distributed. To assess the source of energy consumption in the SADC region, I use data from the World Bank to identify and categorise the energy resources used in generating electricity in three themes: fossil fuels, combustibles or wastes and alternative or nuclear energy. There are vast fossil reserves in sub-Saharan Africa. Fossil fuel comprises of coal, oil, petroleum, and natural gas products.[52] Combustible or traditional biomass is the primary source of energy for most Africans and involves the direct burning of wood, straw, other plant materials, charcoal, twigs, leaf litter, agricultural residues and dung.[53] Lastly, alternative or nuclear energy is also referred to as clean energy. It is non-carbohydrate energy that does not produce carbon dioxide when generated and includes hydropower, nuclear, geothermal and solar power.[54]The ternary plot below depicts the available sources of energy consumption in the region.

Figure 3: A ternary plot showing the distribution of energy resources in the SADC region



[52] International Energy Agency (IEA)

[53]Ejigu, M. "Toward Energy and Livelihoods Security in Africa: Smallholder Production and Processing of Bioenergy as a Strategy" in Natural Resource Forum, 2008, Vol. 32, p. 152.

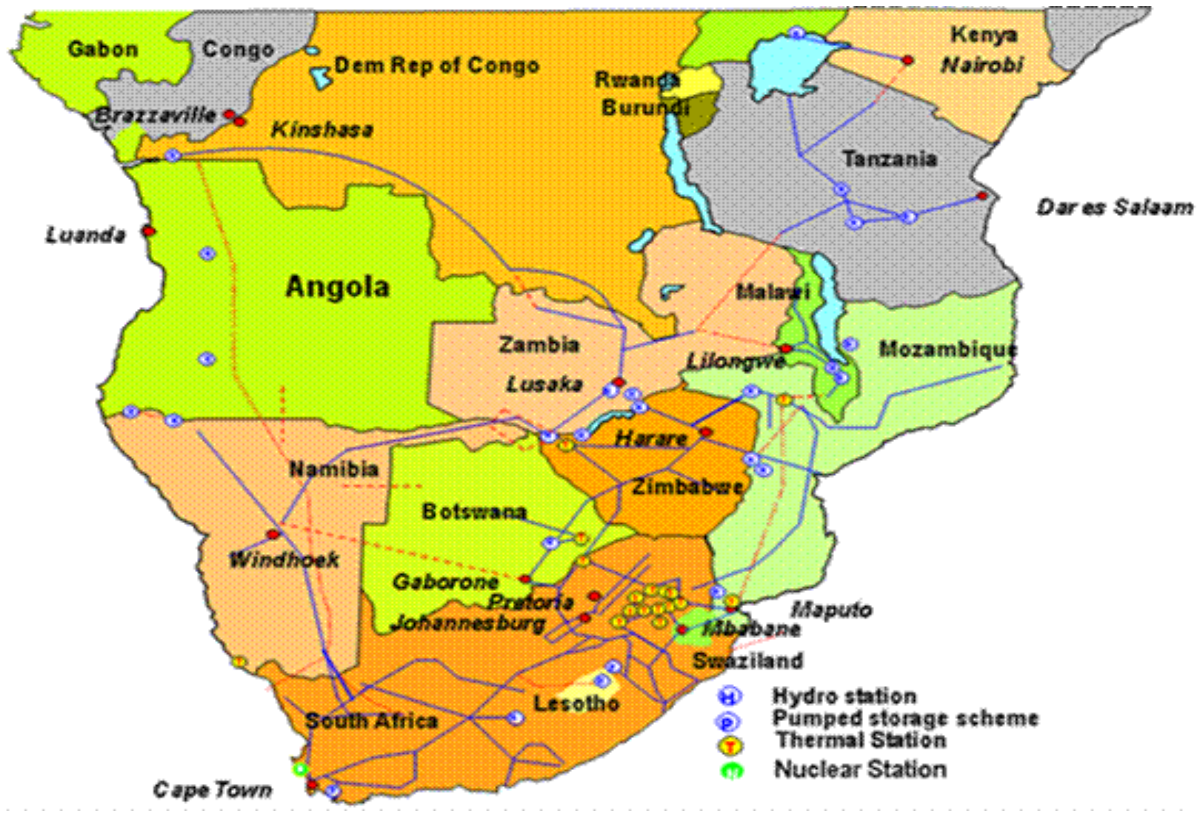
[54] IEA

The ternary plot above is a relationship triangle that depicts the energy consumption profile of the SADC region. The numbers in the grid represent countries in the SADC region.[55] The fossil arm of the triangle is from top-bottom: Botswana (2), Namibia (5) and South Africa (6). Number 6 is the closest to the tip of the triangle showing the level of dependence on coal by South Africa to generate power. This does not imply that it does not depend on the others. The parts of the triangle towards which the numbers fall show the resources on which that country is most dependent on. The really paradoxical case here is the DRC (3) – heavily dependent on traditional biomass energy sources but has vast reserves and potential for hydro, alternative and gas-fired electricity generation. Zambia and Mozambique are almost overlaid; they are still heavily dependent on traditional biomass to generate electricity as opposed to the other two options. The plot paints a picture of the realities of pooling resources together when most of the same collaborating member states are still heavily dependent on combustible wastes. This is a challenge for the success of power pooling in the SADC region. The reason is that preferences are different. For instance, South Africa, having exploited the potential of its coal resources, might be ready to move on to cleaner and renewable modes of energy production. Other countries that are still dependent on wastes might not reason to opt for cleaner energy when there is coal and natural gas reserves that can still be exploited.

Below is a map of the Southern African Power Pool interconnections and the various electricity generating capacities. South Africa houses the only nuclear plant in the SADC region. It also has more thermal stations than the rest of the region. There are hydro stations found in the DRC, Angola and Zambia.

[55] The dataset was gotten from the World Bank's Development Indicator website: http://data.worldbank.org/indicator/EG.USE.COMM.CL.ZS. The dataset is from the year 2009 and combines information of electricity consumption of Alternative and Nuclear energy; Fossil fuels and combustible wastes as percentage of total energy use. The numbers I to 8 represent the countries in this order: Angola, Botswana, DRC, Mozambique, Namibia, South Africa, Zambia and Zimbabwe.

Figure 4: SOUTHERN AFRICAN POWER POOL CONNECTIONS



Source: SAPP website[56]

In addition to this, the proven operating reserves for the region places South Africa above its counterparts. What does this mean for the cooperative initiative which ensues here? It begs to question if this is a win-win situation or an opportunity to South Africa to play the role of a 'Big Brother' while accruing soft power.

Assessing the dynamics of the SAPP interconnection grid, that is, the design, generating capacity and financial investments, it is evident that South Africa is a major player in spear-heading the region's electricity integration process. The SAPP grid thrives on thermal sources to generate electricity most of which are located in South Africa. As mentioned earlier, South Africa produces 80% of the total energy generation in the SAPP. South Africa's Eskom supplies electricity to the national utilities of Botswana (BPC), Zimbabwe (ZESA), Namibia

[56]SAPP-SADC, Op. Cit. p.1.

(Nampower), Mozambique (EDM), Swaziland (SEB) and Lesotho (LEC).[57] This accrues soft power to South Africa. Also, the SADC region has been fairly stable except for the likes of the DRC and Zimbabwe. South Africa is the economic giant of the SADC region and a political force in Africa. Botswana and South Africa have good records of democracy and good governance, contributing to the region's credibility in harnessing foreign direct investments (FDI) – this does not imply however that investments attracted by South Africa's profile will be used for regional common good.

