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**The Potential of Regional
Power Sector Integration**

**Nile Basin Initiative (NBI) |
Transmission & Trading Case
Study**

**Submitted to ESMAP by:
Economic Consulting Associates**

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Contents

Abbreviations and acronyms	iv
Preface	vii
1 Executive summary	1
1.1 Motivations/objectives for trade	1
1.2 The trade solution put in place	1
1.3 Current status and future plans	2
2 Context for trade	4
2.1 Economic and political context	4
2.2 Supply options	6
2.3 Demand	7
2.4 Energy tariffs	8
3 History of scheme	9
3.1 Overview including timeline/chronology	9
3.2 Project concept, objectives, and development	11
3.3 Feasibility studies done	12
3.3.1 Strategic power sector studies	13
3.3.2 Project-specific feasibility studies	13
3.4 Assets built and planned resulting (directly and indirectly) from scheme itself	15
3.5 Interconnections and electricity trade	16
3.6 Environmental and social issues	17
4 Institutional arrangements	19
4.1 Governance structure	19
4.2 Role of national governments and regional institutions	19
4.3 Regulatory agencies	21

4.4	Role of outside agencies	23
5	Contractual, financial and pricing arrangements	24
5.1	Contracts	24
5.2	Ownership and finance	24
5.2.1	Nile Basin Initiative institutions	24
5.2.2	Nile Basin initiative projects	25
5.3	Pricing arrangements	25
6	Future plans	27
	Bibliography	29

Tables and Figures

Tables

Table 1 Socioeconomic Profile of NBI Countries (2007)	4
Table 2 Existing Electricity Installed Capacity and Annual Energy Production	7
Table 3 Average Final User Electricity Tariffs in NBI Countries	8
Table 4 Chronology of Regional Power Integration for Nile Basin Initiative	9
Table 5 Main Elements of NBI Regional Electricity Sector Integration	11
Table 6 Anticipated Trade from New NBI Projects	17
Table 7 Nile Basin Country Membership of Regional Organizations	21
Table 8 Electricity/Energy Regulators in Nile Basin Countries	22

Figures

Figure 1 Opportunities for Power Trade in the Nile Basin	3
Figure 2 Map Showing Population Distribution in the Nile Basin	5
Figure 3 Map Showing Ethiopia-Sudan Interconnector	14
Figure 4 Map of NEL Interconnection Project Lines and Rusumo Falls	15
Figure 5 Nile Basin Initiative Operational Structure	19
Figure 6 Hydropower Potential in the Eastern Nile Region	27

Abbreviations and acronyms

ADB	Africa Development Bank
AFUR	Africa Forum for Utility Regulators
CDM	Clean Development Mechanism
CEEAC	Communaute Economique des Etats de L'Afrique Centrale (English ECCAS)
CENSAD	Community of Sahel-Saharan States (French: Communauté des Etats Sahélo-Sahariens)
CFL	Compact Fluorescent Lamp
CIDA	Canadian International Development Agency
COMESA	Common Market for Eastern and Southern Africa
DRC	Democratic Republic of the Congo
EAC	East African Community
ECCAS	Economic Community of Central African States (French CEEAC)
ENTRO	Eastern Nile Technical Office
ESMAP	Energy Sector Management Assistance Program
EU	European Union
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GWh	Giga-Watt hour (measure of electrical energy)
HDI	Human Development Index
ICA	Infrastructure Consortium for Africa
ICCON	International Consortium for Cooperation on the Nile
IGAD	Intergovernmental Authority on Development (French: Autorité intergouvernementale pour le développement)
IPP	Independent Power Producer
KENGEN	Kenya Generation Company
KPLC	Kenya Power and Light Company

kWh	kilowatt-hour
LDC	Least Developed Country
LRMC	Long-Run Marginal Cost
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MTOE	Million Tonnes of Oil Equivalent
MW	Megawatt (measure of electrical power or capacity)
NBI	Nile Basin Initiative
NBTF	Nile Basin Trust Fund
NEL	Nile Equatorial Lakes region
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NELSAP-CU	Coordination Unit for the Nile Equatorial Lakes Subsidiary Action Program
NGO	Non-Government Organization
Nile-COM	Council of Ministers of Water Affairs of the Nile Basin Countries
Nile-SEC	Nile Basin Secretariat
Nile-TAC	NBI Technical Advisory Committee
PAD	Project Appraisal Document
pcpa	per capita per annum
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PPP	Purchasing Power Parity (when used in relation to GDP)
PSP	Private Sector Participation
R&D	Research and Development
RAERESA	Regional Association of Electricity Regulators for East and Southern Africa
RERA	Regional Electricity Regulators Association of Southern Africa
SADC	Southern African Development Community

SAPP	Southern African Power Pool
SINELAC	Societe Internationale d'Electricite des Grands Lacs
SNEL	Société Nationale d'Electricité (Electricity Utility of DRC)
SSEA	Strategic/Sectoral, Social and Environmental Assessment of Power Development Options in the Nile Equatorial Lakes Region
SWAp	Sector Wide Approach
UETCL	Uganda Electricity Transmission Company Limited
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNOPS	United Nations Office for Project Service
WB	World Bank

Preface

This case study is part of an Energy Sector Management Assistance Program (ESMAP) project on Regional Power System Integration (RPSI). The objective of the project is to facilitate and accelerate RPSI projects in developing countries around the world. The project will draw on international experience and theoretical analysis in this area to provide a framework to assess:

- o the economic, financial and environmental benefits that can accrue to regional power trading;
- o the institutional and regulatory arrangements needed to sustain and optimize regional projects; and
- o the ways in which obstacles to integration have been successfully overcome.

The final output of the project will be an umbrella report, *Regional Power Sector Integration – Lessons from Global Case Studies and a Literature Review*. This review will summarize the 12 case studies and literature review undertaken and analyze common themes on barriers to RPSI and solutions to overcome them.

Economic Consulting Associates was contracted to execute the project. In doing so, we are working closely with ESMAP and World Bank staff, as well as government officials, utility, power pool, and regional economic community personnel, and others directly involved in implementing regional power schemes.

This and other 11 Case Studies are prepared as clear, factual presentations of the selected projects. The intent is to provide a direct, easily digestible description of each of the selected projects without imposing an analytic framework or making judgments about the degree of success. Such analysis will be undertaken at the global level, considering the entirety of experiences from the Case Studies, in the aforementioned umbrella report.

All 12 Case Studies follow a uniform structure to facilitate ease of comparison and reference from one Study to the next. Some sections are longer than others, depending on the specifics of the Study. Additionally, there is some cross-referencing within each Study.

1 Executive summary

1.1 Motivations/objectives for trade

The Nile Basin Initiative (NBI) is a body formed in 1999 to “develop the river in a cooperative manner, share substantial socioeconomic benefits, and promote regional peace and security.” There are nine member countries (Egypt, Sudan, Ethiopia, Uganda, Kenya, Rwanda, Burundi, DR Congo and Tanzania). Eritrea has observer status. The Nile Basin region is characterized by underdevelopment, with low per capita incomes, depressed social indicators and high levels of poverty. Outside of Egypt, electrification rates vary between 2% and 30%, and average consumption of electricity is a mere 77 kWh per capita per annum.

The NBI has a broad development and natural resource management agenda. Within this, the power sector component is important. There are significant electricity sector differences between NBI countries, and as demand grows some will have persistent deficits while others could install low-cost generation capacity which would allow exports of electricity as well as meeting domestic demand for power with a high degree of reliability. In view of such imbalances, and the potential for complementarity between the predominantly thermal system in Egypt and the hydropower potential in the upstream countries, regional integration of the electricity sector is seen by NBI countries as a crucial element of addressing existing power sector deficits in several countries and making it possible for future growth in electricity supply to match the ambitious economic development plans of all the NBI countries.

1.2 The trade solution put in place

At present there is very limited cross-border electricity trading between the countries of the Nile Basin. Besides support at national borders to small networks in neighboring countries, the only significant trading arrangements are those associated with the long-duration 30 MW contract between Uganda and Kenya and the exchanges between DR Congo, Burundi and Rwanda associated with Ruzizi II (36 MW).

The development approach adopted in NBI has been to combine a top-down Shared Vision Program (SVP) with two bottom-up Subsidiary Action Programs, one located in the Eastern Nile (ENSAP – Egypt, Ethiopia and Sudan) and the other in the Nile Equatorial Lakes region (Burundi, DR Congo, Kenya, Rwanda, Uganda and Tanzania). Various power sector studies have been conducted under these three programs.

