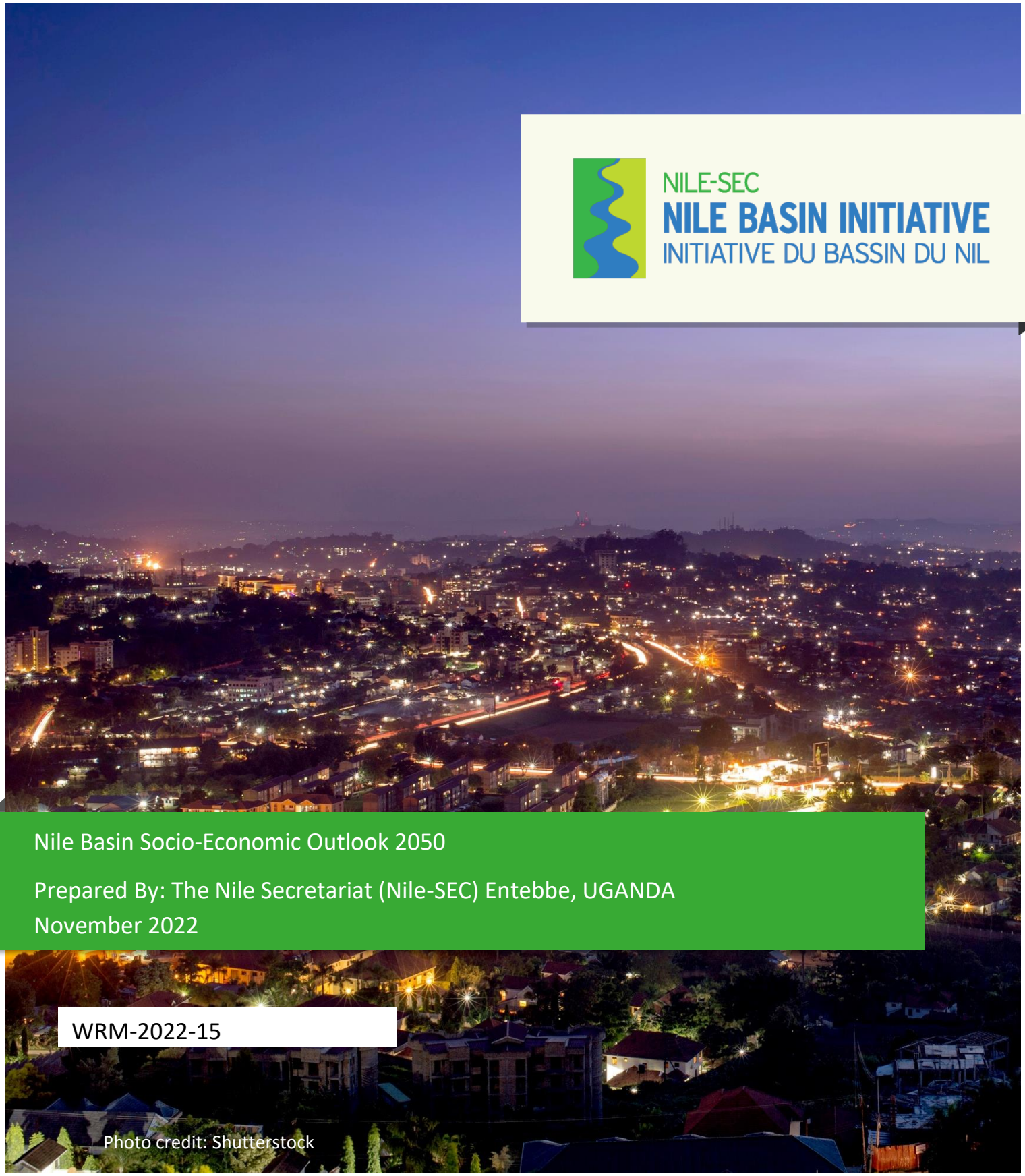

NILE-SEC
NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL

Nile Basin Socio-Economic Outlook 2050

Prepared By: The Nile Secretariat (Nile-SEC) Entebbe, UGANDA

November 2022

WRM-2022-15

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Document Sheet

This Technical Report series publishes results of work that has been commissioned by the member states through the three NBI Centers (Secretariat based in Entebbe- Uganda, the Eastern Nile Technical Regional Office based in Addis Ababa - Ethiopia and the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit based in Kigali – Rwanda). The content there-in has been reviewed and validated by the Member States through the Technical Advisory Committee and/or regional expert working groups appointed by the respective Technical Advisory Committees.
The purpose of the technical report series is to support informed stakeholder dialogue and decision making in order to achieve sustainable socio-economic development through equitable utilization of, and benefit from, the shared Nile Basin water resources.

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1 INTRODUCTION

1.1 Role of the Socio-Economic Outlook within the planning process

Challenges facing the inhabitants of the Nile Basin have been summarised in the State of Basin Report. These include inadequate access to clean potable water, limited food security and a shortage of clean energy or electricity. However, making progress towards addressing the challenges requires an understanding of what demands will be in the future and what the potential may be to meet these demands.

This chapter looks at the economic outlook across the basin in order to reflect on the implications for key sectoral demands and how they may be met, not from an infrastructure point of view but from an economic perspective.

In economics, economic growth refers to a long-term expansion in the productive potential of the economy to satisfy the wants and needs of individuals in the society.

The development of infrastructure and services, including water-related infrastructure, is closely linked to economic growth. Thus, before attempting to identify water infrastructure requirements, it is useful to look at implications of economic growth across the basin and to use this as a basis for informing the strategic planning of infrastructure development options in support of the anticipated growth and potential for production.

(moving from left to right) shows how external drivers influence demand and supply, raising the question of which management and development options can be tabled to make best use of the available supply to meet the demand.

Climate change (top left) has had, and will continue to have an impact on the surface (and ground) water hydrology of the basin hence impacting on the availability of water resources in space and time (the '*supply*'). The effects of climate change on this supply are presented in the Nile Basin Climate Change Outlook Report.

This paper addresses the 'demand' side drivers and their impacts in the form of an high level economic outlook (see lower left of Figure 1-1).

Together, the supply and demand combine to provide a basis for looking at possible basin management and development options (central block of *Figure* 1-1).