One of the projects initiated by the SAPP is the Western Corridor Project which aims to harness the hydro potential in the DRC. The success of this project will enhance the energy sources of the SADC region. The next section will discuss the design and dynamics of the WESTCOR project.

WESTCOR**:**

The Western Corridor Project (WESTCOR) is intended to explore and exploit the environmentally friendly, renewable, hydroelectric capacity of the Inga in the DRC and also in the Kuanza Basin of Angola.[58] At the time of this research, the focus is on the Inga in the DRC – the creation of Inga III and then the Grand Inga[59] with a capacity of 4,500MW and 39,00MW, respectively. This project was conceived through the combined efforts of the SADC Secretariat and the power utilities of Angola, Botswana, DRC, Namibia and South Africa.[60] The focus of this project is to utilise the vast water resources at Inga in the DRC to generate and distribute electricity to the above-mentioned five countries and at a later stage,

[57]UNECA, Op. Cit. p. 44.

[58]Musaba, L., Naidoo, P., Balet, W. and Chikova, A., "Developing a Competitive Market for Regional Electricity Cross Border Trading: The Case for the Southern African Power Pool", http://www.sapp.co.zw/documents/P12%20-%20SAPP%20Publication%20for%20IEE%20-%20JAN%202004.pdf, 20 January 2004, p. 2.

[59] This project is also backed by the New Partnership for Africa's Development.

[60]Khumalo, N. "Implementation of SADC Protocols Affecting Trade in Services", SAIIA, p. 32.

to the entire SADC region.[61] Included in the project is the construction of a 39,000MW hydroelectric dam, a transmission line and a telecommunications line. All participating member utilities agreed to pay an equal initial contribution of 20% of the total $500,000 required for initial studies to enable the financing of the project.[62]

Considering that the DRC has huge renewable energy sources and a potential to power the continent with its hydro resources, the grand Inga project will be beneficial to the participating five, the SADC region and Africa as a whole. Inga I and Inga II were commissioned in 1972 and 1982 respectively under the leadership of former President Mobutu SeseSeko, with a combined output of 1770 Megawatts (MW). These dams are now managed by la Societé Nationale d'Electricité (SNEL) which is the national power utility of the DRC. The proposed benefits of these dams are optimal outcomes for which participating states should be encouraged to see the final execution of the project. However, it is important to survey the context in which such cooperative initiative is to ensue.

With the introduction and the financing of the WESTCOR project by members of the SADC and foreign investments, there is a shift in power from South Africa to the DRC being the host of the energy source. South Africa as a lead player in the SAPP electricity generation process has a reputable record of accountability and reliability. The same cannot be said for the host of the Grand Inga project – the DRC. Considering the historical and contemporary occurrences in the DRC, the fate of such beneficial joint-venture dwindles. Uncertainties about integration or cooperation outcomes impede the success of cooperative initiatives irrespective of the promises of collective gains.

ECOWAS: History

The Economic Community of West African States (ECOWAS) region is the coordinating body of the West African region. It was established in May 1975 via the ECOWAS treaty

[61] Loc cit.

[62] Musaba, L. et al. Op. Cit. p. 1.

which was revised in 1993. The primary aim of the organisation is to promote economic integration in all fields of economic activity ranging from transport and industry to natural resources and socio-cultural issues.[63] It consists of 15 member states namely: Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.[64] The region is characterised by moderate economic growth rates and an increasing population of more than 250 million people culturally diverse but 'harmonious' people.[65] Stability in the region has been shaky with insurgency and militant groups in the Niger-Delta and the political crisis of countries like Sierra Leone, Mali and Cote d'Ivoire. Geographically, most countries in the region are land-locked making it challenging in implementing trans-border infrastructure projects. The ECOWAS is largely modelled according to the European Union (EU).[66]

The West African region is endowed with both renewable and fossil fuel energy reserves possessing an estimated potential of 23, 000 MW of hydroelectric power concentrated among five of the fifteen member-states.[67] 98% of the fossil fuels are concentrated in Nigeria given its proven reserves of natural gas, coal and crude oil which also constitutes about 30% of Africa's total proven hydrocarbon reserves.[68] Oil and gas reserves are also found in Cote d'Ivoire and Ghana.[69] Irrespective of these, consistencies in electricity generation and distribution are abstract. Traditional biomass remains the primary source of energy in the

[63] ECOWAS, "ECOWAS in Brief", http://www.comm.ecowas.int/sec/index.php?id=about_a&lang=en, Retrieved on: 29 July 2013.

[64] ECOWAS, "ECOWAS Member States", http://www.ecowas.int/, Retrieved on: 29 July 2013.

[65] Address by Gbeho, J. V.: "Driving a People-Centred Regional Integration", Conference paper 27 May 2011, p. 1.

[66] Loc cit.

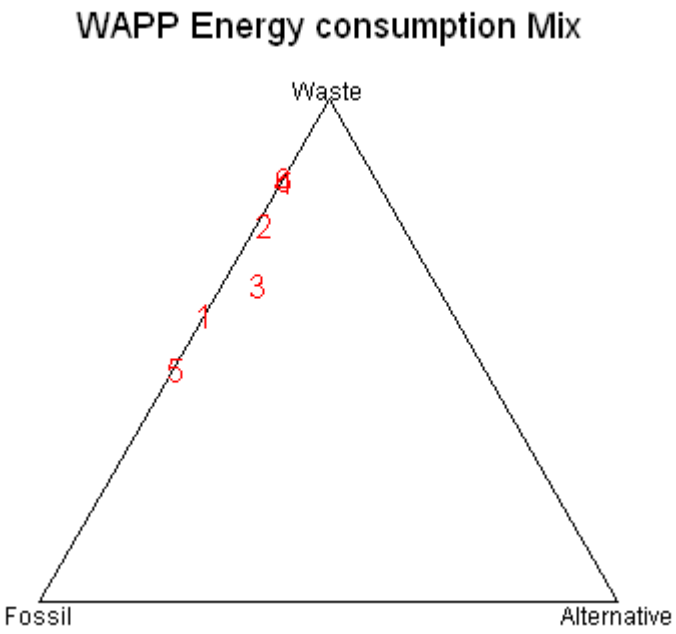
[67] ECOWAS and WAEMU, *Geared Toward Increasing Access to Energy Services for Rural and Periurban Populations in Order to Achieve the Millennium Development Goals*, White Paper for Energy Policy, January 2005, p.14.

[68] Loc cit.

[69] THE WAPP, "Revised WAPP Master Plan", Vol. 3, October 2011, **http://www.ecowapp.org/?dl_id=294**, , October 2011, p. 146.

region yet wind and solar power are viable alternatives to energy supply in the West Africa.[70] Below is a ternary plot with the natural energy resource endowment in the West African region:

Figure 5: A ternary plot showing the distribution of energy resources in the SADC region



The ternary plot above provides an understanding of the energy consumption mix in the ECOWAS region.[71] The region is dependent largely on combustible waste and to a less extent, fossil fuels. The geographic location of these states and the unevenly distributed natural resources all contribute to the above outcome. The numbers in the triangle represent countries in the ECOWAS region.[72] From the diagram, the countries are concentrated

[70] Loc cit.

