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MASTER THESIS

A History of Critical Electricity in Uganda

Integrating a Temporal Dimension into Energy Justice

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To really change things, one should accept that nothing can really be changed within the existing system.

Slavoj Ẑiẑek

Abstract

A History of Critical Electricity in Uganda

by Maarten APPELMAN

Universal access to modern energy emerged in 2015 as one of the seventeen United Nations sustainable development goals. It describes the goal to provide affordable, reliable, sustainable, and modern energy to everyone before 2030. While projects on transmission and distribution of electricity to households have been around since the start of the 20th century, roughly one in five people do not have access to electricity yet. This is concerning given that access to energy is positively correlated to human development aspects such as life-time expectancies, health, education, gender equality, while being inversely correlated to (sexual) violence, poverty, maternal mortality, and child mortality. While energy justice has emerged as an approach to assess the injustices along the energy supply chain that helps to guide policies for new energy related projects, it does not necessarily account for the specific histories of the infrastructures in which these injustices appear. Even though research has been done to let this framework account for particularities of specific nations, regions, and communities, and moreover for the injustices along the electricity supply chain i.e. the spatial aspects of justice, little research has been done that situates the contemporary debate on energy justice in a long-term historical perspective. This thesis however argues that many of the burdens and benefits of energy systems have already been distributed, and that the history of specific energy infrastructures can be incorporated into frameworks of energy justice to make them more adequate. By analysing the history of Uganda's electricity infrastructure from 1894 until 2015 through the conceptual lens of criticality it will be shown how histories can be used to complement energy justice by including a temporal dimension. It will furthermore be argued that what makes electricity critical should also be used to assess developments in universal energy access.

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Given that it has taken me almost two years to finish this thesis, I feel like I can justify writing an acknowledgment section. So here we go. Andreas I'd like to thank you for your never-ending patience with this seemingly never-ending thesis of mine. But mostly for your strangely positive comments whenever I handed in a new draft, I hope you know how famous you are for these and moreover for how well they have been received. Dominic, my first second supervisor. It's a bit of a shame you had to leave the committee near the end because my thesis turned out to be more focused on history and less on ethics than I had anticipated. But your input has nevertheless been of great value, and have definitely made its way into my arguments here. Fokko Jan, my actual second supervisor. I'm grateful that you were willing to step in at the last moment to help me finish this thesis on time. Jonas, it was a happy coincidence to meet an actual expert on the history of electricity in East Africa during the first meeting of our 4TU Energy Access Alliance, when I had just started writing this thesis. Thanks for sending me additional source material on Uganda's history, but especially for giving me valuable insight on how to conduct research like this. Marko Hankins, thanks for lending me your time to discuss the influence of the World Bank on the development of East Africa's electrical infrastructure. Getting information on this topic from someone who has actually been working on rural energy access within the region was extremely valuable. Jelena, without you I probably still would not have known about energy access. Thanks for having the confidence that I could write a master thesis next to being your full-time phd student. Dasha, I wasn't planning on putting any of my close friends in my acknowledgements, but then you did all the design work for the time-line in the appendix, so thanks! And now that you're in here already, I want to say I'm happy that I've found another academic no-lifer who didn't mind staying in the office until 2AM over and over again. My gratitude also goes out to Leandro Panizzon, I probably would've finished this thesis a year ago if I had known about your invention earlier. Papa en mama, dankjulliewel voor alle privileges die me in staat hebben gesteld een tweede master te gaan doen waarvan ik het algehele nut zelf ook niet precies in zag. Mama, het is moeilijk te beschrijven hoe jammer ik het vind dat je hier niet meer bij kon zijn.