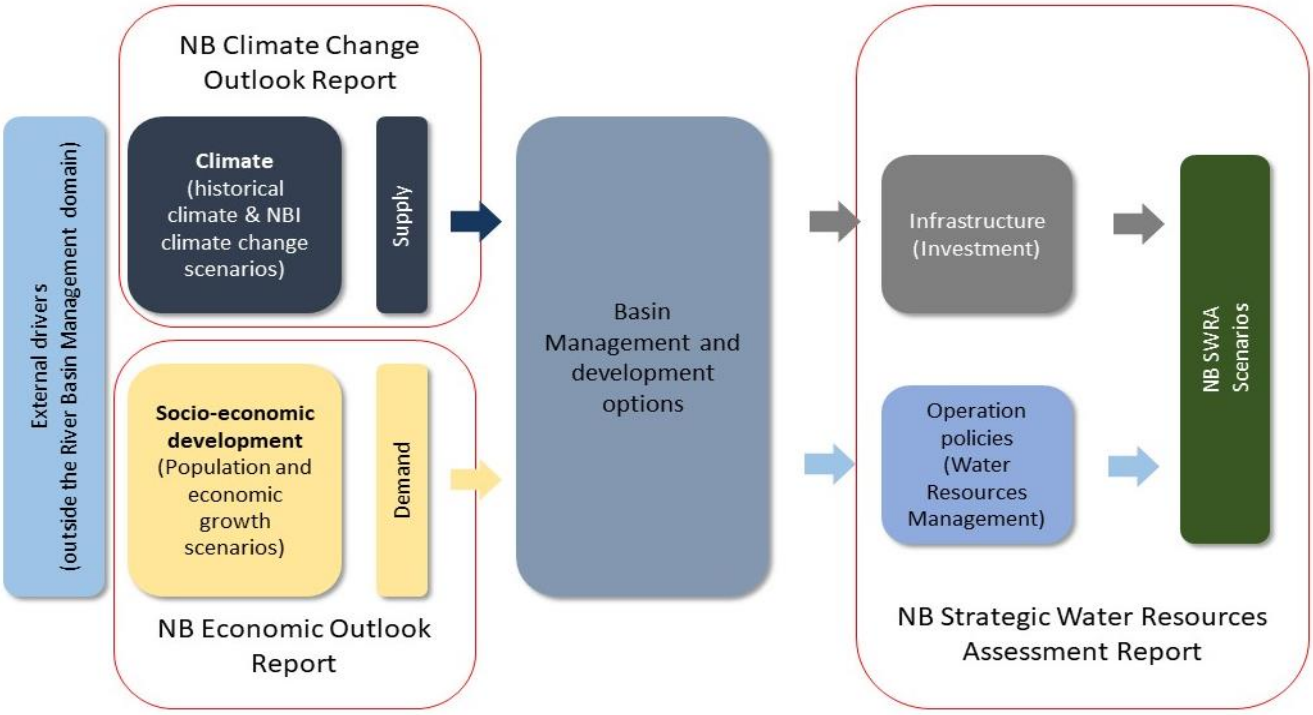

Figure 1-1: Position of the Economic outlook within the process of defining basin management and development options

Analyzing the different combinations of infrastructure options, based on the inclusion of all the infrastructure included in the country development plans is carried out by the Strategic Water Resources Assessment (SWRA).

Economic Outlook Methodology

The steps shown in the analysis are set out under the following headings which represent the logical analytical steps as indicated in Figure 1-2:

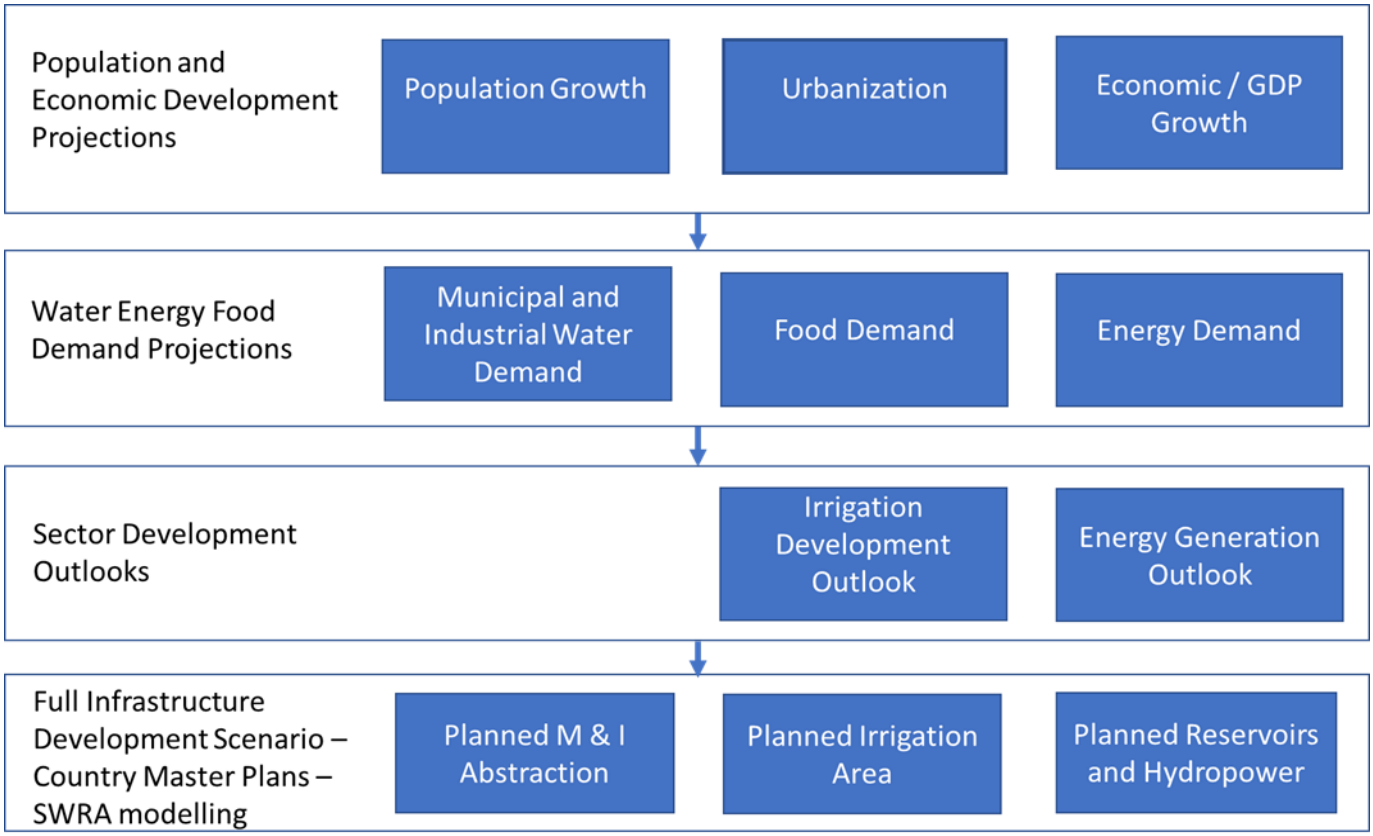

Figure 1-2: Steps in the assessment of the future economic outlook

The process starts with:

i) Assessments of the **drivers behind estimates of need/demand** in the future (population growth, GDP growth, urbanisation rates etc)

ii) the **projections in food, energy,** municipal and industrial demand[1] in line with the estimates of need

iii) The sectoral development outlook to meet these demands, **especially in irrigation expansion and energy production**. These sectoral development outlooks take into account national priorities in irrigation development and electricity production.