[71] The dataset was gotten from the World Bank's Development Indicator website: http://data.worldbank.org/indicator/EG.USE.COMM.CL.ZS. The dataset is from the year 2009 and combines information of electricity consumption of Alternative and Nuclear energy; Fossil fuels and combustible wastes as percentage of total energy use. The numbers I – 6 represent: Benin, Cote d'Ivoire, Ghana, Nigeria, Senegal and Togo.

[72] Loc cit.

between ‘Waste’ and ‘Fossil’. Closer to the waste arm of the triangle is an overlap between: Nigeria (4) and Togo (6). It is alarming that Nigeria’s population is still heavily dependent traditional waste as a source of energy yet it is a net exporter of fossil fuel while Togo is a net importer of energy. Cote d’Ivoire’s (2) dependence on waste in comparison to fossil fuel is 4:1. Ghana (3) stands out of the crowd. The plot shows that Ghana is not as heavily dependent on waste and fossil fuels as the others (depicted by being a bit far from the Waste-Fossil line). It is also exploring its alternative energy sources. Although number 3 is not so close to the ‘Alternative’ arm of the triangle, it is somewhat close to the centre of the triangle. This shows that there are attempts made to diversify energy sources and decrease dependence on the other two. Benin (1) is also more dependent on waste sources than ‘Fossil’ or ‘Alternative’ sources while Senegal (5) has a balance between Wastes and Fossil fuels. The necessity of the regional grid cannot be overstated – it will help reduce dependence on combustible/waste sources of energy which are detrimental to the environment. Extracting fossil fuels can also be detrimental to the eco-system hence, the hydropower potential of the region needs to be explored and exploited.

Just like their SADC counterparts, regional electricity demand is constantly outstripping supply; new capacity is required to sustain this increasing demand. The electricity sector in most of the ECOWAS region is still under-developed. National self-sufficiency has resulted in poor efficiency levels and high power generation costs. As a result, the region’s agreement to ‘pool’ resources together in exploring the plethora of energy sources laden within it can be construed rightly as an attempt to resolve their energy crisis.[73] There is not enough published information on the reforms attempt and the correct state of the electricity infrastructures, however it remains safe to say that the region is heavily dependent on non-renewable energy sources in producing electricity but, more than anything else, needs to explore their renewable options especially hydropower. There is however still a huge challenge immanent – the hot weather conditions which accounts for cases of drought and water sources drying out. For this reason, ECOWAS member states need to cooperate in an attempt to diversify their sources of energy. The main challenge in the ECOWAS region is electricity access.

[73] WAPP Op. Cit. p. 146.

According to ECOWAS, most initiatives undertaken at both national and regional levels are aimed at addressing the socio-economic problems caused by electricity deficit. Indeed, at the national level, countries have dedicated themselves to framing Poverty Reduction Strategies (PRS) that establish particular goals, implement compulsory structures and demand financing in order to broaden energy accessibility.[74] Despite the natural energy endowment of the ECOWAS region, the expansion of its energy sector has been moderate with an average per capita annual power consumption of 160kWh.[75] A strong rationale for a regional collaboration on energy supply is that national self-sufficiency was expensive, ineffective due to lack of political will and commitments and also the poor state of electricity infrastructure in the various countries of the region. At the regional level, participating countries are pooling resources together to increase and diversify their energy capacity and sources respectively. As a result of this end goal, the ECOWAS established the West African Gas Pipeline (WAGP) and the West African Power Pool (WAPP) projects.[76] These are two projects, which have been undertaken by the Community to address the energy access challenges in the region.

THE WAPP

In November 1999 the ECOWAS national electricity sector officials adopted a master plan for the development of energy generation facilities and the interconnection of electricity grids of member states.[77] The WAPP was setup by decision A/DEC.5/12/99 to be the body through which these developments occur. By September 2000, the ECOWAS Ministers of Energy adopted a Memorandum of Understanding (MoU) on the establishment of the WAPP.[78] Within this framework the national electricity utilities of each member state has to invest in the development of generation and transmission facilities. Its mandate is to facilitate

[74]Kabele-Camara, A. K., "Achieving Energy Security in ECOWAS through the West African Gas Pipeline and Power Pool Projects: Illusion or Reality?", March 2012, p. 18.

[75]Regional Energy Projects: *Experience and Approaches of the World Bank Group*, Background paper for the World Bank Group Energy Strategy, February 2010, pp. 49-50.

[76]Loc cit.

[77]UNECA, Op. Cit. p. 51.

[78]Hammons, T. J. Op. Cit. p. 678.

collaboration among member utilities to establish a unified and competitive regional electricity market in West Africa through attracting investments for development of the diverse and abundant energy resources in the region for their collective economic benefit and the integration of the operations of the various national power systems of ECOWAS Member States.[79] The WAPP project establishes an umbrella regulatory structure to aid regional energy trade, promote regional investment in energy generation and distribution through interconnection (transmission lines) and grid systems.[80] The project spans over a 20 year period and is divided into the following project phases:

> "(1) *Design Completion of Interconnection between zone A72 and zone B73 by 2006; (2) Completion of Institutions for the management of international electricity trading by 2012; (3) Full Operation by 2023"*[81]

This project splits the region into two zones: zone A and zone B.[82]

The WAPP institutional organisation comprises of a General Assembly consisting of members from all electricity utilities in the region; an Executive Board; WAPP Organisational Committees consisting of various technical experts from regional utilities; the WAPP Secretariat and the ECOWAS Regional Regulatory Authority which was established in January 2008 with jurisdiction over cross-border exchanges of electricity.[83] The WAPP infrastructure development program was set for 2005 to 2020. Its completion is subject to the successful finalisation of five distinct but related sub-programs aimed at easing the unification and synchronisation of the WAPP operations.[84] These five sub-programs are as follows but this chapter will focus on the 'Coastal Transmission Backbone project:

[79] WAPP, Op. Cit. p.146.

[80] United Nations, *The Contribution of Private Sector to the Implementation of the New Partnership for Africa's Development (NEPAD)*, New York, p.12.

[81] Gnansounou, E., *Boosting the Electricity Sector in West Africa: An Integrative Vision*, International Association for Energy Economics, Third Quarter 2008, p. 27.

[82] Zone A: Benin, Burkina Faso, Ivory Coast, Ghana, Niger, Nigeria and Togo while Zone B includes Cape Verde, Gambia, Guinea, Guinea-Bissau, Liberia, Mali, Senegal and Sierra Leone. Hammons, T. J. Op. Cit. p. 678.

[83] Regional Energy Project, Op. Cit.

[84] Loc cit.

'"Coastal Transmission Backbone" which is concerned with providing interconnection between the power systems of Cote d'Ivoire, Ghana, Benin, Togo and Nigeria; the "Inter-zonal Transmission Hub" which is expected to displace expensive diesel based generation with low cost power; the "OMVG/OMVS Power System Development" aimed at providing access to low cost power from Hydropower Projects to be built on the Gambia, Senegal and Konkoure River basins; the "North-core Transmission" and the "Cote d'Ivoire-Liberia-Sierra Leone-Guinea Power Network."[85]

It is important to note that in the context of the WAPP, interconnection of national systems into a regional grid as well as the creation of a power pool implies that separate organisations be created having an agenda that is compatible with the regional electricity sector structure.[86] In essence, the WAPP creates a platform for bilateral or tripartite agreement on interconnection, generation, transmission and distribution among member states.[87]

The Coastal Transmission Backbone (CTB) project is aimed at increasing the access of the national power facilities of Benin, Ghana, Ivory Coast, Nigeria and Togo – they are also known collectively as "Zone A" – to a "more stable and reliable electricity."[88] This is an attempt to reduce the vulnerability of drought-induced power disruption in major electricity exporting countries in the region.[89] To achieve this, a 330 kV transmission link from three substations in Ghana (Prestea, Aboadze and Volta) would run through MomeHagou sub-station in Togo and Sakété in Benin to the Ikeja West substation in Lagos.[90] As of 13 June

[85] Loc cit.