The projects currently being promoted under the subsidiary action programs are:

- o **Ethiopia Power Trade Project:** interconnection of the Ethiopia and Sudan electricity systems via 454 km dual 230 kV lines. Cost US\$59 million, due to be operational in 2010.
- o **Nile Equatorial Lakes Interconnector Project:** construction and upgrading of 769 km of 110 kV and 220 kV lines connecting Burundi, DR Congo, Kenya, Rwanda

and Uganda. Cost US\$240 million, construction to be completed by December 2013.

- o **Regional Rusumo Falls Hydroelectric and Multipurpose Project:** electricity component is to be 60 to 80 MW hydropower station with transmission links to Burundi, Rwanda and Tanzania. Feasibility study still underway; total cost may be on the order of US\$355 million.

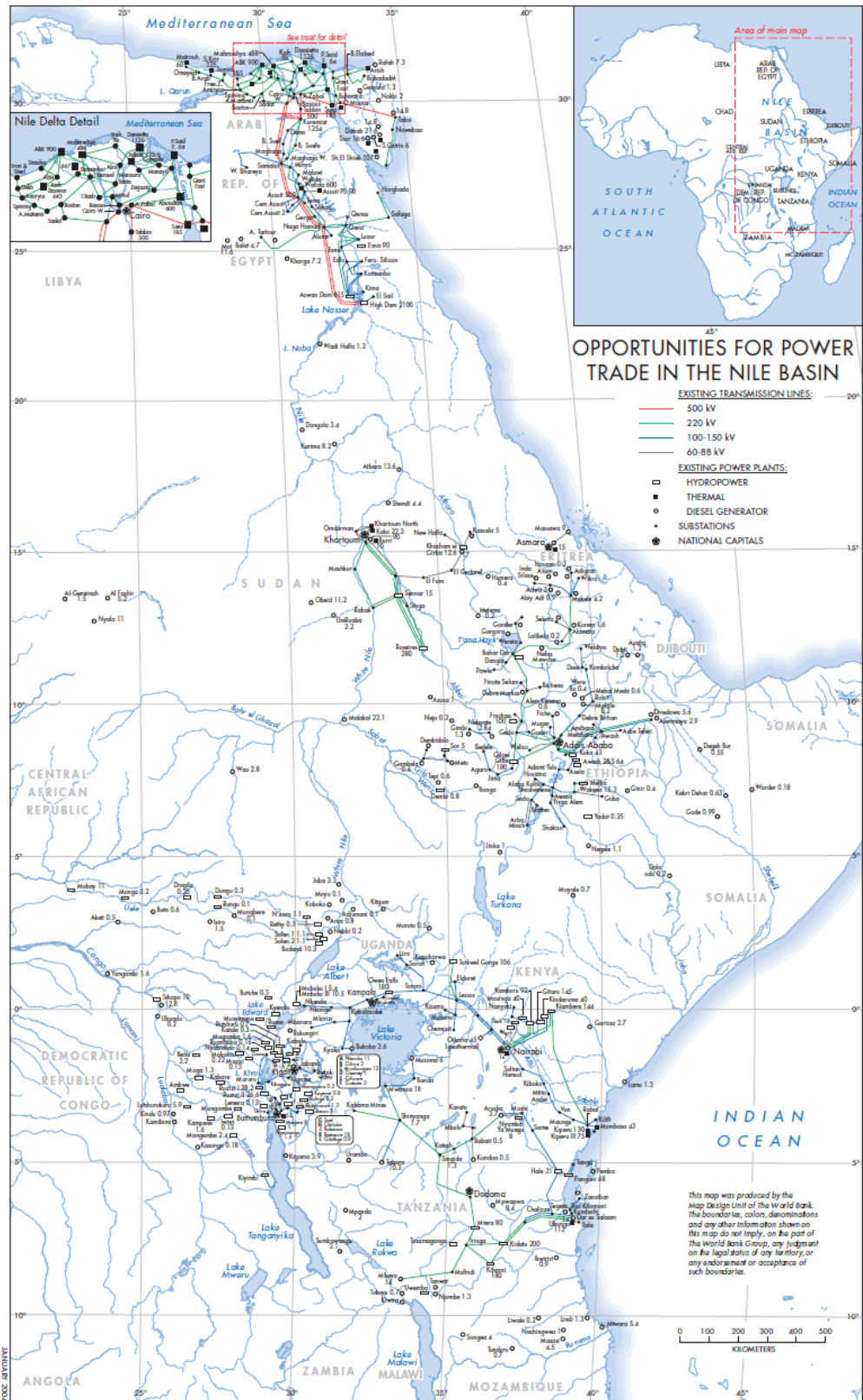
When these projects have been completed, they are expected to result in cross-border electricity trade of at least 220 MW in 2013, rising to 620 MW by 2030.

1.3 Current status and future plans

The three initial projects outlined above have had long lead times. Greater momentum is expected in developing future regional power projects. Figure 1 provides a perspective on the options, showing that at present the electricity systems of the Nile Equatorial Lakes countries are separated from those of Ethiopia, Sudan and Egypt.

Future growth in electricity trade is expected to originate primarily from hydropower developments in DR Congo, Ethiopia and Sudan. For this to occur, the transmission backbone will need to be completed, integrating the networks of the NBI countries. Corresponding development will be needed in the institutional infrastructure – elaboration of market and operational rules for electricity trading and the development of commercial agreements. In the longer term, the intention is to move from trade based primarily on bilateral contracts toward a competitive regional market. This will require further development of the institutional structure, which could ultimately result in the establishment of a regional regulator and regional dispatch center.

Figure 1 Opportunities for Power Trade in the Nile Basin



2 Context for trade

2.1 Economic and political context

By any measure, the Nile is one of the world's greatest rivers. Its length is over 6,600 km, the basin covers 3,400,000 km² (about one-tenth the area of Africa) and the average discharge is 2,830 m³/s. The Nile Basin is a vital source of life and livelihoods for over 350 million people living in the basin, with particular importance in the downstream areas where the river flows through the arid Sahara desert. As shown in Figure 2, the population distribution is highly uneven. The central role of the Nile in the economies of the riparian states is such that there is a history of tension over the use of Nile water. It is a considerable achievement therefore for the countries to have come together in 1999 to form the Nile Basin Initiative (NBI), which "seeks to develop the river in a cooperative manner, share substantial socioeconomic benefits, and promote regional peace and security."

There are nine members of the NBI (the tenth riparian state, Eritrea, shares only a small portion of the Nile Basin and has observer status in the NBI). Basic socio-economic information is given in Table 1. The countries are listed in riparian order, starting with Egypt, which has by far the largest GDP (50% of the NBI total) and electricity sector (82% of total electrical energy). The region is characterized by low income levels, widespread poverty, lack of access to basic social and infrastructure services, environmental problems, and a legacy of conflict and discord which is still evident in parts of the basin.

