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1 Uganda at a Glance

1.1 Population and Geography

Table 1: Population (World Bank, 2014)

Population, total (2012)	36,345,860
Population growth (2012)	3.4% / year
Population density (2012)	181.9 / km ²
Urban population (2012)	15.1%
Life expectancy at birth (2012)	58.6 years
Major Cities (2012)	Capital: Kampala 1.72 million Other: Gulu, Lira
Language	English (official), Ganda or Luganda, other Niger-Congo languages, Nilo-Sahara languages, Swahili, Arabic
Ethnic Groups	Baganda (17%), Banyakole (10%), Basoga (8%), Iteso (6%), Langi (6%) and other small ethnic groups (46%)
Religion	Christian (84%), Muslim (12%) and other (4%)

Table 2: Geography and climate (CIA, 2014)

Location	East-Central Africa, landlocked, about 1100 meters above sea level in average
Area	241550 km ² (82% land, 18% water)
Neighbouring Countries	West: Democratic Republic of Congo; North: South Sudan; East: Kenya and South: Tanzania, Rwanda
Climate	Tropical, generally rainy with two dry seasons
Terrain	Mostly plateau with rim of mountains
Natural hazards	n/a

1.2 Government and Legislation

Table 3: Government system (CIA, 2014), (Transparency International, 2013)

Official name	Republic of Uganda
Conventional short form	Uganda
Government type	Republic
Independence	9 October 1962 (from the UK)
Regions and districts	111 districts and 1 capital city 4 administrative regions: Northern, Eastern, Central (Kingdom of Buganda) and Western
Head of Government	President: Yoweri Kaguta Museveni (since 26 January 1986)
Parties as distributed in the House of Assembly by seats (Electoral Commission of Uganda, 2011)	NRM: 263, FDC: 34, DP: 12, UPC: 10, UPDF: 10, CP: 1, JEEMA: 1, Independents: 43, one vacant seat
Corruption perception index ¹ (2013)	26 (Ranks 140 of 177)

“Uganda’s institutional framework is characterised by several coordination failures, corruption in the public delivery system and a malaise in most of the public sector departments. These challenges impose constraints on planning and budgeting processes, leading to inefficient resource allocation and poor public service delivery outcomes” (Kovac, 2012).

¹ The corruption perception index is developed by Transparency International. A value of 0 is counted as highly corrupt and 100 as very clean.

1.3 Economy and Infrastructure

Table 4: Economic figures (World Bank, 2014), (UNDP, 2014), (Kovac, 2012)

Overview			
World Bank Rating	Low income		
Human Development Index HDI (2013)	0.484 (Rank: 164 out of 187)		
GINI Index (2013)	44.6		
Population living below poverty line	35%		
Currency	Ugandan shilling (UGX)		
Economic Indicators	2011	2012	2013
GDP (in constant 2005 US\$)	405.3	405.3	414.8
GDP per capita PPP (constant 2011 international \$)	1,334.1	1,334.1	1,365.1
GDP per capita growth (annual %)	3.1	0.0	-
Unemployment, total (% of total labour force) (modelled ILO estimate)	4.2	4.2	--
Unemployment, youth (% of total labour force aged 15-24) (ILO)	--	--	--
Ease-of-doing-business index (1: most business friendly)	--	126	132
Inflation, consumer prices (annual %)	18.7	14	5.5
Structure of Economy	2011	2012	2013
Agriculture, value added (as % of GDP)	24.7%	25.9%	25%
Industry, value added (as % of GDP)	27.5%	28.6%	28.7%
Services, etc. value added (as % of GDP)	47.8%	45.5%	46.2%

Uganda is rich in natural resources, with favourable agricultural conditions due to fertile soils and regular rainfall as well as substantial mineral deposits of copper and cobalt (Kovac, 2012).

Uganda's economy is composed of the Agriculture 25%; Industry 28.7%; and Services 46.2%. The agricultural sector includes Fisheries, Animal Husbandry, Dairy, and Crop sub-sectors. The industrial sector includes Manufacturing, Construction, and Electricity Supply sub-sectors. The Services sector consists of Wholesale and Retail trade, Telecommunications, Hotels and Restaurants, Transport and Communications and Tourism sub sectors. Uganda has sustained economic growth at an average rate of seven per cent per annum (Government of Uganda, 2014).