[86] UNECA, Op. Cit. p. 55.

[87] Pineau, P. Op. Cit. p. 215 – 216.

[88] The Infrastructure Consortium for Africa (ICA), 'Project Information Document (PID)', http://www.icafrica.org/fileadmin/documents/Knowledge/World_Bank/PID-WAPP-Coastal-Trans-BckBone-Prjt-FEB-2006.pdf, Accessed 10 August 2013, p. 7.

[89] Ibid. p. 5.

[90] Loc cit.

2013, the status report by the World Bank which is a major funder of the CTB project indicated that there were new changes made to the initial implementation strategy. One of the changes was to extend the deadline for the full implementation of this plan by two and half years to enable the borrower complete activities of the project.[91] There are huge national and capital costs involved in this project and cannot be solely catered for by cooperating member states. The need for attracting investment is eminent. The CTB project is funded by the International Development Association (IDA), the African Development Bank, the Islamic Development Bank and the West African Development Bank.[92]

The WAPP arrangement offers a different approach to power pooling where collective action is mainly in terms of bilateral or tripartite agreements between member states. In the CTB initiative discussed above, the countries involved are along the coastal line and have an advantage of lower cost of transporting the liquid fuels needed for power generation in comparison to their landlocked counterparts that need to truck such fuels over a long distance.[93] Nigeria's electricity is largely generated from hydropower and thermal sources. Its hydropower sources are deposited in the River Niger housing the Kanji dam, the River Benue and the Jebba River. More recently, the weather conditions have posed the challenge of drought. Also, the River Niger is a shared resource as it runs through Nigeria to Niger. Increased competition for access between Mali, Niger and Nigeria are likely because of the changing climate conditions, this could fuel conflict in the region.[94] Irrespective of these hydro-resources, Nigeria's power sector struggles to supply electricity to its domestic population.

[91] The World Bank, "Benin – Second Phase West Africa Power Pool Program (WAPP) – Coastal Transmission Backbone Project (APL 1): Restructuring (vol. 2 of 2): Data Sheet (English)", http://documents.worldbank.org/curated/en/2011/03/14014649/benin-second-phase-west-africa-power-pool-program-wapp-coastal-transmission-backbone-project-apl-1-restructuring-vol-2-2-data-sheet, Accessed August 12, 2013.

[92] PID, Op. Cit. p. 5.

[93] Ibid. p. 146

[94] Goulden, M., Abebe, L. and Vernon, P. "Climate Change, Water and Conflict in the Niger River Basin", http://www.wilsoncenter.org/sites/default/files/NigerPresentation.pdf, Accessed: 15 August 2013, p. 22.

Ghana has a stable political economy and energy sector. They have played a major role in building the regional electricity grid and successfully aligned its national needs to regional ones. It is estimated that about 45 – 47 per cent of Ghanaians, including 15 – 17 per cent of the rural population have access to grid electricity.[95] About half of the electricity supply is used by domestic consumers while commercial and industrial users account for the other half.[96] Togo and Benin Republic have made national efforts to improve their respective electricity sector through privatisation and attracting foreign aid.[97] The results have been unequivocal. As countries on the coastal line, interconnection will be easier because the resources needed to power supply can easily be accessed and transported.

Irrespective of this promising project, the CTB programme has been unsuccessful for a number of reasons. One of the major problems is that national priority and regional ones have failed to converge. For example, the Communauté Electrique du Benin (CEB) has held up implementation of the Tema (Ghana) Mome-Hagou portion of the 330KV CTB project because it has not converged with the national energy projects priorities of the Togo and Benin.[98] These energy dependent countries need a reliable source of supply and look to diversify their supply chain instead of focusing on expanding the regional transmission line. Although Benin Republic has a hydroelectric potential in the Mono and Ouémé river estimated at 1100 and 1300 GW/h respectively, its failures to develop these potentials has resulted in the country being 80 per cent dependent on imported electricity.[99] But the existing interconnection line from Cote d'Ivoire through Ghana to Benin has the capacity to transport the amount of energy required by these two countries. But the capital to which these importing countries have are limited, and the assurance of supply is needed to motivate them to partake in the regional project.

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[95] Resource Center for Energy Economics and Regulation, "Guide to Electric Power in Ghana", http://www.beg.utexas.edu/energyecon/IDA/USAID/RC/Guide_to_Electric%20Power_in_Ghana.pdf, July 2005, p. 1.

[96] Loc cit.

[97] Council of Private Investors in Benin (CIPB), "Electricity Power Supply in Benin", http://cipb.bj/medias/documents/electric_energy_in_benin.pdf, May 2007, p. 12.

[98] WAPP Op. Cit. p. 150.

[99] CIPB, Op. Cit. p. 6, 12.

This above example poses the challenge of clashing priorities among member states in the WAPP's CTB project.[100] The thermal plants in Takoradi in Ghana and Maria Gleta in Benin are very crucial to the success of this plan.[101] But no significant progress has been made in the development of these matching generation plants.

All four states have also attempted to diversify their energy sources to include natural gas through gas-fired power generation. Nigeria is a major supplier of natural gas in the ECOWAS region and has partnered with its coastal neighbours in an initiative called the West African Gas Pipeline (WAGP).[102] While this is not the focus of this chapter, it helps in understanding the strategic concerns of these actors motivating their option to diversify energy base. Through this project, natural gas is transported from the terminal near Lagos to Takoradi in Ghana, Cotonou, Lomé and Tema.[103] The success of this project will be beneficial in cushioning the energy alternatives of these suppliers from hydropower while scouting for clean energy sources.

Power pools have the potential to reduce electricity access problems and in a long-run alleviate them. But for this to be successful, the structure and organisation of such arrangements should be efficient. The needs of the region should inform the establishment of institutions, norms and regulations. Pineau argues that most power pools in Africa are modelled according to Western pools.[104] As a result, there is a lack of 'African' ownership to the project. He argues that there is a link between "ownership of projects" and a successful implementation. Ownership he argues occurs when policymakers are responsible for the formation and implementation of (electricity) cooperation in their respective regions. He also points out that ownership allows for accountability to the local or domestic population who

[100] WAPP, Op. Cit. p. 149.

[101] Loc cit.

[102] Belguedj, M. "The West Africa Gas Pipeline and Power Pool Project: Building Blocks for Regional Energy Integration", http://www.igu.org/html/wgc2006/pdf/paper/add21194.pdf, 31 January 2006, p. 9.

[103] Loc cit.

[104] Pineau, P. Op. Cit. p. 215

are recipients of policy decisions.[105] The mandate of these power pools is to mitigate the problem of local access especially in rural areas. Reality reveals that electricity cooperation like power pooling often benefit the urban population more than their rural counterparts.[106] The argument about ownership disappears when capital used in building, operating and sustain regional pools are gotten through aid or foreign investments.