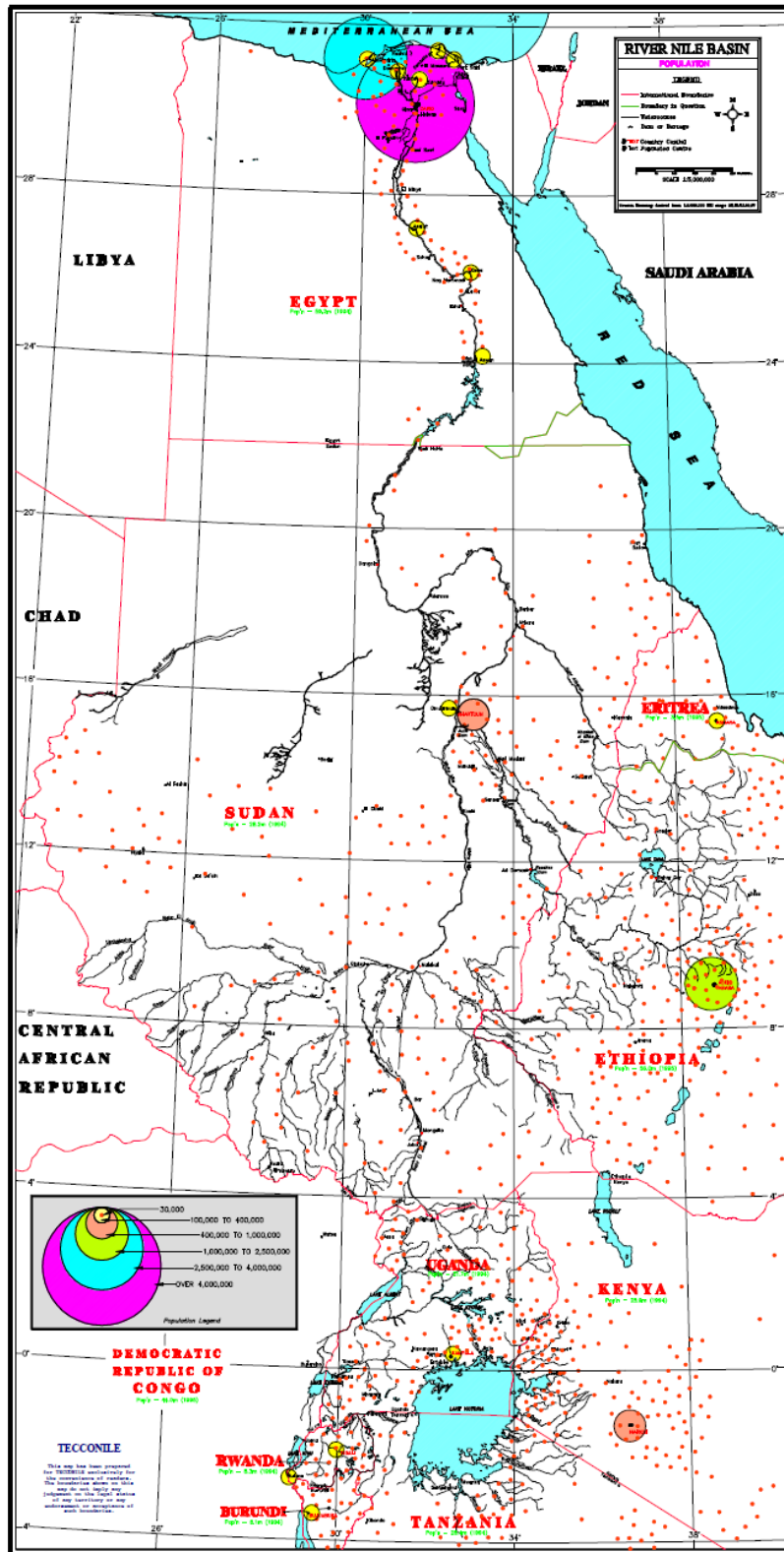
All the countries except Egypt and Kenya are classified as least developed countries (LDCs), and it is only Egypt, Sudan, Kenya and Uganda which have "medium" human development as measured by the United Nations Development Program Human Development Index (HDI). The second-last column gives a total or an average weighted by population for each category of information, with the final column leaving out Egypt and the Democratic Republic of the Congo (DRC). Egypt is omitted to show the effect on the electricity indicators, while the DR Congo is omitted because it is only the eastern part of the country which is really part of the Nile Basin. The country's enormous hydropower resources are mainly located on the Congo River to the south and west.

Table 1 Socioeconomic Profile of NBI Countries (2007)

	Egypt	Sudan	Ethiopia	Uganda	Kenya	Rwanda	Burundi	DRC	Tanzania	Total /wt av	ex. Egypt and DRC
Population (millions)	72.8	36.9	79	28.9	35.6	9.2	7.9	58.7	38.5	367.5	236.0
Surface area (km ²)	1,002,450	2,505,813	1,104,300	236,040	580,367	26,798	27,830	2,344,858	945,203	8,773,659	5,426,351
Human Development Index	0.708	0.526	0.406	0.505	0.521	0.452	0.413	0.411	0.467	0.5053	0.4662
GDP (US\$ billions)	89.4	27.5	11.2	8.7	18.7	2.2	0.8	7.1	12.1	177.7	81.2
GDP per capita (PPP)	4,377	2,083	1,055	1,454	1,240	1,206	699	714	744	1,775	1,236
GDP growth % (some recent average)	2.4	3.5	1.5	3.2	-0.1	0.1	-2.8	-5.2	1.7	0.7	1.6
Inflation (GDP deflator annual %)	4.9	8.5	11.6	8.2	10.3	9.1	13	21.3	8.6	10.8	10.0
Exports (% of GDP)	30	18	6	13	27	11	8	32	17	20	14
Life expectancy at birth (years)	70.7	57.4	51.8	49.7	52.1	45.2	48.5	45.8	51	54.7	52.0
Mortality rate under 5 years (per 1,000)	33	90	109	79	79	118	114	129	76	86.8	93.0
Adult literacy rate (%)	71.4	60.9	35.9	66.8	73.6	64.9	59.3	67.2	69.4	61.3	56.7
School enrollment rate (%)	76.9	37.3	42.1	63	60.6	50.9	37.9	33.7	50.4	51.6	48.3
Electricification rate (%)	98	30	15	9	14	5	2	6	11	30	15
Electricity consumption per capita (KWh)	1,465	116	36	63	169	31	22	92	69	354	77

Sources: Human Development Report (UNDP) and World Development Indicators (World Bank)

Figure 2 Map Showing Population Distribution in the Nile Basin



The weighted average electrification rate for the nine countries is 30%, with annual average consumption of 354 kWh per capita per annum (pcpa). When Egypt and DR Congo are removed, the weighted averages for the remaining NBI countries fall to 15% for the electrification rate and 77 kWh pcpa for average consumption.¹ This is an extremely low level, not just in relation to high-income countries, where consumption is over 10,000 kWh pcpa, but to developing countries as a whole (1,220 kWh pcpa), sub-Saharan Africa (478 kWh pcpa), and LDCs (119 pcpa). Tapping the potential benefits of regional power sector integration is an important part of the strategy of NBI countries to improve electrification rates and increase electricity usage in their countries.

2.2 Supply options

The main electrical energy resources that have stimulated interest in regional power sector integration in the NBI region are the hydropower resources of the Nile River itself. The region is also well endowed with other resources:

- o hydropower – potential over 200,000 GWh per annum from 46,000 MW (this excludes the DR Congo; if included, the hydropower potential for the nine countries rises to 660,000 GWh generated from 150,000 MW)
- o petroleum (Egypt, Sudan, DR Congo and to a small extent in Uganda) – 624 million tonnes of oil equivalent (MTOE)
- o natural gas (Egypt, Ethiopia and Tanzania) – 1,300 MTOE
- o geothermal (Ethiopia, Kenya, Uganda, Rwanda) – 2,540 MW
- o coal (Egypt, Ethiopia, Kenya, DR Congo) – 500 million tonnes, also unknown quantities of coal bed methane
- o methane from Lake Kivu (Rwanda and DR Congo) – sufficient for 700 MW of electricity generation.²

There is also extensive potential for harnessing renewable resources for electricity generation (particularly wind and solar) and for energy substitution (e.g., solar water heating substituting for electrical geysers).

The existing installed capacity and typical production levels are shown in Table 2. This table emphasizes the dominance of Egypt, which accounts for 84% of the installed capacity and 88% of the energy. The bulk of Egypt's installed capacity is thermal (mainly gas), so that when Egypt is included, hydro accounts for 20% of installed capacity, while when Egypt is excluded hydro accounts for over 60% of installed capacity.

¹ This is the total electrical energy divided by the population, not the amount consumed by those who have direct access to electricity.

² Data in this section from World Bank (2004), pg 23.

Table 2 Existing Electricity Installed Capacity and Annual Energy Production

	Thermal MW	Hydro MW	Subtotal MW	Isolated MW	Total MW	Energy GWh
Egypt	19,456	2,810	22,266	484	22,750	123,066
Sudan	507	342	849	135	984	3,741
Ethiopia	29	670	699	59	758	3,299
Uganda	65	317	382	2	384	2,118
Kenya	471	677	1,148	9	1,157	4,080
Rwanda	21	34	55	0	55	300
Burundi	6	37	43	4	47	160
Eastern DRC	0	40	40	55	95	499
Tanzania	600	557	1,157	29	1,186	4,414
Total	21,155	5,484	26,639	777	27,416	141,677
Excluding Egypt	1,699	2,674	4,373	293	4,666	18,611

Sources: World Bank (2004) updated with latest feasibility studies and SAPP data—see

With regard to electricity sector reform, there has been discussion of unbundling and private-sector participation in all of the countries, but to date it is only Kenya, Tanzania and Uganda which have made significant moves in the direction of reform. Kenya has established a separate generation company – the Kenya Electricity Generation Company (KenGen), which competes with independent power producers (IPPs) – while transmission and distribution remain under the Kenya Power and Light Company (KPLC). In Tanzania, early intentions to unbundle the Tanzania Electric Supply Company (TANESCO) have not been realized, but IPPs have been established, and the current structure is essentially an integrated single-buyer model. In Uganda, there was unbundling of generation, transmission and distribution and there is a degree of involvement of outside companies in the generation and distribution components. Transmission and the single-buyer function are the responsibility of the state-owned Uganda Electricity Transmission Company Limited (UETL).