As landlocked country, Uganda relies heavily on its neighbours for access to the world market, particularly on Kenya (Kovac, 2012). The country is a member of the East African Community (EAC) and Common Market for Eastern and Southern Africa (COMESA).

Table 5: Infrastructure (CIA, 2014), (PCtech Magazine, 2013)

Railways	1,244 km
Roads	71,100 km (total), 33% of which is maintained
Airports (2013)	47 (5 paved)
Telephones (main lines in use) (2012)	315,000
Telephones - Mobile cellular (2012)	16.355 million
Internet users (2013)	6.2 million (17%)

The poor infrastructure in Uganda is a major constraint for the economic development of the country. Access to modern energy services (see section 2), clean water and sanitation is limited. Only about 25% of the national roads are paved (Kovac, 2012).

2 Energy and Renewable Energy

2.1 Overview

Table 6: Country Energy Overview (EIA, 2014), (WHO, 2014)

	2001	2011
Energy use (TWh)	10.27	17.89
Energy production (TWh)	4.7	4.11
Net import of energy (% of Energy use)	54,24	77.03
Electricity consumption (TWh)	1.28	2.28
Electricity production (TWh)	1.55	2.49
Electricity consumption per capita (kWh/person)	51.02	64.87
Total electricity capacity (MW)	303	572
Electric power transmission and distribution losses (% of output)	7.03	7,68
Access to electricity, total	8.5% (2010)	14.6 %
Urban	n. a	55.4%
Rural	n. a.	5.3%
Electricity production by source (in % of the total electricity production)		
Hydro	99.6	54.2
Nuclear	0.0	0.0
Oil, gas and coal sources	0.4	41.8
Renewable Energy excl. Hydro	0.0	4.0
Share of population using solid fuels (2012)	97%	

Uganda has one of the lowest electricity consumption per capita in the world. It is estimated at 69.5 kWh per capita, which is significantly lower than Africa's average of 578 kWh per capita (World's average is 2,752 kWh per capita). "Increasing access to electricity is considered a high priority and a major challenge to the government of Uganda and other stakeholders including development partners, energy researchers, etc. The government has come up with a number of policy documents such as the Renewable Energy policy, the rural electrification strategy and plan, the National development plan and the vision 2040, all putting emphasis on increasing electricity access." (Musinguzi, 2014)

The comparison of energy use and energy production of Uganda shows that only 23% of the overall energy used is from internal sources. 77% of Uganda's energy has to be imported,

which reveals strong energy import dependence. This dependence has grown in the years from 2001 to 2011.

In the electricity sector Uganda’s production exceeds the current demand which means the country is a net exporter of electricity. Uganda’s electricity consumption is at a very low level and even significantly lower than the SSA average of 535 kWh in 2011 (nearly one tenth).

The electricity generation capacity of Uganda has increased from 303 MW in 2001 to 572 MW in 2011. In 2001 there were 300 MW capacity of hydro power installed and 3 MW of conventional thermal power. The additional 269 MW include 129 MW of hydropower, 120 MW conventional thermal power and 20 MW renewables from biomass and waste.

The energy losses in the transmission and distribution grids of 7.7% are slightly lower than the SSA average and a first indicator for a more or less reliable grid although data about blackouts are missing. Only 55.4% of the urban households have access to electricity. In the rural areas, this number drops to 5.3%. However, the total access to electricity increased from 8.5% in 2010 to 14.6% in 2011. The share of population using biofuels is 97% (comparison: Rwanda: >95%; Zimbabwe: 71%).

Uganda currently upgrades its energy production capacity remarkably. Further efforts are undertaken to strengthen the grid in order to improve the energy supply of new and existing customers. However, the country needs to find additional energy sources as the demand for electricity is growing at an annual rate of 10 -12% (Electricity Regulatory Authority, 2013).