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List of Abbreviations

AES	**A**pplied **E**nergy **S**ervices
BEAMA	**B**ritish **E**lectrotechnical and **A**llied **M**anufacturers' **A**ssociation
BEL	**B**ujagali **E**nergy **L**imited
CDF	**C**omprehensive **D**evelopment **F**ramework
DAC	**D**evelopment **A**ssistance **C**ommittee
EA	**E**nergy **A**ccess
EAP&L	**E**ast **A**frican **P**ower and **L**ighting Company
EMC	**E**lectromagnetic **C**ompatibility
EASP	**E**lectricity **A**ccess **S**cale-up **P**roject
EIRR	**E**conomic **I**nternal **R**ate of **R**eturn
ERA	**E**lectricity **R**egulatory **A**uthority
ERT	**E**nergy for **R**ural **T**ransformation
ESMAP	**E**nergy **S**ector **M**anagement **A**ssistance **P**rogram
GEO	**G**lobal **E**nvironmental **O**bjective
HFO	**H**eavy **F**uel **O**il
HMSO	**H**is **M**ajesty's **S**tationery **O**ffice
HV	**H**igh **V**oltage
ICOLD	**I**nternational **C**ommission **o**n **L**arge **D**ams
ICT	**I**nformation and **C**ommunication **T**echnology
IEA	**I**nternational **E**nergy **A**gency
IEGWB	**I**nternational **E**valuation **G**roup **W**orld **B**ank
IGG	**I**nspector-**G**eneral of **G**overnment
IGO	**I**nter**g**overnmental **O**rganization
IMF	**I**nternational **M**onetary **F**und
IBRD	**I**nternational **B**ank for **R**econstruction and **D**evelopment
KPI	**K**ey **P**erformance **I**ndicator
MDG	**M**illennium **D**evelopment **G**oal
MoESTS	**M**inistry **o**f **E**ducation, **S**cience, **T**echnology and **S**ports
MoH	**M**inistry **o**f **H**ealth
MoWE	**M**inistry **o**f **W**ater and **E**nvironment
MPPT	**M**aximum **P**ower **P**oint **T**racker
MTF	**M**ulti-**T**ier **F**ramework
NAPE	**N**ational **A**ssociation of **P**rofessional **E**nvironmentalists
NGO	**N**on-**G**overnmental **O**rganization
NRM	**N**ational **R**esistance **M**ovement
OBA	**O**utput-**B**ased **A**id
OECD	**O**rganisation for **E**conomic **C**ooperation and **D**evelopment
OWG	**O**pen **W**orking **G**roup
PEAP	**P**overty **E**radication **A**ction **P**lan
PDO	**P**roject **D**evelopment **O**bjective
PPA	**P**ower **P**urchase **A**greement
PPAR	**P**roject **P**erformance **A**ssessment **R**eport

PPP	**P**ublic **P**rivate **P**artnership
PRSP	**P**overty **R**eduction and **S**trategy **P**aper
PV	**P**hoto**V**oltaic
REA	**R**ural **E**lectrification **A**gency
REB	**R**ural **E**lectrification **B**oard
REF	**R**ural **E**lectrification **F**und
SDG	**S**ustainable **D**evelopment **G**oal
SE4ALL	**S**ustainable **E**nergy for **All**
SHS	**S**olar **H**ome **S**ystem
SIDA	**S**wedish **I**nternational **D**evelopment **C**ooperation **A**gency
SP	**S**ervice **P**rovider
STS	**S**cience and **T**echnology **S**tudies
SUNFED	**S**pecial **U**nited **N**ations **F**und for **E**conomic **D**evelopment
UDHR	**U**niversal **D**eclaration of **H**uman **R**ights
UEB	**U**ganda **E**lectricity **B**oard
UEDCL	**U**ganda **E**lectricity **D**istribution **C**ompany **L**td.
UETCL	**U**ganda **E**lectricity **T**ransmission **C**ompany **L**td.
UEGCL	**U**ganda **E**lectricity **G**eneration **C**ompany **L**td.
UK	**U**nited **K**ingdom
UML	**U**ganda **M**icrofinance **L**imited
UNCED	**U**nited **N**ations **C**onference on **E**nvironment and **D**evelopment
UN	**U**nited **N**ations
UNSDG	**U**nited **N**ations **S**ustainable **D**evelopment **G**oal
WPC	**W**ater-**P**ower **C**ommittee of the Conjoint Board of Scientific Societies
WWI	**W**orld **W**ar I
WWII	**W**orld **W**ar II

List of Symbols

V	Voltage	Volt
I	Current	Ampere
W	Power	Watt
Wh	Energy	Watt-hour
$\$/W$	Price per energy unit	US Dollar per Watt
$\%$	Percentage	Percent

Voor mama

Chapter 1

Introduction

The year 1881 must have been one of the most rewarding years for Sir Joseph Swan. Within the span of a only a few months the British physicist saw his incandescent light-bulbs first get world-wide recognition at the first International Exposition of Electricity in France in August, to later see the Savoy Theatre in London adopting his invention and become the world's first building to be entirely lit by electrical light (Crookes, 1882; The Stage, 1881). As the theatre's Manager, Richard D'Oyly Carte, would write at the opening of the Savoy "*The greatest drawbacks to the enjoyment of theatrical performances are, undoubtedly, the foul air and heat which pervade all theatres. As everyone knows, each gas-burner consumes as much oxygen as many people, and causes great heat besides. The incandescent lamps consume no oxygen, and cause no perceptible heat. If the experiment of electric lighting succeeds, there can be no question of the enormous advantages to be gained in purity of air and coolness - advantages the value of which it is hardly possible to over-estimate*" (Lloyd, n.d.). While these advantages are still recognized over a 140 years later - and have led to the full electrification of Europe and Northern America - roughly 675 million people don't have access to artificial lighting (United Nations, 2023a), a number that actually seems to be growing with 10 million a year (IEA, 2024). Energy poverty is especially apparent in low-income countries, and has severe negative consequences to the health and opportunities of their citizens. People with low, or no access to energy often face dangers of physical abuse due to the lack of street lights. The absence of nearby electrified hospitals, and vaccination centers moreover appears as a serious threat to good health and a normal life-span. Household air pollution due to forced reliance on unsafe cooking fuels, is furthermore accountable for 3.2 million premature deaths each year (IEA, 2024). These numbers are by themselves concerning and have - especially with the emergence of Universal Energy Access as an Sustainable Development Goal (SDG) - produced significant attention to household electrification as one of the main requirements for reducing poverty and having good health. Nevertheless, historical explanations to why over a quarter of the world population still doesn't have access to safe forms of energy for their daily needs has received remarkably little attention (Hasenöhrl and Kmeyerr, 2020), especially considering how swiftly Europe and the USA achieved full household electrification (World Bank Group, 2022a; Hughes, 1983).