2.3 Demand

Load growth in the largest electricity market, Egypt, has recently been running at an average of over 6% per annum for both maximum demand and the energy generated. This is resulting in an increase in peak demand of over 1,100 MW per annum. This rapid growth in demand has been accommodated in Egypt by investment in new capacity. In recent times, increasing attention is also being paid to demand-side management measures (such as time-of-use tariffs) in order to reduce peak demand requirements and hence allow new investments to be delayed.

Broadly speaking, load growth has also been accommodated by investment in Ethiopia and Sudan, while in other Nile countries, the pattern has been one of rapid growth in underlying demand, but this has not always been met by adequate increases in generation capacity. The existence of unmet demand is evident from regular load shedding for existing customers and the inability of electricity utilities to provide for new demand, thereby dampening investment in productive activities and limiting GDP growth. A severe regional drought in 2002–2003 resulted in a sharp cutback in hydroelectricity supplies, exacerbating the supply-

demand imbalance. Several governments leased thermal generators on an emergency basis. This expensive capacity is still largely in place pending the commissioning of new projects (e.g., the Bujagali hydropower plant in Uganda or the Lake Kivu methane generators in Rwanda).

The countries upstream of Egypt are all striving to improve the very low levels of electrification (ranging between 2% and 30%), as well as to meet existing demand adequately and to improve security of supply. Rapid growth in electricity demand is anticipated in the region, on the order of 8% to 10% per annum. Even higher rates of demand growth are assumed in the feasibility studies of the regional power projects being implanted at present, notably the Burundi-Kenya-Uganda-DR Congo-Rwanda interconnector project and the Ethiopia-Sudan power trade project.

2.4 Energy tariffs

As shown in Table 3, electricity tariffs vary significantly between NBI countries, from 2.3 USc/kWh in Egypt to nine times that level in Rwanda. The electricity price for consumers in Rwanda would be even higher if the partial government subsidies to generation were to be removed.

Table 3 Average Final User Electricity Tariffs in NBI Countries

Country	Tariff (USc/kWh)
Egypt	2.3
Sudan	9.2
Ethiopia	6.0
Uganda	10.0
Kenya	9.4
Rwanda	20.0
Burundi	8.5
DR Congo	7.1
Tanzania	11.0

Sources: ADB (2007), World Bank (2008), SADC tariff study

3 History of scheme

3.1 Overview including timeline/chronology

Before the Nile Basin Initiative, there was a history of limited regional trade in electricity. Uganda, for example, has exported power to Kenya since 1958, this being associated with the agreements reached between the two countries when the Owen Falls Power Station (150 MW)³ and 132 kV Tororo-Nairobi transmission line were built. Uganda also exported power on a regular basis to Tanzania and Rwanda.

The most significant pre-NBI regional arrangement was associated with the building of the Ruzizi II project (36 MW), which is located in the DR Congo and exports power to Burundi and Rwanda.⁴ Under a convention signed in 1984, Ruzizi II is jointly owned by the three countries and is operated by a special-purpose company Société Internationale des Grands Lacs (SINELAC). The Ruzizi II project was developed under the rubric of the Organisation pour l’Energie des Grands Lacs (EGL), a body formed in 1974 and subsequently absorbed into the Economic Community of the Great Lakes Countries (CEPGL), which was created in 1976 by Rwanda, Burundi and the then Zaire (DR Congo).

The formal launch of the Nile Basin Initiative in 1999 was preceded by several years of negotiation and preparatory work, much of this being promoted by the World Bank. Some of the specific milestones before the launch and the establishment thereafter of NBI programs and the associated implementation institutions are recorded in Table 4. The chronology also records the establishment of non-NBI institutions which are intended to contribute to the deepening of regional integration in the power sector in the region, namely the East African Power Pool (EAPP, formed in 2005) and the Regional Association of Energy Regulators for East and Southern Africa (RAERESA, established in June 2009).

Table 4 Chronology of Regional Power Integration for Nile Basin Initiative

Year	Event
1955	Kenya-Uganda electricity agreement signed
1958	Owen Falls Power Station and Ruzizi I commissioned
1974	Organisation pour l’Energie des Grands Lacs (EGL) formed
1976	Economic Community of the Great Lakes Countries (CEPGL) formed
1984	Convention to build Ruzizi II and establish SINELAC signed
1989	Ruzizi II commences operations (2x12 MW, 3 rd unit added in 2001)

³ In the 1980s, the power station was refurbished and the capacity increased to 180 MW. In the post-colonial period, it is known as the Nalubaale Power Station.

⁴ Ruzizi I hydropower station (32 MW), which is operated by the Congolese utility SNEL, is primarily for internal consumption.

Year	Event
1997	Nile Council of Ministers requests formation of Consultative Group
1998	Nile Basin Technical Advisory Committee (Nile-TEC) formed
1999	NBI launched by Ministers of Water; NBI Secretariat established in Entebbe
2001	Approval of Shared Vision Program project portfolio
2002	Establishment of offices in Ethiopia and Rwanda, respectively, to implement ENSAP and NELSAP
2003	Power Declaration signed by ministers of energy
2005	NELSAP Energy Ministers adopt Power Master Plan for NEL Region
2005	Nile Basin Discourse launched
2005	East African Power Pool (EAPP) established
2005	NELSAP Indicative Power Master Plan endorsed by ministers of energy
2006	NBI signed MOU with East African Community
2009	Formation of Regional Association of Energy Regulators for East and Southern Africa (RAERESA)

Sources: Various; see Bibliography.

The NBI has three main programs:

- o The Shared Vision Program (SVP)
- o Eastern Nile Subsidiary Action Program (ENSAP), involving Egypt, Ethiopia, and Sudan
- o Nile Equatorial Lakes Subsidiary Action Program (NELSAP), involving Burundi, DR Congo, Kenya, Rwanda, Uganda, and Tanzania

The Shared Vision Program is an over-arching “top-down” program encompassing eight different areas, one of which is regional power trade. The two Subsidiary Action Programs are “bottom-up” investment programs, also covering a number of different areas relating to integrated water resource management, including power components.

The current power components of these programs are summarized in Table 5. The three main current investment projects:

- o Ethiopia Power Export Project
- o NELSAP Interconnection Project
- o Rusumo Falls Hydroelectric and Multipurpose Project

are due to be implemented in the next few years. These projects are described in more detail in Section 3.3.2.

Table 5 Main Elements of NBI Regional Electricity Sector Integration

Main NBI Program	Main Electricity Framework Studies	Main Electricity Investment Projects	Implementing Institutions
Shared Vision Program	Regional Power Trade Project		NBI Secretariat (Nile-SEC) – Entebbe, Uganda
Eastern Nile Subsidiary Action Program (ENSAP)	Eastern Nile Power Trade Investment Project	Ethiopia Power Export Project	Eastern Nile Regional Technical Office (ENTRO) – Addis Ababa, Ethiopia
Nile Equatorial Lakes Subsidiary Action Program (NELSAP)	Strategic Social and Environmental Assessment of Power Options	Interconnection of electric grids of Nile Equatorial Lakes Countries (Burundi, Kenya, Uganda, DR Congo, Rwanda) Regional Rusumo Falls Hydroelectric and Multipurpose Project (Kagera River)	Nile Equatorial Lakes Subsidiary Action Program Coordination Unit (NELSAP-CU) – Kigali, Rwanda

Source: NBI website <http://www.nilebasin.org/>

ENSAP Countries: Egypt, Ethiopia, Sudan

NELSAP Countries: Burundi, DR Congo, Kenya, Rwanda, Uganda, Tanzania

The Ethiopia power export project will provide an interconnector between Ethiopia and Sudan, with the intention that at some later stage Sudan will be interconnected with Egypt. Another important longer-term ambition is for the Eastern Nile and Nile Equatorial Lakes regions to be interconnected through a transmission line between the Ethiopian and Kenyan electricity networks. As shown in Figure 1 (in the Executive Summary) the two parts of the Nile Basin are at present completely isolated from each other as far as grid electricity is concerned.

3.2 Project concept, objectives, and development

The Nile Basin Initiative is a partnership with the following objectives:

- o To develop the Nile Basin water resources in a sustainable and equitable way to ensure prosperity, security, and peace for all its peoples.
- o To ensure efficient water management and the optimal use of the resources.

- o To ensure cooperation and joint action between the riparian countries, seeking win-win gains.
- o To target poverty eradication and promote economic integration.
- o To ensure that the program results in a move from planning to action.

These objectives form the basis for the NBI's Strategic Action Program, which has a twofold, complementary approach:

- o Lay the groundwork for cooperative action through a regional program to build confidence and capacity throughout the basin (the Shared Vision Program).
- o Pursue, simultaneously, cooperative development opportunities to realize physical investments and tangible results through sub-basin activities (subsidiary action programs) in the Eastern Nile and the Nile Equatorial Lakes regions.