2.2 Energy Policy

Table 7: Uganda Energy Policy (Mudoko, 2013)

Organisations responsible for energy policies	Ministry of Energy and Mineral Development
Energy regulator	Electricity Regulatory Authority
Government Agency	--
Energy policy publications	Electricity Act 1999 Energy Policy for Uganda 2002 Renewable Energy Policy 2007
Targets to increase use of Renewable Energy	To increase the use of modern renewable energy, from the current 4% to 61% of the total energy consumption by the year 2017
Subsidies/Incentives for RE	Renewable Energy Policy 2007: <ul style="list-style-type: none"> • Introduction of feed in tariffs • Tax incentives on renewable energy technologies • Standardised Power Purchase Agreements

The main public authority for the Electricity supply industry is the Ministry of Energy and Mineral Development, which is responsible for public energy policies and the establishment of additional power generating infrastructure including hydropower as well as thermal, solar and nuclear energy (Ministry of Energy and Mineral Development, 2014).

The Electricity Regulatory Authority is the statutory regulatory authority according to the Electricity Act of 1999. Among the main responsibilities of the authority are the regulation of most aspects of the electricity sector through establishing a tariff structure, investigating tariff charges and issuing of licences (Parliament, 1999).

Through the unbundling process initiated by the government, the Uganda Electricity Board (UEB) has been separated into the successor companies for generation (Uganda Electricity Generation Company Ltd / UEGCL), transmission (Uganda Electricity Transmission Company Limited / UETCL) and distribution (Uganda Electricity Distribution Company). These companies are the only ones to build and maintain the energy system. The Uganda Electricity Distribution Company was handed over to Umeme Ltd on 1st March 2005 and is responsible for the distribution network up to 33 kV. UEGCL is wholly owned by the Government of Uganda and UETCL is owned by the Ministry of Finance, Planning and Economic Development.

The Electricity Act of 1999 defines the authorities and their funding for the electricity sector. Additionally, the assignment of licenses, the rural electrification and the rights and duties of customers are regulated (Parliament, 1999).

The main goal of the Energy Policy for Uganda from 2002 is to meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable way. The objectives of this policy are to increase access to modern and reliable energy services from various energy resources in order to stimulate economic development. The governance and administration of energy supply needs to be improved (Mudoko, 2013).

The Renewable Energy Policy 2007 aims to provide a framework to expand the contribution of renewable energy in the energy mix from 4% in 2007 to 61% in 2017. "A vigorous program to increase access to modern energy services through rural electrification has been implemented since 2001. The main targets for rural electrification are district headquarters, production areas and communities which create nuclei for rural social and economic transformation. The delivery mode includes grid extensions, decentralised grids and solar PV for schools, health centres and households" (Mudoko, 2013).

2.3 Renewable Energy

2.3.1 Potential and Projects

Solar: Uganda is endowed with favourable solar radiation from 1,825 kWh/m² to 2,500 kWh/m² per year. Small solar applications are often used in rural electrification projects such as Photovoltaic Solar Home Systems or in the form of solar thermal panels for

water heating in urban areas. Over 30,000 solar PV systems have already been installed to in rural areas of Uganda (Mudoko, 2013).

Currently, there are two larger projects in line. The Ugandan government wants to build 500 MW of utility-scale solar power with Ergon Solair, a Taiwanese-US partnership. This capacity will be split up into four parks of 125 MW each. The construction of the first one was planned to start in 2014 with an expected completion by October 2016. Additionally, Ergon Solair signed a 2,000 MW agreement with the East African Chamber of Commerce, Industry and Agriculture (EACCIA) owned by a Kenyan, Tanzanian and Ugandan chamber (Parnell, 2013).

Wind: According to the Alternative Energy Resource Assessment and Utilisation Study carried out between June and September 2003, the wind energy resource in Uganda is insufficient for large scale electricity generation. Measurements at two sites at Kabale and Mukono showed an average wind speed of 3.7 m/s at 20 m (energypedia, 2014). Nevertheless, wind farms are planned by Mola Solar Systems with a total capacity of 100 MW in several regions of Uganda (Sanya, 2013).