The introduction of foreign investors into the power pool arrangement complicates issues around mutual costs and benefits. Investments are very crucial in establishing, operating and managing power pools. Most of this capital cannot be solely harnessed by cooperating members because of the socio-economic differences among states in this capitalist economy. When donors offer their funds through aid or investments, cooperating members have to adjust their preferences to accommodate those of these donors. Considering that capital is needed to fund projects, actors have no choice than to meet the demands of their funders. In most cases, this tends to leave certain actors worse off, but all is endured to reach the region's envisioned goal. In such situations, actors sign deals with donors just so that they can have some funds to execute their regional projects. The challenge of sustaining that cooperative agreement usually surfaces in the course of implementation.

An assessment of the above power pools reveals that one or two states are more dominant than others in terms of soft power and endowment in natural resources. The generating capacity of electricity is unevenly distributed. States with little or no resources have to accept the terms and conditions of pooling resources together for the purpose of having access to electricity for their domestic consumption. All of these issues can become subliminal if each collaborating party is assured that the required efforts will be harnessed for the common good of all. In addition to this strategic concern, other (national) socio-economic issues impede or slow-down regional cooperative initiatives.

[105] Loc cit.

[106] AFDB, "An Integrated Approach to Infrastructure Provision in Africa", http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Economic%20Brief%20-%20An%20Integrated%20Approach%20to%20Infrastructure%20Provision%20in%20Africa.pdf, April 2013, p. 6-7.

This chapter has provided a background to understanding the dynamics of cooperation in regional power pools using the SAPP and the WAPP as case studies. It provided a background to the respective sub-regions and focused on project-based cooperation for electricity security – WESTCOR and the Coastal Transmission Backbone, respectively. The next chapter will look at the challenges of power pools using the Stag Hunt theory as the analytical tool.

CHAPTER 4

CHALLENGES OF TRANSBOUNDARY ELECTRICITY COOPERATION: CASE STUDIES OF THE SAPP AND THE WAPP

Successful regional energy cooperation is underpinned by each participating member adhering to the blueprint for implementation. This can prove crucial in addressing some of the issues plaguing the continent ranging from pandemic and sluggish economic growth to energy crises and conflict (over scarce resources). Although there are huge potential benefits to (sub) regional power pools, the temptation for individual states to pursue national rather than regional projects is imminent. This poses a challenge to the overall implementation progress of the initiative. In collaborations where divergence in interests is stronger, individual strategic gains are more likely to influence outcomes. This chapter assesses the cooperation dynamic of the SAPP and the WAPP as a bench mark for success in project implementation. It looks at the challenges facing these individual pools and attempt to attribute it to the divergence of interests – as the challenge facing cooperative initiatives.

Electricity security is very crucial to a country's economic development.[107] Central to economic development is the health of the market.[108] For demand to be met, consumer goods and services need to be produced and available for purchase. The cost incurred in the production of goods and services are less when there is electricity to facilitate production. The purchasing power of consumers is strengthened when goods and services are cheaper. In a technologically evolving world, the service sectors in most economies are heavily dependent on constant electricity supply. Divisions like telecommunications, banking and finance, and public service all require access to electricity to be effective and efficient. This is does not imply that constant electricity supply per se, is the key to economic development. There are other factors that interplay to cause a progressive economy – good standards of infrastructure and policies regulating the respective business environment are essential. The

[107] Electricity security is characterized by: availability, affordability, reliability and sustainability.

[108] The market is a space where the forces of demand and supply interact.

argument here is that having access to constant electricity supply helps in reducing cost of production and consequently, offer consumers a cheaper price on goods and services.

The concept "electricity" and "security" is a goal and a challenge at the same time. The 'security' issue here refers to fear, uncertainty and doubt. By placing both concepts together, "electricity security" the meaning is dependent on the level of use. On a national level, electricity security is when the population has access to electricity without fear, uncertainty and doubt of supply. This is the dilemma of states grappling with electricity security issues. On a regional scale, states come together each having the above-mentioned dilemma hoping that cooperation helps in resolving the problem of access to electricity. But the regional scale transcends the national and there is interaction between different states. This introduces another complexity to successful cooperation.

Once agreements have been signed based on the envisioned benefits of the initiative, capital injection into the project is required. States begin to question the assurance that everyone will equally commit to the project. The reason is, in a collaborative setting actors are not equal. While some states are naturally endowed with energy resources and have the infrastructure to garner electricity for their domestic users, others have very little or no resources and become dependent on those who have. Energy dependent states worry about security of supply from energy exporters especially if the internal setting of the supplying state(s) is unstable. For others, the resources are available but the state of their energy infrastructure is in need of investments. These states need to provide guarantee that the investments made by other states in the respective country will yield returns. In a nutshell, the problem of electricity security becomes uncertainty, fear and doubt that investments will produce returns.

In this chapter, I discuss the challenges facing power pool arrangements in sub-Saharan Africa. Using the Stag Hunt analytical framework, I show how strategic concerns of collaborating states manifest in practical actions to impede on the success of cooperation. To better understanding the challenges these power pools face, I will discuss two crucial levels of challenges: strategic and practical.

Regional electricity cooperation through power pool agreements can be effective in tackling sub-Saharan Africa's electricity problems if national priorities are completely aligned with regional ones. This is almost impossible because the behaviour of actors over the period of cooperation is unpredictable. The 'stag' in such cooperative initiative is the regional electricity grid to which all participating states need to invest to get returns on electricity. The 'hare' is investing in their national electricity sectors. The choice between the stag and the hare are policy decisions governments have to make. Although there are potential benefits from getting the stag, the disadvantage is that investing in the 'stag' will mean relinquishing some sovereign authority but with doubt, fear and uncertainty about the fate of the joint-venture. To overcome this fear, doubt and uncertainty, states who are recipient of investments need to assure investors that they will meet their commitment to keep and protect the electricity supply infrastructure.

Strategic challenges:

The benefits of having access to constant electricity cannot be overemphasised. States are aware of the importance of electricity to development and the huge capital and labour costs involved in rehabilitating their individual national energy sectors. Pooling resources with other countries in the regions will results in mutual benefits but pose potential risk to participating countries. The fact is that cooperating states are fully aware of the benefits of joining their resources together to tackle the electricity access problems in their respective regions but the lack of confidence or trust between these states impedes successful results. The challenge is the point where 'electricity' and 'security' meet. It is a non-issue when states envision the benefits of regional energy cooperation at the point of signing the agreements; the challenge becomes visible in sustaining cooperation till completion. Mutual benefit is only possible when there is collective action; trust is the missing link. This threatens effectiveness of such initiatives.

Considerations about national security are a strategic concern of collaborating states. It is important to understand the environment in which this cooperation (is about to) occur. States are not equally endowed with natural energy resources so those with more have leverage over those with very little or nothing at all. In terms of size, some countries are more populated that others and therefore electricity consumption pattern is higher in the former. In the case

studies, Nigeria is the dominant player in the WAPP and South Africa, in the SAPP – though there have not been reports of them shutting off power flows as a tool to extract concession or exert political power over its interconnected partners.[109]

The regional grid which supplies electricity to all countries in the respective region is powered by those with the generation capacity. The power pools create a market for these countries to trade their electricity without tariffs; this is the 'public good' of power pools. This implies that the price of electricity sold intra-region is merely to recover investment cost with no gains. But these producing countries could trade their electricity with buyers outside the region and get more rents in return. Considering talks about depleting energy resources, states need to find other alternatives to their current fossil or non-renewable energy source. This requires capital investments into research and infrastructure development. States are restrained from nationally diversifying their sources of supply because they have made investments into the regional grid. But what guarantee do states have that after investments have been made to build the required infrastructure, that their access to electricity supply will not be disrupted by unforeseen circumstances. This concern contributes in restricting the commitment of states to regional projects.