2 DRIVERS BEHIND DEMAND

2.1 Overview

"The evolution of socio-economic conditions in the basin countries will have an important influence on food and energy demand, and on water demand for domestic purposes. This evolution, although hard to predict, reflects changes in population, urbanization, and overall economic development, all of which increase demand due to their connection to living

[1] Municipal and industrial demands are critical, but in terms of the quantities of water required they are very small compared to irrigation and hydropower generation. They are not considered further in the high level outlook.

standards" (Jeuland, 2019). Because of the uncertainties related to predictions of growth, it is normal practice to consider low, medium and high growth scenarios as described in Table 2-1.**Error! Reference source not found.**

For the sake of brevity, only the middle growth projection has been used in this report.

Table 2-1:Summary of framework assumptions for the three socio-economic variants considered in this analysis, for year 2050 future projection

	Low growth	**Middle growth**	**High growth**
Population change[1]	High population projection from the UN Pop Division (2050)	Median population projection from the UN Pop Division (2050)	Low population projection from the UN Pop Division (2050)
Urbanization rate[2]	5-year deceleration, relative to UN urbanization projection (i.e., year 2045)	Normal UN urbanization projection (i.e., year 2050)	5-year acceleration, relative to UN urbanization projection (i.e., year 2055)
Economic growth rate (ΔGDP/capita)[3]	Annual growth rate in slowest growing Nile country; 1980-2018	Annual growth rate in median growing Nile country; 1980-2018	Annual growth rate in fastest growing Nile country; 1980-2018
Change in the real value of water (%)	No change	+0.5%/yr up to 2050 (12% increase overall)	+1%/yr up to 2050 (25% increase overall)
Change in the real value of energy (%)	No change	+0.5%/yr up to 2050 (12% increase overall)	+1%/yr up to 2050 (25% increase overall)
Change in real flood damage (%)[4]	No change in real value; scaling up based on urbanization rate	+0.5%/yr up to 2050 (12% increase overall); plus scaling up based on urbanization rate	+1%/yr up to 2050 (25% increase overall); plus scaling up based on urbanization rate
Discount rate[5]	Relatively low	Middle	Relatively high

2.2 Population

As shown in Figure 2-1 The population of the 11 Nile basin countries is projected to grow from 556 million(2020) to 1,044 million by 2050,with DRC having the largest population of 197 million just ahead of Ethiopia on 191 million and Egypt on 138 million. For the DRC, Uganda and Burundi the population is expected to more than double over the 3o year period, while population growth in Egypt is anticipated to slow. In terms of population within the second largest population behind Egypt is projected to be Uganda.

2.3 Urbanization

Following the current trend across all of the basin countries, the urban share of the population will continue to grow rapidly (see Figure 2-2).

Urbanization rates will be highest in DRC, Eritrea and Rwanda.

Within the basin, the populations of Cairo and other Egyptian cities are anticipated to grow from 41 million (2018) to 59.94 million by 2040 and Khartoum to grow from 5.0 million to 8.7 million by 2040. The combined population of Kampala, Jinja and Tororo is expected to grow from 1.71 to 3.55 million.

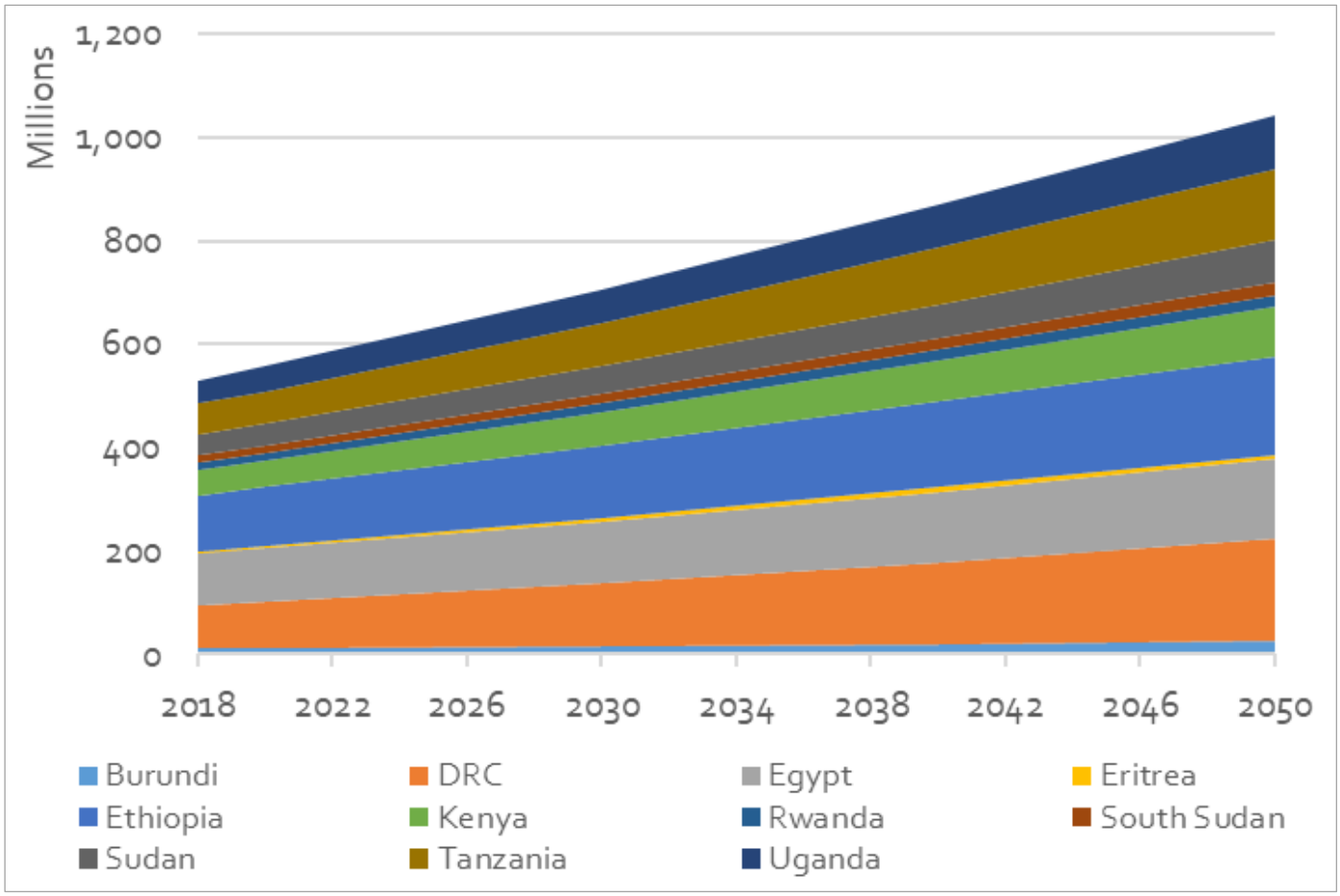

Figure 2-1: Projected Population growth by country (median growth) (Source: UN population Division)