In the power sector, the specific objectives are to:

- o ensure sufficient and reliable power supply to meet social and economic development objectives;
- o develop hydropower and other sources of electricity in a manner that is environmentally and socially sustainable;
- o improve access of the population to reliable and low-cost power in the Nile Basin;
- o establish institutions that can develop regional power markets among the Nile Basin countries.

The expansion of trade in electricity is regarded as an immediate priority, while the development of a regional electricity market is a longer-term objective. The potential benefits of regional power integration which have been identified include providing higher quality of supply at lower costs, ensuring that the hydropower resources of the Nile Basin are developed and managed in an integrated and sustainable manner, and reducing emission of greenhouse gases and other pollutants by shifting from thermal to hydropower-based generation.

3.3 Feasibility studies done

As indicated in Table 5, there have been two categories of studies carried out in connection with integrating the power sectors of NBI countries:

- o Strategic, overview studies as part of the SVP, ENSAP and NELSAP
- o Specific project studies

These are discussed in turn in the next two subsections.

3.3.1 Strategic power sector studies

Under SVP, the first phase of **Regional Power Trade Project** included preliminary analysis of long-term power supply, demand and trade opportunities as well as identification of potential projects for development within the Subsidiary Action Programs. An important component of Phase II calls for a comprehensive basin-wide study of power development options and trade opportunities. Funding for this has been secured from the Nile Basin Trust Fund (US\$4.1 million), and the study is due to be carried out over the period mid-2009 to mid-2011.

Under ENSAP, the **Eastern Nile Power Trade Investment Project** (2006–2008) made a Cooperative Regional Assessment of Power Trade Opportunities, including hydropower pre-feasibility studies, and in a subsequent phase carried out a feasibility study of power interconnection involving Ethiopia, Egypt, and Sudan.

In the NEL region, the major study which was completed in early 2007 was the **Strategic Social and Environmental Assessment of Power Development Options in the Nile Equatorial Lakes Region (SSEA)**. Grounded in a thorough analysis and screening of electricity development options, the SSEA study provided analysis of the risks and environmental implications of preferred options and assessed cumulative impacts. SSEA provided an **Indicative Power Master Plan** for the NEL region which was endorsed by the NELSAP Ministers of Energy in December 2005. The plan includes a set of “best evaluated” power generation options and transmission interconnection projects for the next 20 years, including social and environmental concerns.

3.3.2 Project-specific feasibility studies

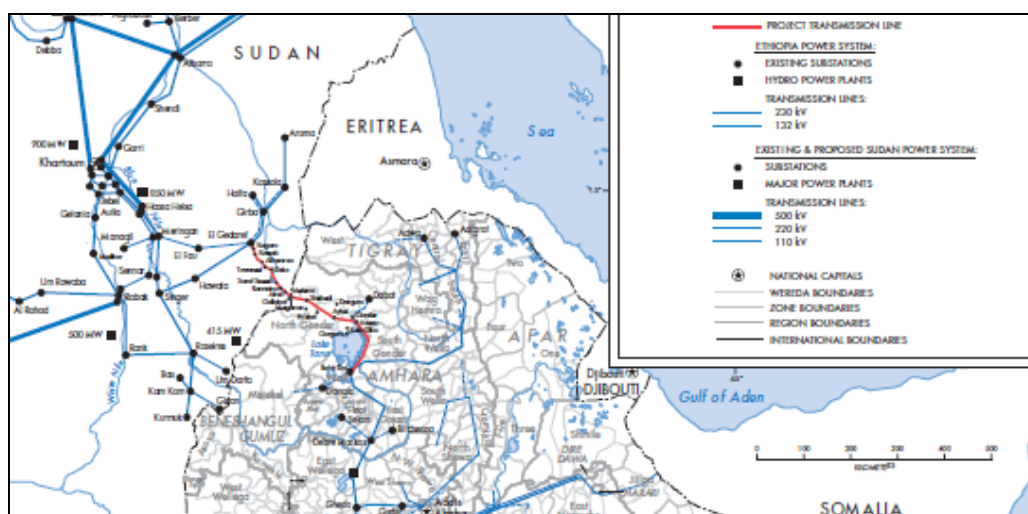
A large number of feasibility studies have been carried out of electricity projects in the NBI countries, many of which have regional ramifications. This subsection gives an overview description of the three main regional investment projects which are currently reaching implementation stage, drawing on the respective feasibility studies, while the next section gives the details of the infrastructure investments that are envisaged.⁵

Ethiopia Power Export Project

The Ethiopia Power Export Project (formerly called the Ethiopia-Sudan Interconnection Project) will connect the power grids of Ethiopia and Sudan to facilitate cross-border energy trade and optimize existing and planned generation capacity. This is needed in order to overcome the severe electricity shortage in both countries, which is a major constraint to poverty reduction and economic growth. It is considered a first step toward greater regional power trade. The World Bank is providing financing for investments in Ethiopia (US\$43 million), and the government of Sudan is funding activities in Sudan (US\$26 million). The total project cost is therefore US\$59 million. The location of the new transmission line, which is expected to be operational in 2010, is shown in Figure 3.

⁵ A fourth project which is presently subject to a full feasibility study is Ruzizi III (82 MW–140 MW).

Figure 3 Map Showing Ethiopia-Sudan Interconnector



NEL Interconnection Project

The objectives of the NEL Transmission Interconnection project are to improve the living conditions of the people as well as the quality of the socioeconomic development environment of the region, based on the availability of affordable electric energy and access by the communities to electricity through increased cross-border electric power trade.

The studies for the project include detailed design for four key transmission lines between Burundi, DR Congo, Kenya, Rwanda and Uganda. The feasibility study examines the economic and financial performance, environmental and social impact, institutional issues and implementation arrangements. The principal sponsor of the project is the African Development Bank. The total cost is estimated at around US\$240 million.⁶ Construction is due to start in December 2009 and to be complete in December 2013.

Rusumo Falls Hydroelectric and Multipurpose Project

The Regional Rusumo Falls Hydroelectric and Multipurpose Project on the Kagera River is to be a dam with an associated run-of-the-river hydropower plant that will be equally shared between Burundi, Rwanda and Tanzania (see Figure 4). The hydroelectric power component is to have an installed capacity of approximately 60 to 80 megawatts (the final capacity is being decided as part of a feasibility study which is still in progress). The Rusumo transmission lines will connect the power station to the national grids of Rwanda and Burundi and will supply electricity to the western mining provinces of Tanzania, which are currently not connected to the country's national grid.

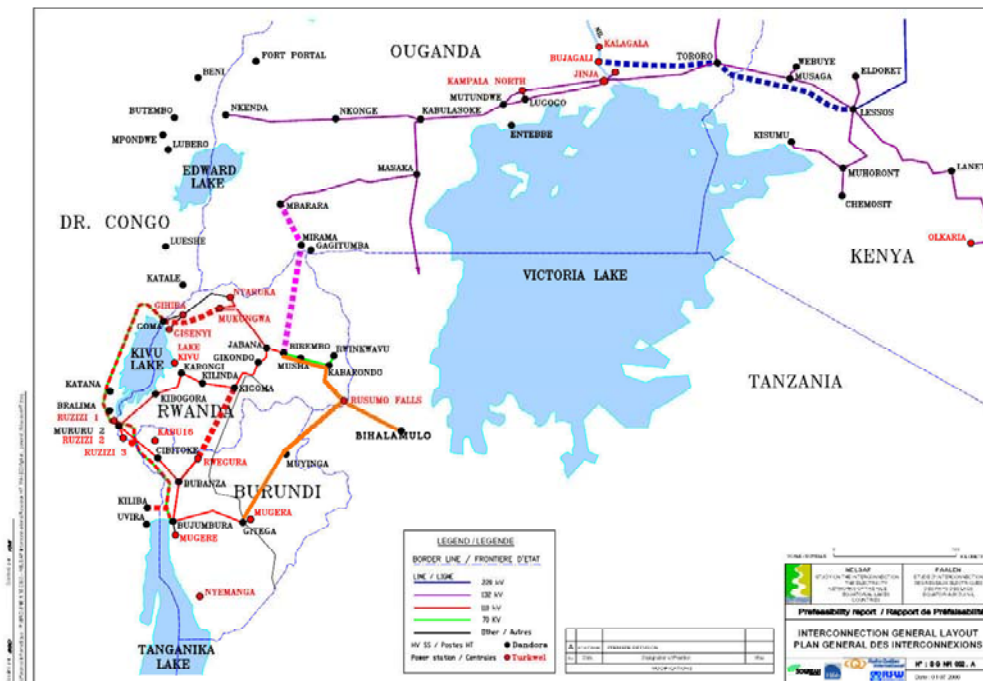
Beyond hydropower, the "multipurpose" aspects of the development will include watershed management, key catchment restoration, erosion control, programs for prevention and treatment of waterborne diseases, HIV/AIDS prevention in association with dam construction, and stakeholder communication. In addition the project will provide

⁶ In the ADB unit of account, the total cost is 160 million.

support for targeted local communities and businesses, including capacity building for small enterprises, micro-finance schemes and social development funds.