All of these issues on investment risk complicate the prospects of cooperation being accomplished. Although there are institutions within the respective power pools to regulate interactions between states within the framework of the power pools, the fact remains that states are sovereign and have jurisdiction over their actions. They can choose to commit or defect for their individual benefits. These concerns are often considered by decision makers in an attempt to invest in a regional project. Issues around inequality, uncertainty, doubt and fear about the fate of the energy dependent country all daunt a successful regional cooperation.

[109] United Nations: http://www.geni.org/globalenergy/library/technical_articles/united_nations

Practical challenges:

Having considered the basis of cooperation choices which states make, other practical challenges contribute in impeding the success of regional cooperation. Power pools are mega-projects that require more than will and commitment to materialise; they need capital. The truth is that in Africa, resources needed to execute these projects are not available.

Internal political and socio-economic structures differ across states, while some thrive in the virtue of democracy and good governance, a healthy economy, functional regulatory principles and good human development indexes, others are more authoritative, dysfunctional and economically struggling. Some countries consistently experience wars, unrest and chaos because of political instability, repression, (ethnic, racial) discrimination, religion and the effects of globalisation on the population (widening the gap between the haves and the have-nots). For example, the DRC is the host country for the WESTCOR initiative but constantly grapples with civil unrest stemming from disputes over ownership of resources to politically-oriented conflicts. Also, the Niger-Delta is home to Nigeria's thermal substation and gas pipelines. The consistent vandalism and unrest in the region poses a threat of supply by Nigeria to the other member state in the WAGP cooperative initiative. These are some of the dynamics of states in the respective sub-regions posing a threat to accomplishment of regional electricity cooperation.

The interdependence of the electricity sector of states makes room for collaborating states to be involved in the internal politics of each other. As the regional grid is built in another country and transmission lines run from that country to others, it is in the collective interest of cooperating states to ensure that these infrastructures are properly guarded from damage or vandalism. For example, if a country is dependent on buying electricity from another that is plagued with constant internal strife, the buying country will be unwillingly drawn into the political or even military issues of that state. In cases of conflict, collaborating partners have to be involved because once lost, it requires an injection of huge capital to recover. Or in cases where political tension occurs between the country housing the regional grid or the hydropower dam and an importing country, the former could turn off supply to the rival

country. Political tension could escalate and result in conflict. Unlike food or finished goods, electricity cannot be stored. Hence, countries dependent on electricity import may see no benefit in investing in a warring exporting country because of high cost risk. Schiff and Winters (2002) agree that the exploitation of regional public goods can yield maximum results but the failure to cooperate turns such effort into a waste which is economically costly to the collaborating countries.[110]

The Western Corridor project undertaken by members of the SADC under the SAPP initiative is a tangible example of the challenges stated above. The WESTCOR is an ambitious power project undertaken by the five member states backed by the continent's NEPAD framework. The project seeks to pool resources together to tap into the hydro-rich DRC. The capacity of the Inga is estimated at 100, 000MW of which less than a third has been exploited due to the poor state of infrastructure coupled with lack of maintenance of the Mobutu initiated Inga I and II. The signing of the WESTCOR deal was going to help the DRC build its hydroelectric capacity which it could not do on its own. Considering the huge gains from exploring and exploiting this hydroelectric capacity, cooperation seemed viable. In 2006, when MagEnergy, a Canadian owned energy company offered to renovate the Inga dam to restore it to its full capacity of 1,744MW by 2010, the DRC abandoned the WESTCOR and opted for the deal with MagEnergy.

The BHP Billiton became involved because of the Memorandum of Understanding signed with the Congolese government in February 2006 to develop an aluminium smelter.[111] The prerequisite of the construction was to fund the proposed Inga III and the construction of a $500 million deep sea port. This was going to give the DRC majority ownership in the project.[112] This was going to give the DRC immediate capital while project construction was

[110] Schiff, M. and Winters, A. L., "Regional Cooperation and the Role of International Organisations and Regional Integration," in World Bank Policy Research Working Paper 2872, July 2002, p. 1.

[111] Nasser, J., "Call for BHP Billiton to Halt Congo Smelter, Inga 3", http://www.internationalrivers.org/resources/call-for-bhp-billiton-to-halt-congo-smelter-inga-3-3080, Accessed 15 August 2013.

[112] Loc cit.

underway, this was a feature lacked by the WESTCOR initiative. The DRC opted for the BHP Billiton deal over the regional cooperation initiative.[113] Although the DRC benefited, the region recorded huge capital loss to the other members and undermined their credibility in moving the SADC region out of its electricity dilemma. Each member had contributed $100,000 to the establishment and operation of the WESTCOR in 2004. Namibia lost N$ 2 million that year which could not be recovered.[114] Applying the stag hunt game, the DRC unilaterally defected leaving them better off and the rest of participating members worse in the worse possible situation (1, 2).

The WAPP project for 2009 to 2012 was budgeted at US $182.37 million. Considering that the ECOWAS member states cannot afford to incur this cost, there is need for external investment for project financing. In a case where external funding is unavailable it is more viable for states to hunt 'hares' instead of the 'stag'. States are likely to opt for improving national self-sufficiency as opposed to investing surmountable amounts of money in a regional scheme where funds dry out and projects are incomplete. Capital is needed to install large-capacity transmission paths to aid simultaneous distribution of electricity from the regional grid to the utilities.[115] This does not mean that the bigger the number of countries cooperating, the more likely for cooperation to succeed. The argument here is that, even if Africa was to invest in a trans-regional pool, the strategic considerations as discussed above impeded the prospect of the project reaching completion. Accomplishing reliable interconnection requires the expertise of engineers and economic analysis on anticipated transfer over the lines. Interconnection imposes additional cost on utilities and other owners of generating capacities. The reason is that generators need to be adjusted to accommodate utilities elsewhere on the regional grid. Unless there is a mechanism to compensate countries that bear additional cost in adjusting their distribution capacity to include other utilities, then there is no motivation to incur such costs.

[113] Swanepoel, E., "WESTCOR to Withdraw from Inga 3 Hydropower Project", http://www.engineeringnews.co.za/print-version, July 2009.

[114] Haulofu, S., "Namibia Loses N$2m in Power Project", http://www.observer.com.na/archives/46-namibia-loses-n2m-in-power-project, Accessed 15 August 2013.

[115] Hammons, T. J. Op. Cit. p. 678.