Biomass: Biomass constitutes 93% of the energy consumption, mainly in traditional forms like cooking or water heating, especially in rural areas (Mudoko, 2013). “Research was conducted to compare various technology options suitable for providing electricity to rural areas based on available resource and the conclusion was that distributed small-scale Biopower creates the most economic opportunities within the community even though the use of this technology is still in its infancy stage in Uganda.” (Musinguzi, 2014)

Hydropower: Though some conventional thermal power plants have been installed in recent years, hydropower is still the major source of electricity generation. Currently, there are several projects to increase hydropower generation capacity. Two projects are planned to be finished in 2018, 600 MW will be installed in Karuma and 183 MW in Isimba (Onyango, 2014). Another project with 600 MW shall be installed with the Ayago power project (Wesonga, 2013). Other potential sites have a potential of more than 1,500 MW (Mudoko, 2013). Additionally, the Ministry of Energy and Mineral Development gave permission to five small hydropower projects with a total capacity of 33.7 MW (Electricity Regulatory Authority, 2014).

2.3.2 Market and Jobs

“The Government of Uganda began a privatization program in 2001 that has resulted in the sale of 128 public enterprises”. This has involved also the energy sector. “In the electricity sector a concessional approach has been used to privatise the government owned electricity generation and distribution companies as well as off-grid isolated power stations”. The private sector shall play an important role to address the challenges of the Rural Electrification Strategy and Plan 2013-2022 (Ministry of Energy and Mineral Development, 2012).

However, the government has the role to create the right environment, through low-cost capital financing, build-up of the organizational and infrastructure capacities for electricity services, promotion of electrification-related economic development, and reduction of obstacles and risks which could pave the way for private sector take over.

Renewable Energy is one of the pillars the investment plans would rely on. A market analysis in the solar and small-hydro sectors was drawn up by GIZ and dates back at the year 2009. A more recent review of the solar market in East Africa countries has been made available by UNEP Risø Centre-Energy, Climate and Sustainable Development. “The solar PV market in Uganda has steadily grown over the last 15 years with new players entering the market that include foreign investors. While in the 1990s there were a handful of solar companies mainly engaged in institutional solar PV installations, in 2009 over 30 companies were involved in the solar business (both PV and thermal)” (GIZ, 2009a).

It seems that the development of the PV market in Uganda was influenced by a gradual expansion of PV suppliers and by the spill-over of policy experiences from Kenya, where the market started earlier. In general, a movement from donor-supported initiatives towards commercial-based market development can be observed. “Grid-connected, utility-scale PV power plants have not been put into operation in Uganda” (UNEP Risø Centre, 2014).

The solar market is generally characterized by relatively small solar firms (the great majority has no more than a few dozen employees). On the supply side there is a number of distributors, system integrators, dealers and installers. Moreover some solar consulting businesses have been recently attracted: these are involved in offering engineering services (design and installation), training and solar market business development. “The largest proportion of the PV market in Uganda is accounted for by the institutional PV market segment. PV applications in this segment were mainly utilized in the health (e.g. rural health clinics), water (e.g. pumping systems), education (e.g. off-grid boarding schools) and local government sectors (e.g. public agency offices) ... The Solar Home Systems (SHS) market is one of the biggest areas for commercially driven solar PV business. ... The Telecommunications and ICT sector is another key PV market demand segment. The applications in this segment include small offices, ICT training centers and base stations and repeater sites (VHF, UHF and cellular) for data, video and voice communication. ... The Solar Water Heating (SWH) sector has fewer companies operating. There are three leading companies in competition with all the products imported; these include Solar Construct, Balton and UltraTec” (GIZ, 2009a).

“The micro-hydro generation capacity in Uganda is in its early stages of development. There are quite a few undeveloped opportunities and very few operational micro-mini hydro plants in Uganda at the moment” (GIZ, 2009).

Biogas Solutions Uganda Ltd (BSU) is the National Implementing Agency for biogas activities in Uganda and is a company limited by guarantee. In the last quarter of 2014, the sector has

witnessed a steady growth and is expected to increase due to capacity building of Biogas Construction Enterprises (BCEs) and interest from partner organizations (ABPP, 2015).

2.4 Conclusion: Barriers, Trends and Patterns

The large project pipeline of additional generation capacity in Uganda shows that the country is developing its electricity sector in order to raise the very low electricity consumption per capita of about 65 kWh per year. The largest projects concern the development of hydropower, but photovoltaic and wind power plants are under construction or in the planning phase as well. This development is driven by the Renewable Energy Policy 2007 which aims to increase the use of modern renewable energy from the current four per cent to 61% of the total energy consumption by the year 2017.