Frameworks of Energy Justice on the other hand, have emerged as a conceptual lens through which such energy related injustices can be assessed (Sovacool and Dworkin, 2014). Energy justice goes beyond the endeavor of universal energy access, as it is a theoretical approach that seeks to principles of justice to global energy sector as a whole, including energy policies, energy production and systems, energy consumption, energy activism, energy security, the energy trilemma[1]political economy of energy, and climate change (Sovacool and Dworkin, 2014, p. 14-17). In the

context of energy access, the nexus of energy justice can (cautiously) be reduced to recognizing access to clean energy as a human right, and ensuring this fundamental right in a fair, democratic, and reliable manner. While methods of implementation differ, energy justice is generally split up into three modes: distributive justice, recognition justice, and procedural justice (Jenkins et al., 2016, p. 175). Where the first form of justice is concerned with fair allocation of energy to citizens, companies, agencies, and any other consumers. Recognition justice is intended to ensure a fair representation of individuals' demands and concerns in the formation of new energy policies, including the establishment of new energy structures such as photovoltaic (PV) plants, High Voltage (HV) lines, micro-grids, and hydroelectric power stations. Lastly, procedural justice requires all stakeholders to be represented throughout procedures in a non-discriminatory way (Heffron and McCauley, 2014, p. 436).

Energy justice has shown to be a flexible approach and research has e.g. been done to assess how energy injustices occur within a spatial domain, where e.g. the benefits and burdens of the energy supply chain are not fairly distributed. Healy et al. coined the concept of *embodied energy injustices* in order to illuminate hidden socio-environmental injustices that can occur throughout transboundary fossil-fuel supply chains (Healy, Stephens, and Malin, 2019). Injustices here are mostly concerned with unfair allocations of burdens such as environmental pollution, and the benefits that predominantly go to higher income countries and multinational corporations. In a similar vein, Bouzarovski and Simcock have indicated that peoples inability to attain vital energy services are often the consequence of structural geographic inequities, and e.g. the infrastructural and economical composition of societies (Bouzarovski and Simcock, 2017, p. 645). Furthermore, given that people's household location is morally arbitrary, the authors argue that spatiality is one of the root causes of energy injustices, and that the responsibilities to solve it lie with those who are also responsible for the distribution of electricity (Bouzarovski and Simcock, 2017, p.641, 656). In other words, spatiality can be accounted for by the energy justice framework as it boils down to a fair *distribution* of energy and the burdens that come with generating and transmitting it, the *recognition* of people who have to deal with energy poverty due to their geographical household location, and the formation of just *policies* to repair the injustices.

Returning to the observation that over two-thirds of a billion people don't have access to electricity while the incredible benefits of electricity have been known for almost 150 years brings the question whether energy justice requires a historical component. Similar to how the spatiality can be mapped on energy justice by scrutinizing the energy supply chain from acquiring energy carriers to distributing electricity, it might be valuable map temporality by considering the present unjust energy system as the result of historical decisions and power struggles. This thesis will develop this idea through the research question:

How can a historical account of a specific electricity infrastructure enrich debates on energy justice?

Historical research is required to answer this research question, specifically on electrical infrastructure of a region where energy poverty is still apparent. Hasenöhrl and Meyer similarly emphasized the potential of historical research in tackling the 'energy challenge', and identified multiple historical research gaps. Among them are

transnational societal actors, the 'Global South', and international organisations, who have either been largely ignored, or should simply receive more prominent recognition in histories of energy (Hasenöhrl and Kmeyerr, 2020, p. 302). By focusing on the history of the electricity infrastructure of Uganda this thesis touches on all these subjects. Uganda has a low household electrification rate and has seen multiple foreign actors shaping its infrastructure, from the British Empire that colonized that nation to the World Bank and the UN who influenced them through various development projects. This thesis uses historical research to illuminate how such actors influenced Uganda's electricity sector, but to understand why they influenced it the way they did the notion of 'critical infrastructures' is used as a lens through which research is conducted.