The total cost of the project will be known with more accuracy when the feasibility study has been completed. The highest estimate of the cost is US\$355 million, of which US\$257 million is for the generation component and \$98 million for transmission lines and substations.⁷ Most of the financing is expected to be provided by a consortium of bilateral and multilateral donors, led by the World Bank. A public-private partnership arrangement is proposed for the hydropower station.

Figure 4 Map of NEL Interconnection Project Lines and Rusumo Falls



3.4 Assets built and planned resulting (directly and indirectly) from scheme itself

The projects just described involve the following infrastructural investments:

- o **Ethiopia Power Export Project:** construction of dual 230 kV transmission lines from Bahir Dar on Lake Tana in Ethiopia to Gedaref in Sudan (total distance 454 km; some existing line will be reused), together with substation expansion and rehabilitation and telecommunication systems.

⁷ ICA (2008).

- o **NEL Interconnector Project:** construction and upgrading of 769 km 110 kV and 220 kV line, as well as the construction and reinforcement of 17 transformer stations:
 - o Uganda-Rwanda interconnection: The line runs from Mbarara station to Mirama station in Uganda, then from Mirama station to the new Birembo station in Rwanda.
 - o Kenya-Uganda interconnection: The line runs from Lessos station in Kenya to Bujagali station passing through Tororo station in Uganda.
 - o Upgrading of the Burundi, DR Congo and Rwanda interconnection. This component consists in upgrading the current line from Goma station to the Rusizi I station in DR Congo from 70 kV to 220 kV, and the line from Rusizi I station to Bujumbura in Burundi from 70 kV to 110 kV, as well as the construction of an extension from Bujumbura to Kiliba in DR Congo and the construction of a 110 kV line from Kibuye station to Gisenyi station in Rwanda.
 - o Construction of the line from Gisenyi station in Rwanda to Goma station in DR Congo.
- o **Rusumo Falls Hydroelectric and Multipurpose Project:** construction of a hydropower station of 60 to 75 MW (optimal size still being investigated), together with transmission lines from Rusumo to:
 - o Gitega, Burundi (200 km)
 - o Kigali/Kabarondo, Rwanda (50 km)
 - o Biharamulo, Tanzania (100 km)

3.5 Interconnections and electricity trade

As pointed out in Section 3.1, at present there is very limited cross-border electricity trading between the countries of the Nile Basin. Besides support at national borders to small networks in neighboring countries, the relatively significant trading arrangements are those associated with long-duration contracts between Uganda and Kenya (although in recent years the flow has been from Kenya to Uganda – around 20 MW) and the exchanges between DR Congo, Burundi and Rwanda associated with Ruzizi II. As shown in Table 6, the new projects are expected to significantly increase electricity trade flows within the region.

Table 6 Anticipated Trade from New NBI Projects

Transmission Line	Minimum (MW)	Maximum (MW)	Comment
Ethiopia-Sudan	100	200	100 MW firm, up to 100 MW non-firm
Rwanda-Uganda	30	60	
Uganda-Kenya	70	160	Lower level for 2013, upper is projected level for 2030
Burundi-Rwanda-DR Congo	20	200	
Totals	220	620	

Source: Project feasibility studies, World Bank (2007) and ADB (2008)

3.6 Environmental and social issues

The framework studies, notably the SSEA power options study, include analysis of the environmental and social implications of regional hydropower options. The strategic approach that SSEA developed into the Indicative Power Master Plan which was approved by the NEL ministers was to use projects with low social and environmental impacts to meet medium-term demand increases. According to the SSEA projects, by 2020, almost all such projects would have been taken up.

The current transmission projects – the Ethiopian-Sudan line and the NEL interconnectors – have both been subject to detailed environmental and social impact assessment using World Bank and African Development Bank environmental and social assessment procedures and in accordance with the environment code of the countries concerned by the project. National and local institutions, local authorities, project stakeholders, NGOs, village chiefs and the general public have been involved and their concerns addressed in the studies. Environmental and Social Management Plans and a Resettlement and Compensation Plan have been drawn up and approved by relevant authorities.

The Rusumo project is still in the feasibility study stage. It will have a greater impact than the transmission projects, for example, requiring the relocation of an estimated 3,000 people who will be displaced when the dam fills. A baseline socio-economic and environmental study has been carried out, and this is being used to assist in designing the multipurpose components of the project. The intention is not just to mitigate potential negative effects of the project, but to provide a range of new opportunities for the population, so that the local area will have a palpable development benefit when the project is implemented.

As regards climate change, in the Ethiopian Power Trade project, consideration is being given to obtaining carbon financing. The Ethiopia-Sudan interconnector is potentially eligible for carbon credits as it will reduce CO₂ emissions from thermal plants in Sudan by importing cleaner and more competitive hydropower electricity from Ethiopia.

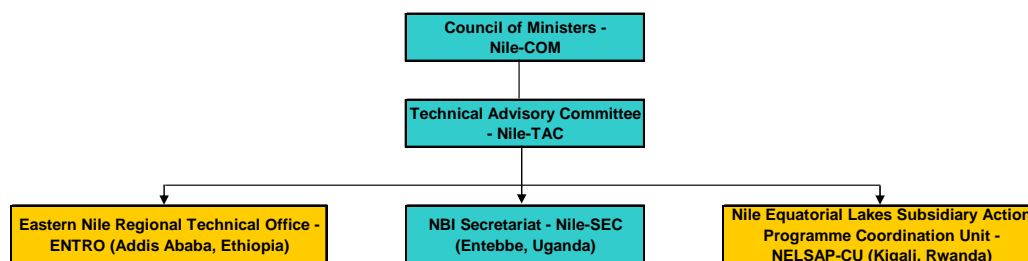
In the NEL region, the ADB feasibility study on the interconnection project analyses the climate change implications of NBI power development in more detail. It argues that the future development of hydroelectric production in preference to thermal generation will help to avert the emission of around 2 million tonnes of CO₂ equivalent greenhouse gases in the NEL region. This estimate is based on the assumption that by 2020 the interconnected network will have an installed capacity of about 2,875 MW, generating 25,000 GWh, over 70% of which will be from hydroelectricity. With the energy trade ensuing from the interconnections, an estimated thermal energy production of 10,000 GWh will be avoided. Furthermore, it is argued that higher electrification rates will result in less pressure on biomass and that improved energy security will enable NBI countries to better manage the negative impacts of climate change.

4 Institutional arrangements

4.1 Governance structure

The NBI-Operational Structure consists of the Council of Ministers of Water Affairs of the Nile Basin Countries (Nile-COM), which provides policy guidance and makes decisions on matters relating to the NM; the Technical Advisory Committee (Nile-TAC), which renders technical advice and assistance to the Nile-COM; and the Nile Basin Secretariat (Nile-SEC), which renders administrative services to the Nile-COM and Nile-TAC (Figure 5). Nile-SEC is based in Entebbe, Uganda. As indicated previously, each of the subsidiary action programs has secretariats, ENSAP being located in Addis Ababa, Ethiopia and NELSAP in Kigali, Rwanda.

Figure 5 Nile Basin Initiative Operational Structure



One of the NBI partners is the Nile Basin Discourse, which is a civil society network of organizations seeking to achieve positive influence over the development of projects and programs under the Nile Basin Initiative.

4.2 Role of national governments and regional institutions

The Nile Basin Initiative has thus far been a nonbinding commitment made by member states to regional integration objectives. The responsibility remains with the national governments for taking actions which further those aims. In particular, donor-funded regional projects are financed via national governments.

Besides the Nile Basin Initiative itself, there are a number of other regional institutions (introduced in Section 3.1) which have roles in the regional electricity industry, the most prominent of which are:

- o the East African Power Pool (EAPP)
- o the Organisation pour l’Energie des Grands Lacs (EGL), a specialized institution of the Economic Community of Great Lakes Countries (CEPGL)
- o Société Internationale des Grands Lacs (SINELAC)

The Ruzizi II hydropower plant, operated by SINELAC, is significant as being one of the very few electricity assets worldwide which are jointly owned by more than one country. SINELAC does not, however, have a history which allows it to be presented as a model for other regional integration schemes. As the SSEA study puts it (pp. 3–9), “SINELAC has been operationally handicapped for most of its existence. This is due to chronic insecurity in the region, the lack of adequate resources, and the lack of respect for their commitments by the shareholder countries.” With World Bank assistance, a targeted rescue had to be made in 2006. Subsequently, the countries involved (Burundi, DR Congo and Rwanda) have shown greater willingness to resolve the underlying problem (subeconomic electricity tariffs).