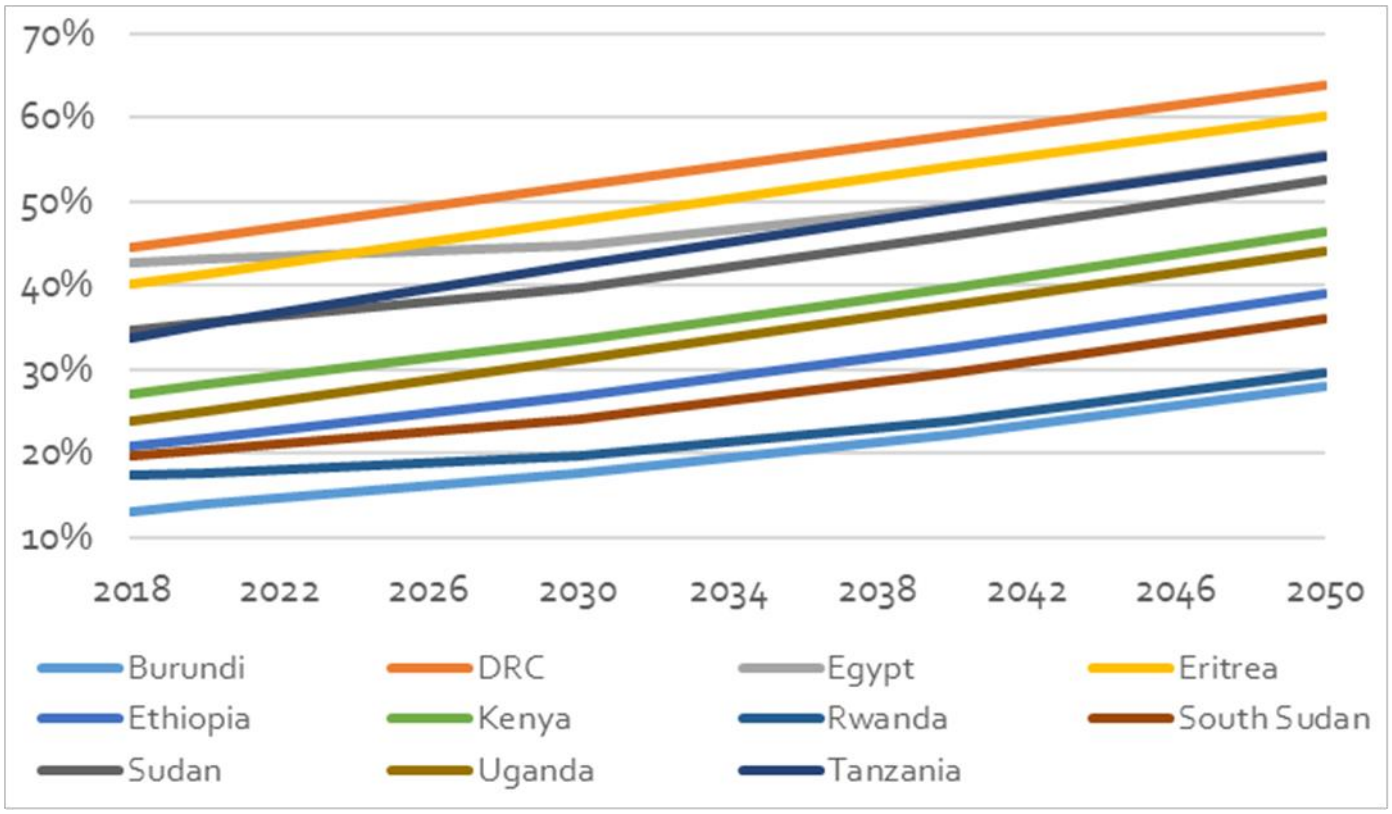

Figure 2-2: Estimated rates of urbanisation between 2018 and 2040 (Source: UN population Division)

2.4 GDP

Accurate projections of GDP are difficult to make since trends can be severely impacted by a range of possible shocks inlcuding natural disasters, political shocks and, as witnessed recently, the likes of COVID19. Similarly, there can be changes which bring about high levels of growth following years of relative stagnancy, The historical rates of GDP growth (1980-2018) have been used as the basis of the GDP projections.

For the low rate of growth scenario, the basis was the rate of growth of the slowest growing Nile country over the 38 year period, while the high growth rate is based on the historical growth rate of the fastest growing Nile country over that period. The middle growth rate (as shown in Figure 4 6 Figure 4 5 (GDP per capita) and Figure 4 6 (GDP by country) is based on the growth rate of the median growing Nile country over 1980 to 2018..