The small number of people with access to the grid is still a problem. A program to increase access to modern energy services through rural electrification has been implemented since 2001, but the percentage of people who have access to the grid in rural areas remains very low at 5.3%. While the length of the transmission grid shall be doubled by 2017 (newvision, 2013), the distribution networks need to be expanded as well.

A regulatory framework is already in place and incentives for renewable energies like feed-in tariffs or tax incentives on renewable energy technologies are going to be implemented (Electricity Regulatory Authority, 2013).

3 Education and Higher Education

3.1 Primary and Secondary Education

The education system in Uganda is similar to the British one, it has been introduced in the 1960s. The Ministry of Education and Sports is in charge for all private and public schools and academic institutions.

Primary education in Uganda takes seven years, participation is free of charge. The Ugandan school system is highly competitive. Schools are aiming to take the best students in order to improve their national standing. Students are only promoted to the next class in case of successful performance (findeducationsolutions.com, 2014).

After successful completion of the primary school, students continue their education with the secondary school, consisting of a lower secondary cycle of four years (ordinary level) and an upper secondary cycle of two years (advanced level). For the majority of the students, education ends with the secondary level. Some attend vocational education. Students with good results are allowed to go to university. (Kibale Student Support Programme, 2014)

The enrolment ratio for primary, secondary and tertiary education is shown in Table 8. The enrolment ratio for tertiary education is barely above the Sub-Saharan average of 6.1% and far below the world average of 24% and the preferred 40% needed for economic take off (UNESCO Institute for Statistics, 2014).

Table 8: Gross Enrolment Ratio in the primary, secondary and tertiary education sector (UNESCO Institute for Statistics, 2014)

	Primary Education	Secondary Education	Tertiary Education
Gross Enrolment Ratio	109,8% (2011)	27,6% (2009)	9,1% (2011)

3.2 Higher Education

3.2.1 Shape of higher education

At the moment, there are six public universities which account for about 50% of all higher education enrolments, with 31 private universities accounting for another 50% (Uganda National Council for Higher Education, 2014b), (Ministry of Education and Sports, 2011). Universities and other tertiary institutions need to be licensed and/or recognised by the National Council for Higher Education (NCHE) and function within the legal framework of the Universities and Other Tertiary Institutions Act (UOIA), 2001. Despite increasing demand for higher education, the share of education budget devoted to public universities declined from 24% in the early 1990s to about 11% in 2000/2001 which supported the establishment of private universities (Mugabi, 2009). The existing state and privately-owned universities in Uganda are listed in Table 9.

Table 9: Universities in Uganda (Uganda National Council for Higher Education, 2014b)

State universities	Private universities	
Busitema University	Africa Renewal University	Kumi University
Gulu University	African Bible University	Livingstone International University
Kyambogo University	African Rural University	Mountains of the Moon University
Makerere University	Aga Khan University	Muteesa I Royal University
Mbarara University of Science and Technology	All Saints University, Lango	Ndejje University
Muni University	Bishop Stuart University	Nkumba University
	Bugema University	Nsaka University
	Busoga University	St. Augustine International University
	Cavendish University	St. Lawrence University
	International Health Sciences University	Uganda Christian University
	International University of East Africa	Uganda Martyrs University
	Islamic Call University College	Uganda Pentecostal University
	Islamic University in Uganda	Uganda Technology And Management University
	Kabale University	Victoria University
	Kampala International University	Virtual University of Uganda
	Kampala University	

It can be observed that the majority of enrolments at universities and university colleges are in arts and humanities (see Table 10). Less than half of the students are enrolled in science and technology courses. In absolute figures, there was a rise of 50% in the number of total students from 2006 to 2011 and the number of students in science and technology courses nearly doubled. Noticeable is the strong rise of the number of students in arts and humanities from 2009/2010 to the following year and the decline in science and technology during the same period.