NBI member states belong to a number of organizations with broad regional integration objectives which go beyond the electricity sector. Among these, the regional economic communities which are mandated by the African Union to promote regional infrastructure integration are:

- o Economic Community of Sahel-Saharan States / Communauté des États Sahélo-Sahariens (CENSAD)
- o Common Market for Eastern and Southern Africa (COMESA)
- o East African Community (EAC)
- o Inter-Governmental Authority on Development (IGAD)
- o Economic Community of Central African States (ECCAS) / Communauté Economique des États de L’Afrique Centrale (CEEAC)
- o Southern African Development Community (SADC)

Table 7 shows the complex pattern of overlapping memberships of the NBI states. Besides the NBI itself, the most important institutions for the electricity sector are EAPP and COMESA. These two organizations have as members all the NBI countries except one (Uganda has declined to join EAPP, while Tanzania has ceased to be a member of COMESA).

- o **EAPP:** With financing from the European Union, EAPP has recently initiated a three-year capacity-building project which should result in EAPP being able to play a forceful role in advancing regional integration in the electricity sector in the future. Main elements of the project are:
 - o Studies of the East African power market
 - o Preparation of a strategic plan for the East Africa power sector
 - o Elaboration of market rules and commercial agreements for cross-border trade in electricity
 - o Institutional support for the establishment of a regional regulatory institution and a regional coordination/dispatch center

- o COMESA has recently become very active in the energy sector. For example, to encourage harmonization, COMESA has published guidelines for energy policy of its member states and has been instrumental in the recent formation of the Regional Association of Energy Regulators for East and Southern Africa (RAERESA).

Table 7 Nile Basin Country Membership of Regional Organizations

Country	NBI (Entebbe, Uganda)	EAPP (Addis Ababa, Ethiopia)	COMESA (Lusaka, Zambia)	Other Regional Organizations
Egypt	√	√	√	CENSAD
Sudan	√	√	√	CENSAD, IGAD
Ethiopia	√	√	√	IGAD
Uganda	√		√	EAC, IGAD
Kenya	√	√	√	EAC, CENSAD, IGAD
Rwanda	√	√	√	EAC, SINELAC, CAPP, CEPGL, ECCAS
Burundi	√	√	√	EAC, SINELAC, CAPP, CEPGL, ECCAS
DRC	√	√	√	SINELAC, SAPP, SADC, CAPP, CEPGL, ECCAS
Tanzania	√			EAC, SAPP, SADC

Source: Various; see Bibliography. EAPP membership consists of electricity companies – both Kengen and KPLC for Kenya. SINELAC is also a member of EAPP.

4.3 Regulatory agencies

Starting with Kenya in 1998, all the NBI countries (except DR Congo) have established agencies outside of central government structures to regulate the electricity sector (Table 8). Most of the agencies have responsibility for electricity alone (e.g., Electricity Regulatory Authority in Uganda), but some cover the whole of the energy sector (e.g., the Energy Regulatory Commission in Kenya) or are part of multisector infrastructure regulators (e.g., Rwanda Utilities Regulatory Agency).

Table 8 Electricity/Energy Regulators in Nile Basin Countries

Country	Name	Year Became Operational	RAERESA (2009)	Other Regulator Body Memberships
Egypt	Egyptian Electric Utility and Consumer Protection Regulatory Agency	2001	√	
Sudan	Electricity Regulatory Authority			AFUR (observer)
Ethiopia	Ethiopian Electricity Regulatory Agency	2000	√	AFUR (observer)
Uganda	Electricity Regulatory Authority	2000		
Kenya	Energy Regulatory Commission	2008 (Electricity Regulatory Board operational in 1998)	√	AFUR
Rwanda	Rwanda Utilities Regulatory Agency	2002	√	
Burundi	Water and Electricity Regulatory Authority	Being formed		
DRC	(Energy Ministry)	n/a		
Tanzania	Energy and Water Utilities Regulatory Authority of Tanzania	2002		RERA, AFUR

Source: RAERESA press release and websites of regulators

The Energy and Water Utilities Regulatory Authority of Tanzania is a member of the Regional Electricity Regulators Association of Southern Africa (RERA), based in Windhoek, Namibia, and together with Kenya is a member of the African Forum for Utility Regulators (AFUR), based in Pretoria, South Africa (Sudan and Ethiopia have observer status in AFUR). Both of these bodies are representative in nature, providing for their members to exchange ideas and acting as channels through which to represent their interests, but they do not have any of the powers that a true regional regulator would have. The creation of a regional regulator would require national autonomy to be ceded to some degree, and it is unlikely that such a step will be taken in Africa in the near future.

In July 2009, at the initiative of COMESA, another representative body, the Regional Association of Electricity Regulators for East and Southern Africa (RAERESA) was created. The energy regulators that were the initial signatories of the RAERESA Constitution were the Egyptian Electric Utility and Consumer Protection Regulatory Agency, the Ethiopian Electricity Regulatory Agency, the Energy Regulatory Commission of Kenya, the Rwanda Utilities Regulatory Agency, the Electricity Regulatory Authority of the Republic of Sudan and (outside of the Nile Basin) the Madagascar Electricity Regulation Office and the Malawi Energy Regulatory Authority.

4.4 Role of outside agencies

The World Bank has been a major supporter and facilitator of the Nile Basin Initiative even before 1997, when the Nile Council of Ministers (Nile-COM) first formally requested assistance to coordinate donor involvement and establish a Consultative Group to raise financing for cooperative projects. The bank agreed to support the NBI, in partnership with UNDP and CIDA, to facilitate dialogue among the NBI countries and to chair the International Consortium for Cooperation on the Nile (ICCON) Consultative Group Meeting in Geneva, Switzerland, in June 2001. At this conference, development partners committed about US\$130 million to the initiative.

The Nile Basin development partners are:

- o ***Bilateral partners***: the governments of Canada, Netherlands, Denmark, Norway, Sweden, United Kingdom, Finland, Italy, France, United States of America, and Germany
- o ***Multilateral agencies*** extending financial support: World Bank, European Union and African Development Bank.
- o ***United Nations agencies*** extending technical support are: Food and Agriculture Organization, United Nations Development Program and the United Nations Office for Project Services (UNOPS is executing the Shared Vision Program Projects on behalf of the Nile Basin states).

A multidonor Nile Basin Trust Fund (NBTF) was established to efficiently channel development partner finance to the NBI. There are 10 contributing partners to the NBTF. The World Bank administers the NBTF and works closely with NBI and other development partners to facilitate dialogue and cooperation and provide technical assistance to NBI's Shared Vision Program and its sub-basin investment programs.

World Bank support to the NBI is provided through its Nile Basin Coordination Unit and an extended cross-sectoral Nile Team. This team includes specialists in water resource management, environment, social development, project financing, and agricultural development. The African Development Bank also has a high level of commitment to NBI and to the power sector component in particular.

5 Contractual, financial and pricing arrangements

5.1 Contracts

As mentioned in Section 3, the electricity trade contracts between Uganda and Kenya associated with the Owen Falls hydropower scheme date back to 1958. The 30 MW Uganda-Kenya contract had a 50-year duration and was renegotiated in 2008. The new Power Purchase Agreement allowed for an additional 50 MW supply to Kenya when the Bujagali hydropower plant is commissioned around 2011.

The contractual arrangements associated with current NBI projects are as follows:

- o **Ethiopia-Sudan:** The countries have negotiated a 10-year framework for the provision by Ethiopia to Sudan of up to 200 MW on an annual basis, of which 100 MW is to be firm for the term of the contract (provided at a 95% load factor) plus up to an additional 75 MW (and potentially as high as 100 MW) non-firm on an annual basis together with monthly scheduled power for the three months of high rains (June, July and August) in the range of 25 MW. This framework is consistent with the annual pattern and variability of hydro production in Ethiopia.
- o **NEL Interconnector Project:** The countries involved are to sign bilateral supply and transmission wheeling agreements. Under the bilateral arrangements, any two of the member countries can engage in electricity trade. The wheeling agreement (Transit Agreement), will allow any two countries in the region that are not necessarily neighbors to trade in electricity, with compensation being paid to the utilities of the countries involved in wheeling.