In contemporary - especially political and military - discourse critical infrastructures are those infrastructures that would render a society vulnerable if it were to fail. It might be to little surprise then that this concept of criticality finds its origin in the early Cold War where it was being used in the civil defence strategy of the United States (Kristof Lukitsch, 2018, p. 12). This idea of criticality is now widely adopted and can also be used to e.g. form national strategies against terrorist and cyber attacks. In this definition, infrastructures such as the water provision, dams, and fuel stations are all critical infrastructures as failure, disruption, or manipulation of these systems could create a systemic or societal crisis and severely damage the nation's economy. After the Cold War, the idea of critical infrastructures and criticality have seen interests from a range of different academic fields. Instead of using a defined list of vital systems and infrastructures, they have adopted a more qualitative approach. In technical fields such as power electronics or information technology, critical components are those components that are have a high chance of failure or have a severe impact on the system as a whole when they break (Peyghami et al., 2019, p. 3). Other approaches have adopted a historical perspective where they analyze how certain services have progressively been regarded as more important over time, therewith rendering the associated systems as critical due to a society's preferences (Högselius et al., 2013).

The notion of criticality enjoys an even broader understanding when perspectives from Science and Technology Studies (STS) are adopted. Infrastructures here are not mere stand-alone physical structures, but are embedded in a social context, constitute social practices, and can even be political (Shove, Watson, and Spurling, 2015; Larkin, 2013; Winner, 1980). Criticality as such goes beyond valuations of importance. Instead it is a concept that asserts relations between different entities and can moreover be used as a tool to analyze them (Kristof Lukitsch, 2018, p. 14). Within the context of criticality and STS, infrastructures should be understood as themselves being part of a network. The nodes within networks can more or less related to other nodes, therewith making them more or less critical. These nodes can be other (technological) systems, but also e.g. sociocultural practices, business sectors, or non-physical entities. As will be shown in chapter 3, Uganda's electrical infrastructure became more critical over time as it gradually got associated with more 'nodes' such as economic growth, political influence, and human development.

Other researchers have made connections between criticality and notions of vulnerability and resilience in East Africa, and have shown that they are different in the 'Global South' than in the North. Where the breakdown of a critical grid in the North would lay bare the citizens vulnerability, Emanuel Lukio Mchome e.g. showed how

load shedding in Tanzania showed the resilience of households who found flexible ways of dealing with electricity shortages (Mchome, 2022). Similarly, Jethron Aymbah Akallah found that communities without a centralized water supply were less vulnerable to droughts and breakdowns in their water systems because they - in contrast to higher-income areas - had accumulated a variety of water supplies (Akallah, 2022). Even more congruent with the topic of this thesis is the distinction that Hård makes between the contemporary scholarly definition of critical infrastructure and the colonialists regard of these systems. He states that criticality for infrastructures in modern society is understood as those infrastructures that are essential for a society to run smoothly, whereas critical infrastructures in colonial settings were detrimental to preserve colonial power (Hård, 2022, pp. . 3, 4). According to Hård, critical infrastructures under colonial rule were so because they were considered essential to subjugate indigenous people, to exploit the natural resources, and to provide 'civilized' comfort to their men working in the colonies (Hård, 2022, p. 2).

Analyzing the history of an electricity infrastructure through the lens of criticality thus allows to not merely understand how the infrastructure developed, but moreover why it did so. It helps to lay bare how beliefs of the values and importance that were associated with the infrastructure influenced its formation. Providing such a history of the criticality of Uganda's electricity from its colonial era to the current efforts to achieve universal access to energy allows to answer a secondary research question:

> **How can criticality be used to operationalise energy justice in the effort to achieve universal energy access?**

This thesis builds up to answering both research questions through the following structure. The necessary background information on Energy Access and Uganda will be given in chapter 2. The lion's share of this thesis is found in chapter 3, where the history of Uganda's electrical infrastructure is provided in four parts, each describing a period in which the criticality of this system saw significant developments. Uganda's colonial period will be discussed first, in order to provide an account on the genesis of their electricity infrastructure. The second period of interest starts in 1962, when Uganda gained independence, and lasts until 2015 when the SDGs were launched. Due to the high significance of SDG 7 on the contemporary attitude towards energy access, a history of the United Nations Sustainable Development Goals (UNSDGs) will be given as well. Lastly, SDG 7 and its associated metrics will be analyzed through the lens of criticality to conclude the chapter. The research questions will be answered in 4. Here it will first be argued that energy justice should incorporate the notion that existing energy systems are not a given, but rather the result of different actors whose beliefs, interests, and actions have shaped them. Secondly it will be shown that criticality can be used as an analytical tool to display how the interests of various stakeholders influenced - and continue to influence - the development of the infrastructure. Taken together this thesis will argue that frameworks of energy justice are incomplete when they fail to account for the historical actions that have led to the contemporary injustices.

1.1 Source Selection

For the history of Uganda's colonial period, I predominantly relied on secondary literature although a limited number of primary sources have been used as well. For

chapter 3.2 I could use the reports and appraisals of projects that the World Bank has uploaded in their online archive. I also tried to incorporate Uganda's perspective by including accounts found in online Ugandan newspapers such as the Monitor and New Vision, and the work of Ugandan historians and essayists. Most of the research done on the Global Development Goals was similarly based on documents from the UNs online archive. Wherever I heavily rely on the work of a single author, I explicitly announce so and briefly summarize their research.