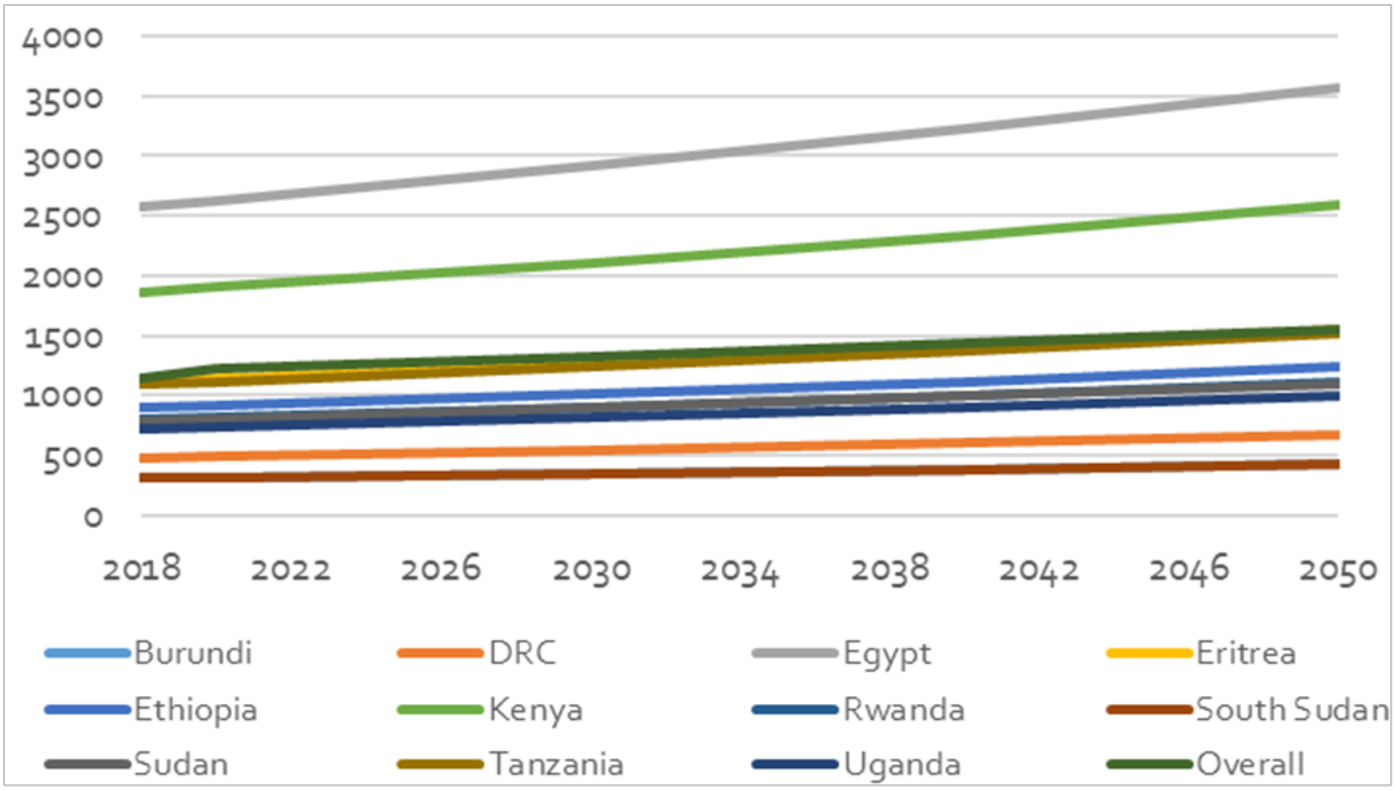

Figure 2-3: Projected middle growth rate of GDP per capita (2018 -2050)

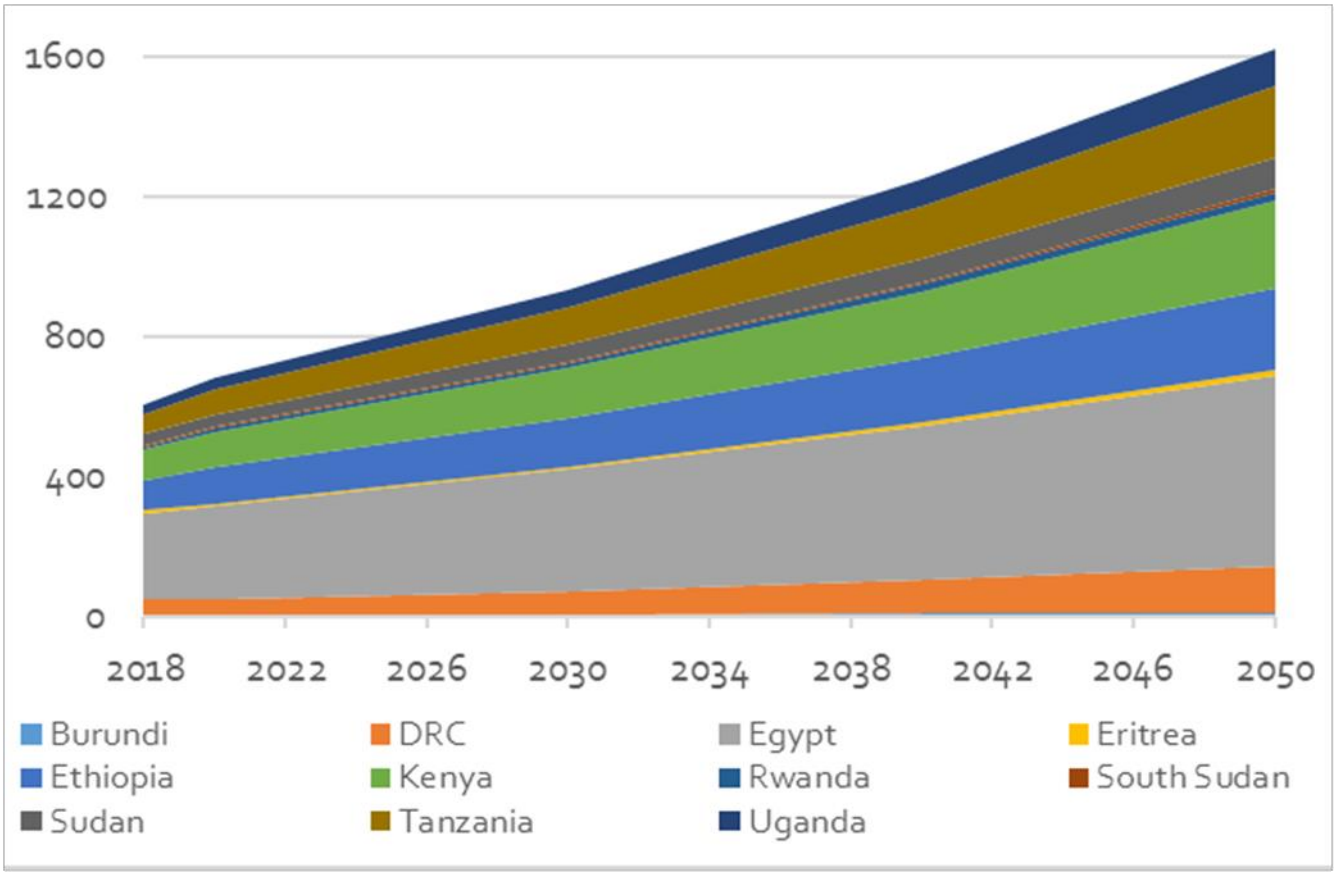

Figure 2-4: Projected growth in GDP per country (2018 -2050)

3 FOOD, AND ENERGY DEMAND PROJECTIONS

3.1 Food

Based on per capita requirements as projected from 2018 through to 2050 (FAO, 2018), combined with population projections (UN Department of Economic and Social Affairs, Population Division, 2022) over the same period, the food requirements of all of the basin countries[2] have been calculated and are shown in **Error! Reference source not found.**.

The growth between 2020 and 2050 is 110% implying that to achieve food security across all eleven Nile countries, a major increase in the supply of food (whether from production within the countries or through imports) would be required. If it is to be achieved through production across the 11 countries, this would imply a much larger increase than 110% since this level of food security is not the current situation.

To put the current level of food requirements into perspective, meeting the current level of demand would be the equivalent[3] to growing wheat under irrigation over 31 million hectares (single cropping) of land. This would rise to 62.5 million hectares by 2050. Of course, this is only an illustration of the implications of producing the required quantify of kilocalories, the reality is that food requirements are and will be satisfied from a combination of food sources, including meat, vegetables, fruits and staples other than wheat, much of which is and will continue to be produced as part of the contribution made by rainfed agriculture and livestock farming.

Nevertheless, there is a clear implication that a major increase in highly productive irrigation will be required across the 11 countries.

[2] NB: This is across the entirety of each Nile Basin country not only the portions within the basin.