5.2 Ownership and finance

5.2.1 Nile Basin Initiative institutions

The core costs of the Nile Council of Ministers, NBI Technical Advisory Committee, and NBI Secretariat are supported by the Nile Basin countries through their continued payment of annual dues. Riparian countries provide counterpart funds for all projects and contribute additional funds to the NBI Secretariat. Sponsorship of SVP project management units, whose local costs are financed by the host countries, is another avenue of riparian support by the NBI countries.

Other NBI activities are supported by the bilateral and multilateral partners listed in Section 4.4. The Nile Basin Trust Fund financial mechanisms in support of the NBI are intended to meet the following objectives:

- o maximize riparian ownership and control of the process
- o meet donor requirements for fiduciary accountability

- o provide timely and efficient administration of funds

At the basin-wide level, NBTf funds support the implementation of the projects within the Shared Vision Program and strengthen NBI institutional capacity. It is also used to facilitate the process of NBI dialogue and engagement.

At the sub-basin level, NBTf funds support the preparation and implementation of investment projects, build capacity for regional coordination and preparation of joint projects, and provide advisory services and support to subregional institutions.

5.2.2 Nile Basin initiative projects

As noted in Section 2.2, in all the NBI countries except Kenya and Uganda, the electricity sector structure is dominated by a vertically integrated, state-owned utility. The assets being created through NBI subsidiary action projects will all be owned by the individual countries, generally through the vertically integrated electricity utilities or, in the case of Kenya and Uganda, the transmission company. Financing from development partners is therefore being channelled through the ministries of finance of the countries involved. Financing and ownership are not via NBI or any other regional organization.

One small caveat to this may be the formation of a jointly owned special-purpose vehicle for the Rusumo Falls project, something not dissimilar to SINELAC. This could be a formalization of the joint arrangement for the promotion of the project (an alliance known as the Akagera Transboundary International Water Resources Management and Development). The joint ownership would, however, still be through the electricity utilities of the participating countries. Consideration is also being given to the involvement of a private-sector entity in the hydropower plant at Rusumo. This may be on a concession basis, with some of the financing being provided by the private operator, or it may be via some form of management contract.

5.3 Pricing arrangements

The pricing arrangements associated with current NBI transmission projects are as follows:

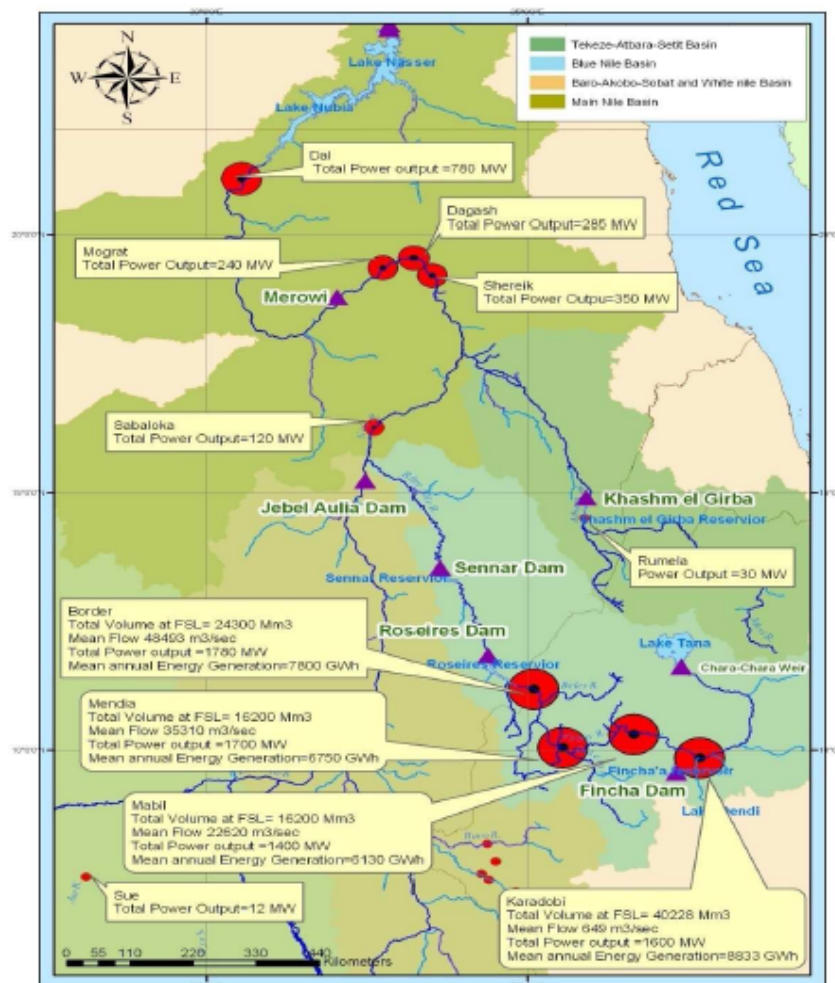
- o **Ethiopia-Sudan:** The reference price for electricity trade is being negotiated between the Ethiopian and Sudan electricity utilities within a range of 5 US cents/kWh to 6 US cents /kWh for firm power (delivered with a reliability of 95%). Annually scheduled power and rainy month surplus power are set as percentages of the reference price. In the feasibility study, the base case evaluation was carried out with a reference price of 5.5 US cents/kWh for firm power, US2.75 cents/kWh for annually scheduled power (i.e., 50% of the reference price), and 1.65 US cents/kWh for rainy month surplus power (i.e., 30% of the reference price). All the prices quoted include the use of the transmission lines.
- o **NEL Interconnector Project:** The capacity charges will be fixed and will be payable annually. The feasibility report recommends a remuneration of US\$100,000 per MW of annual capacity. The price for energy is set at 8 US cents/kWh based on an average between the hydroelectric production costs

estimated at 5 US cents/kWh and that of 10 US cents/kWh which is assumed for thermal production using methane gas.

6 Future plans

The transmission lines in the Ethiopia Power Trade project and the NEL Interconnector Project are being designed and built with a view to creating a backbone for enhanced future trade within the NBI region and with power blocks outside of it (such as SAPP to the south and Europe, the Middle East and the Maghreb to the north). Longer-term NBI ambitions for significant electricity trade are predicated on developing the substantial hydropower resources of the DR Congo (particularly Inga with 40,000 MW of potential in a single site) and of Ethiopia and Sudan; see Figure 6.

Figure 6 Hydropower Potential in the Eastern Nile Region



Some combination of these will likely be needed to meet the projected supply deficit in the Nile Equatorial Lakes region, where it has been forecast that by 2020 demand will reach at least 3,400 MW while the installed capacity based on low social and environmental impact

and low unit costs may be 2,400 MW, leaving a potential deficit in excess of 1,000 MW to be filled via electricity trade.⁸

The DR Congo surpluses could be exported southwards into the Southern African Power Pool (SAPP) region as well as to NBI countries, whereas Ethiopia and Sudan's natural export markets are the other NBI countries. With projects like Gibe III (1,879 MW and 6,400 GWh of firm energy) moving toward implementation, Ethiopia in particular has the prospect of having significant electricity export capacity in the near term. Countries in the NEL region also have untapped hydropower potential, albeit on a lesser scale than possible projects in the DR Congo and Ethiopia.

Realization of the full electricity trade potential will depend on infrastructure – both institutional and physical – being put in place:

- o Elaboration of market and operational rules for electricity trading
- o Completion of the Eastern Nile backbone with a transmission interconnector from Sudan into Egypt
- o Interconnection of the Eastern Nile region with the Nile Equatorial Lakes region via a transmission line between Ethiopia and Kenya.

The present situation is one in which EAPP is taking the lead in developing the institutional infrastructure (including seeking to develop sample commercial agreements, including power purchase and power balancing agreements) while NBI is promoting the physical investments. Both bodies are involved in regional systems planning. Over time, a more clearly defined and formalized division of labor may emerge.

Assuming the framework for electricity trade will be well established by the time the NBI becomes fully interconnected, it is to be noted that the Sudan-Egypt interconnector will open significant opportunities for electricity trade based on hydrothermal complementarity, while the Ethiopia-Kenya link will allow the NBI countries south of Egypt to fulfil their potential as low-cost hydropower electricity exporters, as well as the whole region benefitting from other aspects of interconnected electricity grids (shared reserves, opportunities for coordinated planning, etc.).

As the electricity systems develop and confidence in the regional approach grows, the next stage that is envisaged by NBI participants is for electricity trade grounded in bilateral contracts to evolve toward a more competitive regional market. This will require further development of the institutional structure, which could ultimately result in the establishment of a regional regulator and a regional dispatch center.

⁸ SSEA base case demand forecast; other cases considered in that study have higher demand.

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