1.2 Terminology

Historical narratives are not neutral, neither is language. Especially when this language is being used in the effort to describe the history of nations that have been colonized and have been subjected to various kinds of derogatory classifications and racial stereotypes, descriptive language should be used conscientiously. This inter alia entails that problematic language of the past should not be whitewashed by replacing it with more appropriate vocabulary. For these reasons, descriptive language found in primary sources will be placed within single quotation marks throughout this thesis.

Global development terminology is often similarly problematic and can be laden with unwarranted generalisations and Cold War doctrine. Some of the oldest terms such as *underdeveloped countries*, and *least developed countries* hold derogatory implied references to the so-called developed countries, and depict the former countries as passive victims of their colonial history. The term *poor countries* is inaccurate as some of nations that supposedly fall under this category are rich in natural resources, or have a high cultural wealth. Moreover, this classification ignores the economic inequalities within these nations. The *Third World*, a later classification for roughly the same set of countries was coined by Alfred Sauvy in 1952 and clusters the countries that did not ally themselves with either the USA or the USSR (Toussaint, 2015, p. xv). Given the vast diversity between these nations and the simple fact that the Cold War has ended, the term should be rendered obsolete. The *Global South* is a popular contemporary alternative to group these countries together. This term is also delicate however as it (intentionally or not) promotes ideas of natural fatalism, and furthermore promotes a false homogenization of the southern hemisphere. When possible it is arguably better to simply avoid generalisations like these. Or, if necessary, opt for more context-specific terminology such *low* or *middle income countries* when discussing poverty. Even though this still holds some of the same issues as with the poor-countries-label it at least specifies the type of poverty that is being discussed. When not paraphrasing primary or secondary literature, this thesis will therefore rely on context specific designations. In other cases the aforementioned classifications are considered synonymous.

Chapter 2

On Universal Energy Access

Energy Access is one of these few highly complex problems that can be explained through a single image. Figure 2.1 is a composite photo made from over 400 satellite images which clearly show which parts of the world remain in the dark when night falls. While there are of course regions that stay unilluminated due to (extremely) low population density such as the Australian outback, the Sahara, and the South American rain forests, there are large areas with significant population density but little or no means to illuminate their households.

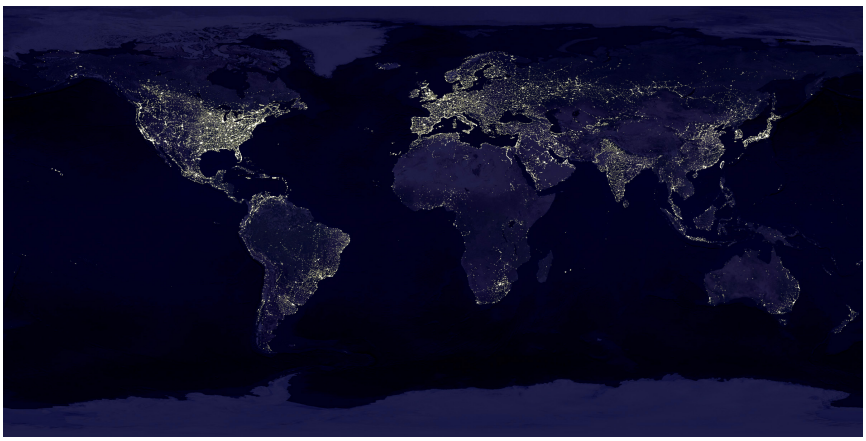


FIGURE 2.1: This composite image of earth shows how large parts of the global south, and especially 'sub-Saharan Africa' stay dark at night (NASA, 2023)

Most of the unelectrified population is found in 'sub-Saharan Africa' ($80\,\%$) and South Asia, and Southeast Asia (Gao et al., 2022) (also see Figure 2.2). Here it is important to realize, that having electricity is not a mere commodity but actually has strong correlations with health, life-time expectancy, business opportunities, ecological restoration, gender equality, and street safety (Mills, 2016; Anditi et al., 2022). In a very straightforward manner, energy access is concerned with human health because electricity is a prerequisite for many hospital services including refrigerating of medicine and vaccines. But in a more intricate way, without access to modern forms of energy people are often dependent on burning biomass in order to cook, have light, and heat their homes. Such practices create high levels of household air pollution, which consequently results in poor health and a significantly lower life-time expectancy. To put this into perspective: the annual mortality rate of 'dirty cooking' practices nears four million, which is higher than that of aids, tuberculosis, and malaria combined (Whiting, 2021). Using biomass and fossil fuels for household energy is furthermore linked to increased rates of shack fires, burn injuries, and

poisoning due to children accidentally ingesting kerosene (Anditi et al., 2022). Moreover, biomass dependency for cooking is one of the main causes of deforestation in Africa, and therewith of greenhouse gas emission (Reinaud, 2022). Conversely, renewable energy can be a very helpful tool for making agricultural practices more sustainable, and is even regarded to be imperative for restoring Africa's ecology and biodiversity (Felix, 2021).