Table 10: Student enrolment in universities and university colleges by major field of study (Uganda National Council for Higher Education, 2014a)

	2006		2009/2010		2010/2011	
Arts/ Humanities	73,204	79%	78,420	65%	103,836	74%
Science/ Technology	19,401	21%	41,220	35%	35,847	26%
Total	92,605	100%	119,640	100%	139,683	100%

3.2.2 Higher education policy

The National Council for Higher Education (NCHE) was established after the Universities and Other Tertiary Institutions Act, 2001. The council is responsible for the objectives' implementation of this Act. It should monitor, assure and strengthen the quality of the tertiary education by setting minimum standards for courses, investigation complaints relating to institutions of higher education and setting and co-ordinating national standards for the admission of students. In these ways the equivalence of all types of academic and professional qualifications of degrees, diplomas and certificates shall be assured. The council shall advise the government on policy and other matters relating to institutions of higher education. (Uganda National Council for Higher Education, 2014)

3.2.3 Higher education staff

The majority of academic staff in universities and affiliated colleges are holders of masters degrees; 2,916 representing 54%. While the numbers of students increased by 50% from 2006 to 2011 the numbers of the academic staff only rose by 33% which lead to a deterioration of the students per academic staff ratio in the last years. (Uganda National Council for Higher Education, 2014a)

Table 11: Highest level of qualification for academic staff (Uganda National Council for Higher Education, 2014a)

	PhDs		Masters		Bachelors		Others	
Universities & Affiliated Colleges	852	16%	2,916	54%	1,434	27%	177	3%

3.2.4 Funding of higher education

The share of the national budget allocated to education increased from 21.9% in 2004 to 14% in 2012. The expenditure per student within tertiary education decreased by nearly 60% in the same period, from 1,431 in 2004 to 596 (PPP \$) in 2012 (UNESCO Institute for Statistics, 2014).

3.3 Renewable Energy Higher Education

The college of Engineering at Makerere University offers an MSc in Renewable Energy since 2008, the course has been accredited by NCHE in 2008. The target group are graduates from engineering and science programmes in Uganda, the region (e.g. Tanzania, Mozambique, Malawi, Ethiopia) and other parts of the world. The development of the programme was funded by NORAD until 2013 in partnership with regional universities and the Norwegian University of Science and Technology (NTNU). The programme runs in cooperation with University of Dar es Salaam (Tanzania). In addition to the training of MSc students, several PhDs have been trained in order to enhance teaching and research capacity at the respective universities in the region. A Renewable Energy incubator project has been established at the Department of Electrical Engineering, with the aim to support emerging businesses by providing advisory services and connecting with funding agencies.

Further Renewable Energy and Energy courses are offered within the curriculum of several bachelor programmes by engineering and science faculties, mainly at Makerere University and Kyambogo University (Musinguzi, 2014).

In 2001, the Centre for Research in Energy and Energy Conservation (CREEC: <http://creec.or.ug/about-creec/>) was founded, closely affiliated with the College of Engineering at Makerere University.

3.4 Conclusion and Recommendations

With the Universities and Other Tertiary Institutions Act from 2001 and the establishment of the National Council for Higher Education the tertiary education grows in importance and the quality of this education is monitored. As a result the enrolment ratio increased from 3.7% in 2003 to 9.1% in 2011.

Apart from the already mentioned Renewable Energy Master at the College of Engineering at Makerere University, there is no other full-fledged course on the ground in the country so far. .. The number of staff with PhD has grown from 858 in 2010 to 914 in 2011. The numbers are still very low for the universities and affiliated colleges.

Uganda needs additional university and college facilities to enrol more students. The number of academic staff with PhD as the highest level of qualification needs to be expanded. "Training in Renewable Energy and related fields for research and education does not only experience shortage in the required qualified staff (PhD) but also lacks the required infrastructure such as buildings and lab equipment to offer quality education. Thus, most PhDs graduating in Renewable Energy have utilised facilities at the partner university in the North such as NTNU in Norway and KTH in Sweden which have state-of-the-art training facilities. This training has been made possible under the sandwich arrangement where the students study both in Makerere and at a partner University in the North" (Musinguzi, 2014) Since the Norwegian (Norad) and Swedish (Sida) government have already put in significant efforts and resources, in order to establish the RE Masters and to foster the outreach

activities of the Ugandan public universities respectively, it is highly recommended to coordinate further activities with them and to additionally foster transnational approaches, in particular with Tanzania, Zimbabwe and Rwanda (Makerere University, 2013).

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