The Coastal Transmission Backbone (CTB) project of the WAPP raises more issues around cooperation. The challenges the CTB project is one of coordination and management of implementation. Countries have different capabilities and face different challenges in terms of attracting investments for infrastructure development because of their varying macro-economic and political structures. These factors have contributed to the sluggish implementation of the CTB project. As a result of the vary capabilities of states, the pace of project development and implementation is dictated by the weakest state or utility in the initiative. Consequently, states become busy with national programs while waiting for the weakest link to get up to speed. By the time this happens, the variation in the stages of development in terms of electricity infrastructure and generating capacity further creates difficulty in achieving a set goal. It would take another period of time for those weak states to get to the level their counterparts are on. But while the weak links are trying to achieve that, the other ones are getting better. This undermines the need for cooperation as it will result in slowing down a developing national electricity project.

The CTB project was undertaken by key energy exporters and importers in the ECOWAS region: Ghana, Ivory Coast and Nigeria; the importers being Benin and Togo.[116] The macro-economic and political situation among these countries puts Ghana at the lead position. Togo and Benin are small countries compared to Ghana and Nigeria hence, development is not at the same pace. The CTB project was largely a failure because it was expensive for Togo and Benin to upgrade their national transmitting capacity to match the regional generation one. That is, they had to install transmission lines and power plants that could accommodate the Kilo Watts of electricity coming from the other countries through the regional grid. Due to the sluggishness of Togo and Benin in meeting their commitment, Ghana has turned its focus to building an interconnection line with Burkina Faso while building its domestic generating, transmitting and distributing capacity.[117]

From the above illustration, it is evident that it is in the best interest of Togo and Benin to collaborate with Cote d'Ivoire, Ghana and Nigeria to diversify their sources of energy. This is an objective the energy importers aim to achieve. But the importing countries defected in

[116] WAPP Op. Cit. p. 149.

[117] Trojan Power Limited, Op. Cit.

meeting their commitments because of real economic constraints. Monies have been invested in building an interconnection from sub-stations in the exporting countries; this can be a waste of investment if Togo and Benin do not pull through with the agreement. In the meantime, the exporting countries have decided to 'Hunt Hare' by building their national electricity sectors to improve the quality of supply to their domestic populations.

The World Bank is a major financer of the CTB project. In a report the World Bank stated that the project deadline needs to be pushed further by two and a half year. This shows that commitment to the project as well as shortage of funds have served to impede the success of this programme. Other contributing factors could be the unrest in Nigeria and the Ivory Coast which have swayed the attention of these governments and their respective utilities to attend to more pressing national issues. In the meantime, some of these countries have focused on improving their national utility for fear of a failed regional project leaving them wanting. Ghana has made huge capital investments in its electricity sector.[118] This means that the source of electricity for the importing countries is uncertain in the face of recurring civil and religious strife in the supplying countries. Applying the stag hunt game shows that Nigeria defecting in its commitment to the CTB program has resulted in Ghana (another energy exporter) focusing its resources on its national energy sector and finding a new partner to share in the deal – Burkina Faso. This move leaves the Togo and Benin worse off. Togo is still grappling with energy supply as most of its energy comes from traditional biomass. The options for these energy importing countries are to find alternative supply while remaining dependent on the traditional biomass energy source.

The logic of the stag hunt game exposes the challenge on the finance issue. The infrastructures required to complete grid interconnection are very costly to national governments both in capital and in labour. The success of this interconnection is dependent on the efforts of each member states. The incentive to invest all their resources into the regional grid is counter-balanced by the possibility of others failing to meet their *own end of the deal* or fear of others abandoning the project after huge capital investments have been made. These monies can barely be recovered and are considered a huge loss to the

[118] Trojan Power Limited, Op. Cit.

governments who contributed the monies. Such a move can undermine the credibility of the losing government in their domestic politics. In a similar light, it also means that the chances of investing those monies into the national energy sector is forgone and cannot be recovered. More often than not, this throws countries into debt as they go in search of aid to resuscitate the regional project or invest in their national projects.

National utilities struggle to meet domestic demands for electricity; this is the gap that regional initiative promises to fill. But in a situation where there are additional costs incurred to execute regional joint-ventures while national projects suffer, states become unwilling to participate and cooperation fails. For instance, the interconnection between Mozambique's Matambo substation and Malawi's Phombeya substation was largely unsuccessful. The former was to put up a 124 km transmission line and renovate the existing Matambo substation at the cost of US $1.3 million and US $27 million, respectively.[119] Malawi was supposed to build a Phombeya substation and install a 76km transmission line which will amount to US $32 million.[120] This project was unsuccessful because the huge capital required was unavailable and Malawi at that time grappled to put in place its national financial budget.

A key issue in the energy sector of sub-Saharan Africa is the lack of investments in physical infrastructure to produce, transmit and distribute this important resource to end users. Considering the huge capital and labour costs of infrastructure rehabilitation, most of these countries cannot afford to inject such monies into the energy sector. This is a strong motivation for regional cooperation because costs of production, transmission and distribution are shared among collaborative states. All of which will result in the collective good of all which is access to electricity. But in a regional cooperation, harnessing investment is also dependent on the dynamics of the region.

[119] Moshoeshoe, M. Op. Cit. p. 175.

[120] Loc cit.

A region comprising of politically and economically stable states, with good records of democratic practice are more likely to get investments than their authoritative and dysfunctional counterparts. This is another concern of states in collaborative initiatives because aid, loan and investments need to be shared to benefit participating counterparts. Most states want to be able to use such money for their own benefits and not for regional benefits. Ghana was able to secure a US $ 25.9 million loan from the International Development Association (IDA) in 2012 to facilitate the construction of transmission lines between Ghana and Burkina Faso.[121] This money is to foster the objective of the WAPP which is regional electricity integration yet Ghana is expected to repay the loan in 10 years.[122] Although some of the money will be used in improving the energy sector in Ghana, it is unfair that Ghana handles the debt repayment alone. All of these contribute to keeping Africa in the vicious cycle of aid which is also blamed for Africa's sluggish growth.

Currently, the WAPP is redundant as there are only a limited number of interconnections between the national electrical systems of participating states. In addition, some member states with resource endowments have struggled to generate enough electricity for their domestic consumption and struggle to get enough to sell. Other states ignore the electricity crises within their jurisdiction but sell to neighbouring countries. The SAPP has been more functional in comparison to the WAPP but has experienced a number of black-outs due to insufficient electricity to cater for both domestic and external demands.

Anticipated regional gains of power pool arrangements include the possibility of reduced generation costs and the development of electricity infrastructure to facilitate efficient generation, transmission and distribution of electricity for national use. As a result, power pools are perceived as an effective way in countering the constant shortage in electricity supply because of the regional grid. The mutual gains in the electricity market of the SAPP and the WAPP strengthens the rationale of regional cooperation. However, the analytical

[121] Quartey, L. "Ghana Secure Multi-Million Dollar West African Power Pool Project", http://www.theafricareport.com/West-Africa/ghana-secures-multi-million-dollar-west-african-power-pool-project.html, 24 March 2012.

[122] Loc cit.

framework of the Stag Hunt game shows that states has two choices in a given (cooperative) situation – to cooperate or to defect. As a result of the envisioned mutual gains from cooperation, the member states of the SAPP and the WAPP signed a cooperative agreement for the establishment and operation of a regional electricity market. Governments and Ministers of national power utilities signed on to the agreement by signing a number of memoranda as well as creating a protocol to guide electricity exchange in the respective region.