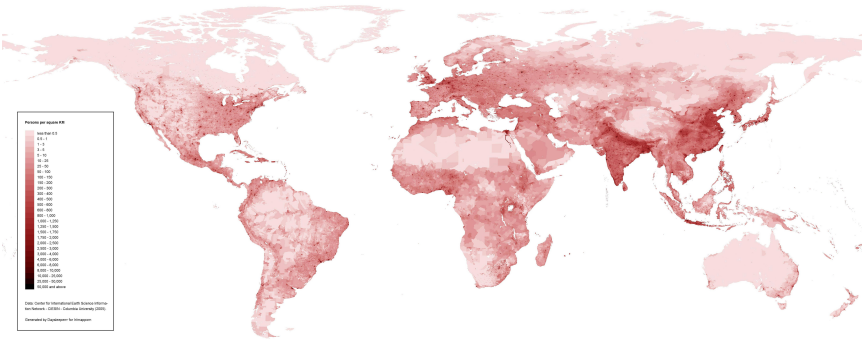


FIGURE 2.2: Map of the world showing population densities. 'Sub-Saharan Africa' is the most prominent example where high population densities don't correlate with electricity distribution. Data retrieved from (International Earth Science Information Network CIESIN Columbia University, 2005), figure by (Daysleeperrr, 2015).

In a similar fashion, electrical lighting is also firstly replacing dangerous and unhealthy practices. Candles and kerosene lamps bring identical concerns with respect to household fires, burn traumas, kerosene and paraffin poisoning, and even mental health deterioration due to inadequate lighting (Grant et al., 2021). Access to safe and abundant lighting furthermore allows people to increase their hours and e.g. study after sunset or do household chores. Most distressingly, insufficient street lighting is highly correlated to street violence, particularly sexual harassment and rape, disproportionately affecting women and girls as victims (Anditi et al., 2022).

2.1 Sustainable Development Goal 7

The topic of energy access gained world wide prominence in 2015 when the UN published their UNSDGs, where SDG 7 is concerned with *"ensuring access to affordable, reliable, sustainable and modern energy for all"* (United Nations, 2015b, p. 14). These four adjectives reveal much, though not all, of the intricacies of achieving universal access to energy. The emphasis on affordability directs towards intentions of equitability within the aim of universality, and simultaneously affirms that energy is much more expensive wherever it is scarce. The reliability of energy is essentially articulating that it should be available continuously, which is often not the case due to improperly sized infrastructure and poor maintenance. The UN divided sustainability into the subcategories economic, social, and environmental, which they argue need to be balanced (United Nations, 2015b, p. 1). Lastly, modern energy is distinguishable from the traditional forms in the sense that they pose lower health risks to its users, are more efficient, and cause lower green house gas emissions. It should thus be noted that modern energy is not merely electrical energy but also encompasses energy carriers such as biomass pellets and LPG which can both be used for purposes like heating and cooking. Moreover, electrical energy can be more

or less 'modern' depending on how it is being generated. This thesis however is predominantly concerned with electrical energy, and while different electricity generation methods are mentioned it is not concerned with prioritizing them. SDG 7 has five targets, depicted in Table 2.1.

TABLE 2.1: Targets of Sustainable Development Goal 7 (United Nations, 2015a, p. 19)

Goal 7.	**Ensure access to affordable, reliable, sustainable and modern energy for all**
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3	By 2030, double the global rate of improvement in energy efficiency
7.a	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.b	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support

2.2 Levels of Energy Access

One of the key issues with energy access that SDG 7 omits to assess, or even mention, is that someone having access to energy does not mean that they have access to enough energy. Instead, the only success indicator for electrification according to SDG 7 is the proportion of the population with access to electricity, in percentage (United Nations, 2024b), which provides an overly optimistic display of reality. A limited but certainly better method to assess electrification rates is provided by Energy Sector Management Assistance Programs (ESMAPs) so-called MTF, where access to energy is measured in tiers starting at 3 watt (tier 1) and continuing up to tier 5 that is described by a minimum of 2 kilowatt (see 3.4.2).

Within the context energy access there are generally four solutions through which electrification can be realized. At the lowest level of electrification there are the so-called pico solar solutions, which are small single purpose devices (usually lanterns) that can be charged through small dedicated solar panels. One level higher, we generally find the solar home systems (SHSs) which can cautiously be described

as large power banks, charged by a medium sized solar panel, that can power a small number of low power devices such as LED lamps, fans, a mobile phone, and a radio. The most versatile energy systems among the decentralized solutions are micro-grids, which can be sized to any desired capacity and power output. Micro-grids are essentially small electricity distribution networks that are most often used to power rural villages that the high voltage transmission network has not reached. They can however also be used to supply electricity to e.g. a single building that demands larger amounts of energy such as a community centre or a hospital.