[3] Based on a per hectare yield of 5 tonnes

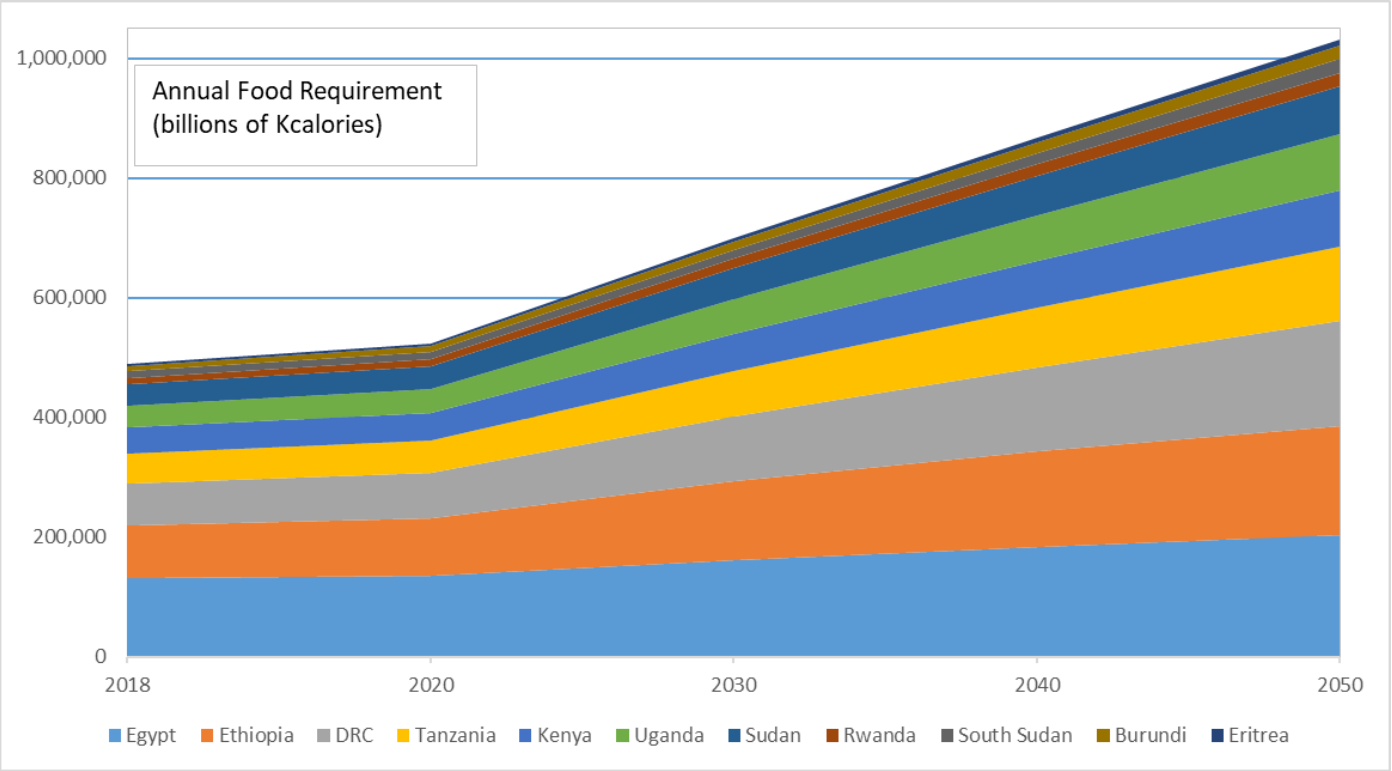

Figure 3-1: Food requirements for Nile Basin countries (in billions of kilocalories/annum)

3.2 Energy

Demand for electricity is growing rapidly across the region. Figure 3-2**Error! Reference source not found.** shows the EAPP's projections of demand between 2020 and 2030. This covers Burundi, Djibouti, Democratic Republic of Congo (DRC), Rwanda, Egypt, Ethiopia, Kenya, Sudan, Tanzania, Uganda, and Libya, so 9 of the 11 Nile Basin countries.

The total population of these 9 countries plus Libya and Djibouti for 2020 was 538.2 million, so annual per capita demand was approximately 624 kWhrs. Demand is projected to increase to 560 TWhrs by 2030, so an increased per capita demand of 812 kWhrs. Demand figures for 2050 are not available, but based on a steadily increasing per capita demand reaching nearly 1,200 kWhrs in 2050, and a population of 1,030 million, annual demand would be in the order of 1200TWhrs across the EAPP member countries.

Given that the estimated potential hydropower capacity of the Nile River basin is around 31,000 MW (NBI, 2021), or 31 GW,it is anticipated that annual hydropower production[4] would be of the order of 150 to 250 TWhrs. This, combined with other renewables, and the relatively untapped hydropower potential of the Congo River, provides option for the future.

[4] Precise levels of production will depend on the availability of water which may be affected by levels of consumption by irrigation and other sectors. More accurate estimates will become available as work on the SWRA proceeds.