An assessment of cooperation in the Southern African and the West African region show that other strategic concerns of the involved states have constrained their ability to meet their commitment. There is a problem in aligning private gain with regional initiative. For instance, countries in the respective region have consorted to developing their national generating capacities as an assurance in a case where the regional plan fails. Among these countries are Zambia with the plan to expand the Kafuoe, Zimbabwe to construct a 1400MW thermal power station at Gokwe North[123] and Ghana's Kpone project.[124] Alluding to the stag hunt game, the action to defect is dependent on another state defecting. Here, these countries lean towards improving their national capacity as a backup in case the regional plan crumbles. As a result, other states resort to having a backup plan and not completely trust the regional joint-venture. If states were really committed to collective action, they would invest all their resources into making it work. The mere fact that considerations are made on how much to invest in the joint-venture effort challenges the nature and fate of the projects. Also, the necessary expertise is required to build, operate and maintain regional grid. The fact remains that the continent does not have the necessary expertise, skills and technological know-how to manage these mega-projects. The expertise has to be imported from those with the required skills.

[123] Moshoeshoe, M. Op. Cit. p. 169.

[124] Trojan Power Limited: "Ghana's $600m Independent Power Project takes-off", http://trojanpowerghana.com/index.php?option=com_content&view=article&id=71:ghana-s-600m-independent-power-project-takes-off&catid=78&Itemid=611, Accessed: 15 August 2013.

In conclusion, cooperation is not clear-cut. There is a strong rationale for regional cooperation but the African continent records huge failures of regional initiatives. As identified using the stag hunt game as the analytical tool, there are a number of strategic concerns players have that constrain their actions and decisions. But the action of one actor is dependent on the action of others as demonstrated using the WESTCOR and the CTB project of the SAPP and the WAPP. This chapter established a case that commitment to regional electricity cooperation is impeded by the strategic concerns of participating actors. Using the stag hunt as the analytical framework, I was able to assess the WAPP and the SAPP initiatives as a Stag Hunt game. Cooperation can be successful but the strategic and practical challenges they pose need to be addressed.

CHAPTER FIVE

DISCUSSIONS AND CONCLUSIONS

It is no doubt that electricity is an essential tool in pulling Africa out of poverty but the reality is that in most part of Africa, access to electricity is a luxury which many cannot afford and even those who can afford it, are left wanting. Power blackout is a consistent scene in villages, cities and towns across the continent which has adverse effect on the quality of living standards as well as economic productivity. Although there are a number of explanations for blackouts but a major issue is the poor state of electricity generating, transmitting and distribution infrastructure in Africa. These infrastructures require huge capital injection to refurbish them, but these countries do not have the money to fund such projects. In addition to that, the energy sectors in most African countries are experiencing challenges which previous efforts through aid and privatization have not tackled like worn-out infrastructure and consequently, low production and problems of access. For these reasons, regional cooperation has been proposed as a way to overcome challenges that individual states face in achieving energy security. That is, by 'pooling' resources together states are forced to meet their set obligations to ensure that the respective goals are met. For one, regional cooperation plays a critical role in strengthening national efforts through disseminating information on good practices and policy options as well as capacity building.

The proposition that regional cooperation would be efficient in tackling the challenges that national efforts have failed to accomplish is a long standing notion in African politics. An assessment of cooperative initiative in Africa shows that there are numerous of such efforts on record but a very small number of them have been successful. The failures of these joint-venture initiatives have largely been blamed on the political structure of cooperating government as lacking democracy, accountability, rule of law, enforcement mechanisms and corruption.

The aim of this study is to tease out the role of (sub) regional organisations in contributing to Africa's development goals especially in terms of energy security and sustainable development. However, considering the record of failures of cooperative initiatives in Africa, this study also aimed at understanding the challenges facing cooperation apart from the mainstream reasoning. Also, electricity security is a strategic concern of sub-Saharan Africa because of its natural energy endowment versus the prediction of depleting non-renewable energy resources. As a resource rich continent, it is important to understand why most part of sub-Saharan Africa still struggle with electricity access.

I use data from the World Bank to determine the sources of energy dependence in the Southern African and the West African region. This helped me assess whether the energy consumption mix of the countries informs the strategic action of states in a collaborative initiative. Using the data, I drew a plot to place the energy sources of the countries into three categories: fossil fuels, alternative or nuclear energy and combustible/wastes. The results showed that sub-Saharan Africa is still heavily dependent on traditional biomass fuels and fossil fuels to generate electricity.

Using game theory, the Stag Hunt game, I assessed cooperation beyond just the political structure discourse to understand the bargaining tools actors have when they sit to negotiate cooperative deals. My focus here is on electricity cooperation and so I make use of the Southern African Power Pool (SAPP) and the West African Power Pool (WAPP) as case studies. Instead of looking broadly at these organisations, I apply the stag hunt game to selected projects established by these organisations namely: the West Corridor Project (WESTCOR) and the Coastal Transmission Backbone (CTB). From my analysis, cooperation is not impeded by the lack of democracy and accountability only but very importantly the strategic gains and concerns of actors play a crucial role in decision to cooperate or defect. When the strategic interests of actors are misaligned with those of regional ones, cooperation becomes impossible.

The WESTCOR and the CTB are mega-projects that could prove beneficial to the respective regions but challenges associated with successfully pooling agreements need to be addressed. Cooperation in the WESTCOR will still be uncertain unless there are measures in place to assure member states. I speculate increased cooperation between the DRC and South Africa which is a major player in the SADC region. South Africa has to win the trust of the DRC to follow through on the WESTCOR project. This might plunge South Africa deeper into the DRC's domestic politics to make sure that President Joseph Kabila stays in power (at least) till project is nearly done except an opposing candidate offers a better deal. In the CTB, the project has a huge potential to renovate and improve electricity supply in the West African region but their debt accumulation is on the increase. I speculate that before the project reaches completion, the debt accumulated will be so high and motivate states to drop-out of the regional project. This is because monies will have to be paid back to donors over a certain period and during this period other crucial issues needing national attention can arise. States will be discouraged by the amount of debt they have to repay and abandon the project.

This report strongly recommends an exploration and exploitation of renewable energy resources. It fosters a reduction in the frivolities and heavy dependence on conventional energy resources in resource-endowed countries. Solar panels have proven economically efficient once installed and sustainable. Other green energy economy initiatives include wind power and liquefied natural gas (LNG). Extracting natural gas in an environmentally sustainable manner should be looked into as an investment option for both regions. This is because electricity security as a trade-off for environmental degradation does not align with global efforts at human development. Both problems need to be efficiently addressed in the quest to remedy the electricity crises. Mini-grids can prove viable in a geographically challenged setting like West Africa. This mitigates the need for constructing long transmission lines which face threats of vandalism due to terrorism, protests or natural disasters.

My study contributes to the literature on electricity security through trans-boundary cooperation in Africa. It shows that the problems of cooperation in such strategic subject-matter transcend the lack of will and political commitment. My case studies show that

strategic or private gains do play a role in stagnating regional joint-ventures. This thesis has assessed the energy cooperation initiatives of the two prominent power pools to tease out their challenges so that other younger power pools can learn from their mistakes. Successful power pools like the Nordic power pool can be a good model for pools in Africa to learn from.

This report has assessed the challenges of cooperation using the SAPP and the WAPP as case studies in achieving energy security in sub-Saharan Africa. The findings of this report show that strategic gains of individual states are often prioritised in collaborative initiatives. This impedes success in the set goal. An interesting area for further research is to assess the politics of cooperation and partnerships in sub-Saharan Africa's energy development initiatives.

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