Of course, the most recognized electricity infrastructure is the high voltage grid, by some described as the largest machine on earth. While most people in the global north receive their electricity through this infrastructure, this would be very difficult to achieve in the global south. Indonesia for example has so many small islands that it would become unduly expensive to tie them all into a centralized grid, in tandem with creating massive disruptions to the ecosystem through the submarine cable laying activities. 'sub-Saharan Africa' on the other hand has fewer problems with remote islands, but more so with the vastness of its continent, the often incredible distances between rural communities and the larger cities (see Figure 2.3), and the large rural populations. To put this into perspective, as of 2023 the rural population share in the Netherlands is $7\,\%$, while that of Uganda is a staggering $73\,\%$ (World Bank Group, 2023), making it significantly more difficult to provide electricity access to the whole of Uganda than it is for the Netherlands. That being said, it should be noted that even a connection to the high voltage grid does not necessarily provide abundant or continuous electricity. Especially in 'sub-Saharan Africa', even nationwide blackouts occur relatively often (Dahir, 2023), and grid capacities can be so low that load-shedding becomes necessary (IEA, 2020). This then brings the technological reality that centralized electricity networks do not necessarily provide the capacity and reliability that is required, and that decentralized solutions can be preferable in both urban but especially rural areas.

2.3 On Uganda

As of 2021, Uganda has a low electrification rate, at $45.22\,\%$. The landlocked nation is surrounded by Tanzania, Rwanda, the Democratic Republic of Congo, South Sudan, and Kenya whose populations each have an energy access percentage of 42.73, 48.7, 20.77, 7.75, and 76.54 respectively (see Figure 2.4)). Uganda's rural population sits at $35.9\,\%$, while the urban electrification rate is significantly higher at $72.3\,\%$ (World Bank Group, 2022b; World Bank Group, 2022c) (also see Figure 3.10). Interestingly, Uganda's electricity generation mix consists of $99\,\%$ renewable energy with the large majority ($89.5\,\%$) generated by hydro dams. As will be shown in chapter 3.1, the high representation of hydro-generated electricity is largely explained by Uganda housing the beginning of the Nile river, which created the perfect environment to develop large hydro stations. The fact that the nation is landlocked moreover makes it difficult to import other energy carriers such as crude oil or gas. Nevertheless, the low electrification rate makes it so most households have to rely on biofuels and waste to heat their homes and cook their food. In fact, only five per cent of the population has access to clean cooking, and only one percent of the total energy mix is actually generated by the hydro dams (IEA, 2021). In a way, Uganda's electrical infrastructure is thus not failing due to blackouts, load shedding, or other

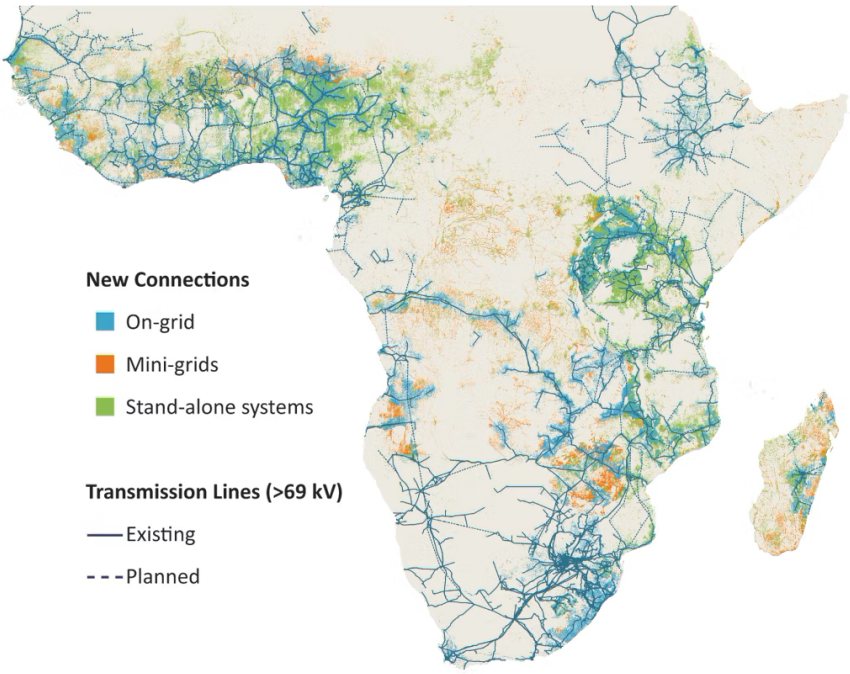


FIGURE 2.3: Map showing the existing and proposed electricity supply systems in 'sub-Saharan Africa' and South Africa (Cozzi et al., 2020).

disruptions, but rather because it fails to reach most of Uganda's households.