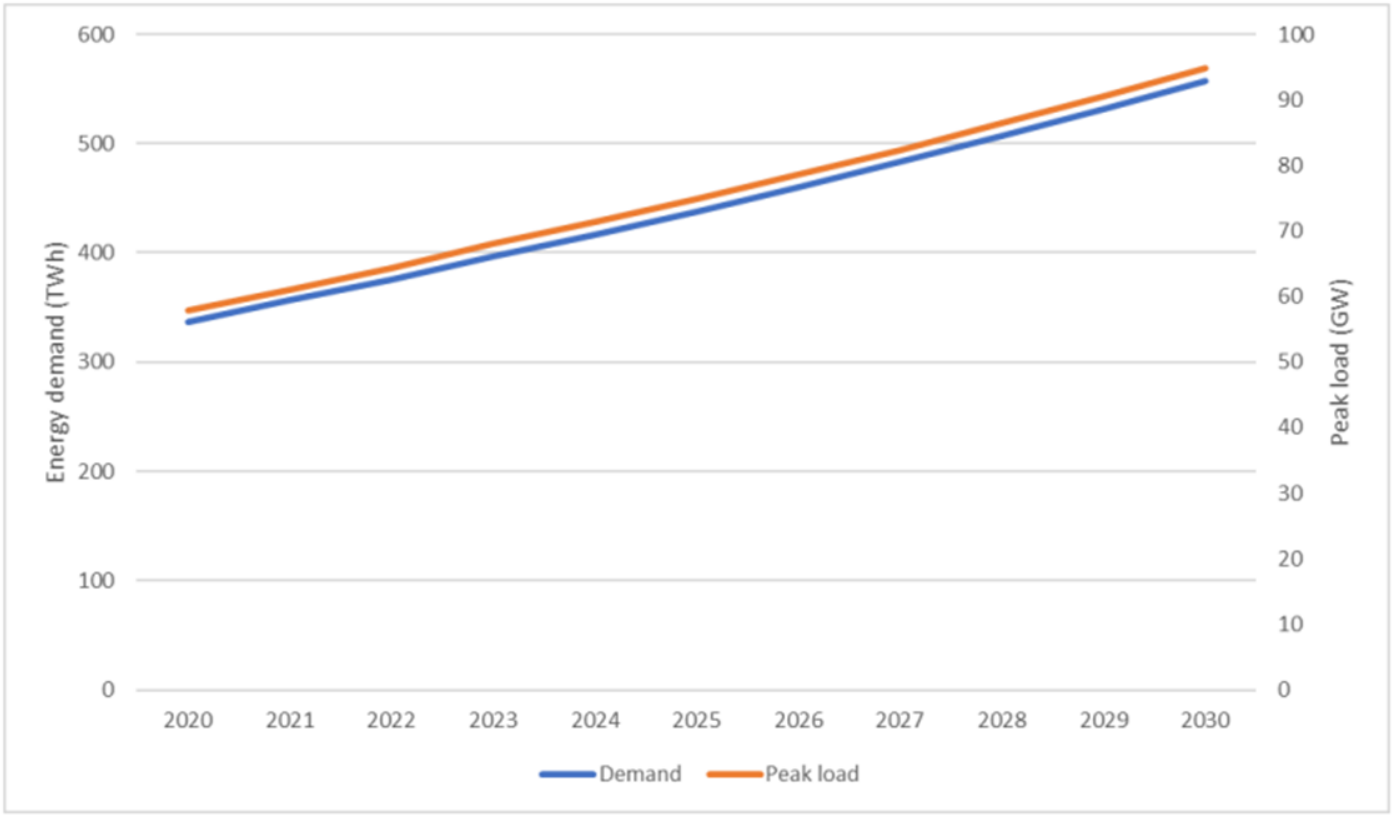

Figure 3-2: Figure 4 1: Project energy demand across the EAPP countries (source EAPP)

4 SECTORAL DEVELOPMENT OUTLOOK

4.1 Overview

Meeting or even exceeding food security needs from within the member countries is clearly a major challenge. Both this and meeting the demand for electricity will depend on major infrastructure investments and effective and efficient water resources management.

4.2 Irrigation

Current Situation

While rainfed agriculture has an important role to play in supporting food security especially in the rural areas, as the population grows and urbanization increases, combined with the impacts of climate change, irrigation will play an increasingly important role. In Sudan and Egypt irrigation production outstrips rainfed crop production, while for the other basin countries rainfed crop production, albeit highly variable, is higher. Data on current (2018) cropped and irrigation-equipped areas in the Nile Basin are summarised in Table 4-1: Areas under Irrigation in the Nile Basin in 2018 (IWMI 2020) (IWMI, 2020)

Table 4-1: Areas under Irrigation in the Nile Basin in 2018 (IWMI 2020)

Country	Irrigated (ha x 1,000)	Equipped (Ha x 1,000)
Burundi	14.9	8.8
Egypt	6529.6	3823.7
Ethiopia	455.4	547.4
Kenya	33.2	61.3
Rwanda	7.7	8.9
South Sudan	265.1	111.4
Sudan	1381.3	2023.8
Tanzania	32.2	33.4
Uganda	14.7	21.2

Country priorities, strategies and plans

Egypt has a 'Strategic Framework for Economic and Social Development Plan' that aims at poverty reduction. It provides guidance for different policy formulations, including agriculture and food security. This document indicates that Egypt's future desire for irrigated agriculture is shifting toward improving sustainability, productivity and water efficiency, " the 'National Water Resources Plan of 2005' aims at improving overall water-use efficiency in agriculture, improving allocation and distribution of the Nile water, preventing or reducing emissions, and treatment of wastewater.

Egypt's strategic objectives for 2030 focus on (i) sustainable use of natural agricultural resources; (ii) increasing the productivity of both land and water units; (iii) raising the degree of food security of strategic food commodities; (iv) increasing the competitiveness of agricultural products in local and international markets; (v) improving the climate for agricultural investment; and (vi) improving living standards among the rural population and reducing the poverty rate in rural areas. Therefore, Egypt's policy toward long-term expansion is limited (although plans do exist for expansion of around 500,000ha of irrigation) and focuses on improving productivity and water-use efficiency.

Ethiopia's Ten years Development Plan (2021-2030) builds on the first two 5 year Growth and Transformation Plan (GTP). Agricultural development if the first of 7 sectors to be addressed in the Plan. As stated in the Plan, "The major focus areas of agricultural development plan are reducing the reliance on rain-fed agriculture by developing irrigation capacity;".

"The main objectives of the agricultural development plan are to raise the incomes and livelihoods of farmers and pastoralists and end poverty by making agriculture more productive and competitive".

One of the focus areas of the development agendas of all the Nile Basin countries is expanding medium and large-scale irrigation schemes, applying improved irrigation technologies.

Irrigation objectives include increasing the study and design of medium and large-scale irrigation networks from 600,000 hectares to 2 million

hectares, and their construction from 490,000 hectares to 1.2 million hectares.

Kenya has set itself a national irrigation development goal of 1.2 Million hectares by 2030 to strengthen its agricultural sector so that it can contribute more to the national economy. The development target includes large-scale (public), small-scale (smallholders) and private irrigation schemes. For the Nile Basin part of Kenya, the irrigation development plan is divided into two components, the Lake Victoria North Catchment Area (LVNCA) and Lake Victoria South Catchment Area (LVSCA), Accordingly, Kenya plans to develop 277,764 ha of irrigable land in the Nile Basin part of the country by 2030.

Rwanda developed an Irrigation Master Plan (IMP) in 2010. The primary objective of the IMP is to develop and manage water resources, to promote intensive and sustainable irrigated agriculture; and to improve food security. The plan aims at full, efficient and sustainable exploitation of surface water (runoff, rivers and lakes) and underground water resources.

As part of a detailed joint master plan study by the Ministry of Agriculture and Animal Resources, Ebony Company Limited and World Agroforestry (ICRAF) identified 589,712.7 ha of irrigable land area in Rwanda.

Tanzania The national agriculture policy of Tanzania (JICA 2018) recognizes irrigation development as an effective approach to achieve food security and poverty reduction as it improves crop productivity and assures stable expansion of agricultural production. The Government of Tanzania began to focus on irrigation development at the government level in 1994 and formulated the National Irrigation Development Plan (NIDP) to achieve more efficient irrigation development. The National Integrated Master Plan (NIMP2002) proposed to develop 626 irrigation schemes with a total irrigated area of 405,000 ha. Tanzania has managed to achieve an annual growth in irrigation area of around 10%. The revised NIMP 2018 set out national irrigation development targets for 2025 and 2035. The target for 2035) was an additional 45,140 ha in the Nile Basin.

South Sudan commissioned an Irrigation Development Master Plan (IDMP) study in 2015 with the goal of achieving sustainable irrigated agriculture and other productive uses of water in order to improve food security and resilience, reduce poverty and contribute to economic growth and sustainable development. The study charted out irrigation development for 2021, 2027 and 2040 with the area planned for 2040 totaling 582,928 ha.

Sudan. The Green Mobilization Program (GMP) and Revitalizing Sudan's Non-Oil Exports all contribute toward revitalizing agriculture in Sudan. According to the IWMI study Sudan's policy on irrigation development is likely to move toward expansion, encouraged by the recent positive efforts in liberalization and income generation activity. Furthermore, completion of the Grand Ethiopian Renaissance Dam (GERD) and its steady flow may present an additional opportunity to Sudan's farmers to engage more in irrigation activities.

The System Inventory Report on Water Resource Related Data and Information -- Sudan' (Ahmed 2006), submitted to the Eastern Nile Technical Regional Office (ENTRO), estimates the total extent of available irrigable land in Sudan (and South Sudan) to be of the order of 5,159,100 ha.

Uganda's irrigation development policy is aimed at poverty alleviation and economic growth. For sustainable realization of its irrigation potential, while mitigating the likely effects of climate change and contributing to the transformation of society from a peasant to a modern and prosperous country, Uganda is keen to expand irrigation development.

Estimates for potential irrigation area in Uganda have ranged from 170,000 ha to 566,466 ha.

Meeting Regional Future Demand

As already presented briefly in Section 3, food demand across the Nile basin countries (not limited to areas within the Nile basin) will grow by 2050 to levels far in excess of current levels of production. Current levels of production already fall far short of meeting current demand. All the countries of the basin are well aware of this fact and without exception, **a major expansion in irrigation is seen as key to making progress towards food security**. Estimates of the level of expansion vary considerably and it is not the aim of this strategic economic outlook to speculate on what is achievable given the available resources.

Table 4-2: Irrigable Land[5] *in the Nile* Basin as investigated by IWMI in different scenarios

Country	2050 planned	Potential FAO	Potential (IWMI study)
Burundi	15.1	80.0	162.9
DRC		10.0	487.8
Egypt	4,353.1	4,420.0	3,377.9
Ethiopia	1,967.4	2,220.0	7,969.5
Kenya	127.9	180.0	1,927.6
Rwanda	13.3	150.0	464.7
South Sudan	325.7	150.0	3,580.6
Sudan	3,141.6	2,750.0	20,086.8
Tanzania	84.1	30.0	4,273.2
Uganda	25.2	202.0	7,308.5
Total	**10,053.5**	**10,192.0**	**49,794.2**

Table 4-2 Provides a summary of some of the scenarios investigated by IWMI (IWMI, 2020). It included a number of variants developed as part of the IWMI study together with e 1997 FAO estimates of potential and the potential as identified in the IWMI study.

Without taking into account the availability of water, including an assessment of the various storage options across the basin, these areas are relatively meaningless, other than that they do indicate a massive potential provided that development can take place sustainably and within the key provisions of the Cooperative Framework Agreement, once it is in place.

Figure 4-1 shows the differences between existing (2018 values) of irrigated areas, planned (by 2050) and FAO estimates of maximum potential for each of the Nile Basin countries. All figures are taken from the *Irrigation Development Projection for the Nile Basin Countries: Scenario-based Methodology* study carried out by IWMI in 2020.

The most significant differences are for Ethiopia, South Sudan and Sudan. For Sudan, planned irrigation expansion by 2050 is in excess of the potential estimated by FAO.

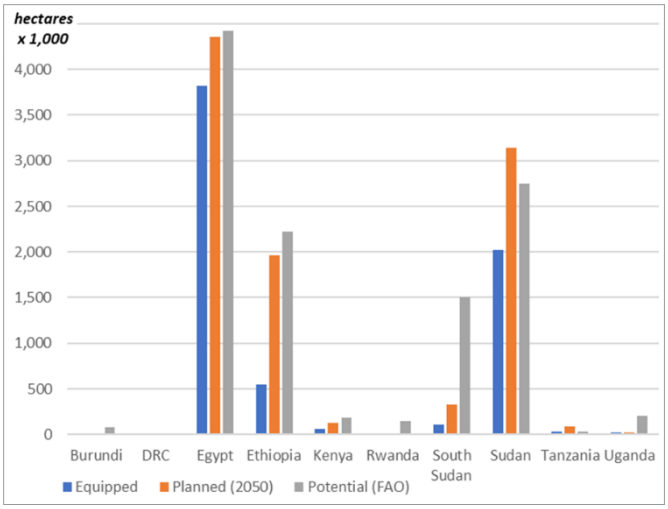

Figure 4-1: Irrigation area by country (2018, planned for 2050 and FAO estimates of potential (source IWMI, 2020)

4.3 Energy production

Given that the estimated potential hydropower capacity of the Nile River basin is around 31,000 MW (NBI, 2021), or 31 GW, it is anticipated that annual hydropower production[6] would be of the order of 150 to 250 TWhrs, or around a fifth of the 2030 demand across the EAPP countries. This, combined with other renewables, and the relatively untapped hydropower potential of the Congo River, provides options for the future.

Figure 4-2 provides a summary of the estimated power generation contributions to be made by hydropower, wind and solar, conventional, geothermal and Nuclear power production between 2020 and 2030.

[5] Estimates of irrigable land in this table do not take into account the availability of water

[6] Precise levels of production will depend on the availability of water which may be affected by levels of consumption by irrigation and

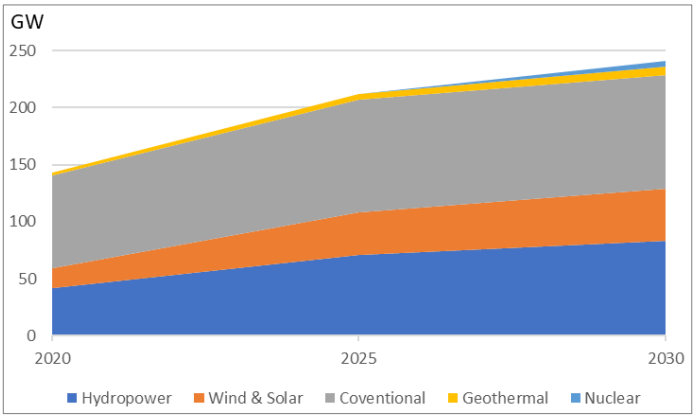

Figure 4-2: Projected Production Capacity across the EAPP countries (2020-2030)

5 CONCLUSIONS

Food and energy demands in the Nile Basin countries will continue to rise rapidly. While a large increase in the irrigated production of food within the Nile Basin can play a major role, it is unlikely that it can satisfy demand without expansion on other basins as well. The same is true for the contribution that hydropower can make to the production of electricity. Hydropower from the Nile has a key contribution to make, especially in the short and medium term but even fully developed, the Nile contribution is unlikely to exceed 25% of demand in 2050.

Looking at the role of other basins in the region to contribute towards food and energy security, especially given the fact that DRC is a Nile Basin riparian and member of the EAPP, it is clear that the Congo basin can play an important role in the future.

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other sectors. More accurate estimates will become available as work on the SWRA proceeds.

ONE RIVER ONE PEOPLE ONE VISION

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