Uganda's history between 1894 and 2015 is one of severe political unrest and major advancements in the field of electricity. The thirty years prior to 1894 in which Uganda was gradually colonized coincided with the period where Edison's electricity networks were first transferred from New York to other cities and nations (Hughes, 1983, p. 47-79). The first two decades of decolonized Uganda were marked by civil wars, power struggles between Buganda, Obote, Museveni, and a horrifying dictatorial regime of general Idi Amin, during which the already limited electricity supply of the nation became heavily damaged (African Studies Center, 2009). During this period and the ensuing decennia, the World Bank started to grant loans to Uganda to inter alia develop Uganda's electricity sector. While the Bank was still granting loans expand and strengthen the infrastructure, the UN became increasingly interested in global sustainable development, and eventually launched SDG 7 as they realized how energy access is intrinsically linked to social, environmental and economical development. However, as will be shown in the following chapter, neither of these international actors have been disinterested in their support to Uganda's electrical infrastructure.

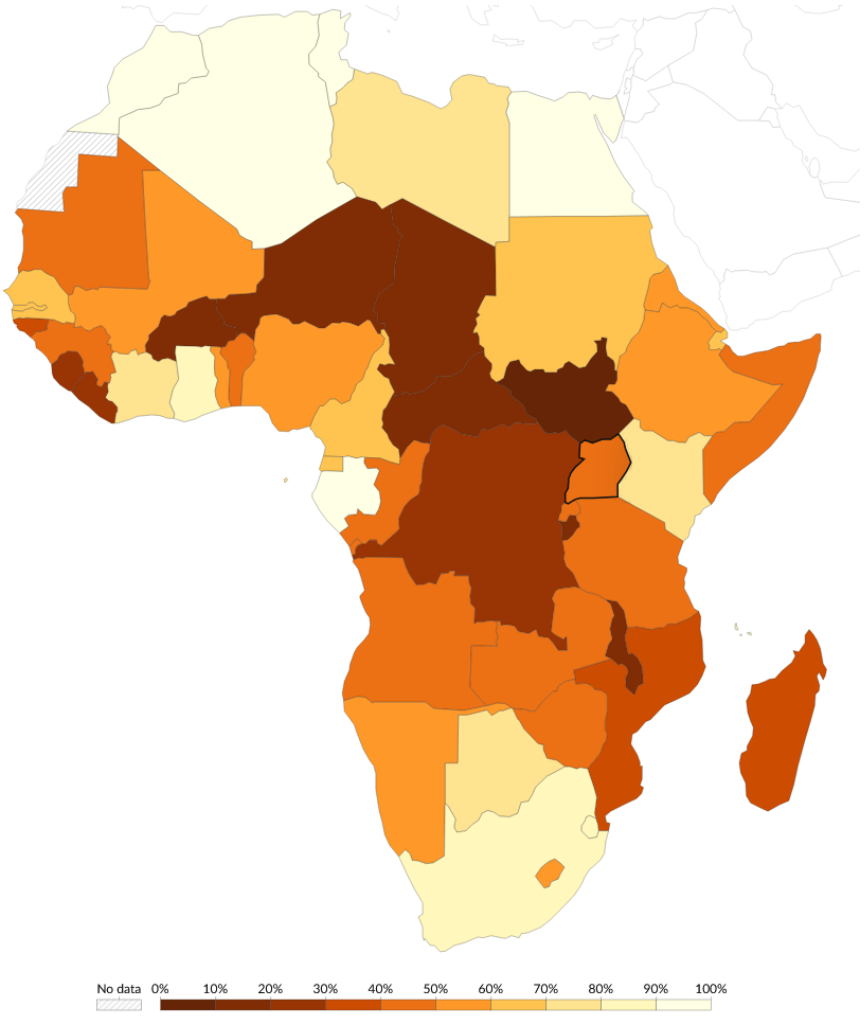


FIGURE 2.4: Map showing the household electrification rates in Africa by percentage. Access to electricity is defined here as having an electricity source that can provide very basic lighting, and charge a phone or power a radio for 4 hours per day, which is right on the edge between tier 1 and 2 of the MTF. Data and figure from (Our World in Data, 2021b), small aesthetic adjustments made by me for the sake of readability.

Chapter 3

A History of Critical Electricity in Uganda

The description of SDG 7 makes it clear that the UN regards electricity provision critical due to its health benefits and other means in which electricity can help to improve the individual lives of its consumers. This functions as one of the most dominant motivations for the UN and other intergovernmental organizations (IGOs), non-governmental organizations (NGOs) and governmental organizations to improve Uganda's access to modern forms of energy. It would however be overly audacious to assume that such reasons have always been the prevalent incentives to build and develop electrical power grids. The values surrounding energy provision have in fact proven to be quite dynamic over time. While electricity infrastructures were initially close to being solely concerned with supporting industry, it is now regarded as vital to households as well. This development did not happen universally however. Especially for former colonies like Uganda, the importance of electricity has historically been defined by external actors such as the British Empire and the World Bank who did not prioritize the needs of households. Even the MDGs defined in 2005 did not include universal access to electricity or other forms of energy as an objective. It was only in 2015 that energy access was adopted within the UNSDGs by including the goal to "*ensure access to affordable, reliable, sustainable and modern energy*" as its seventh UNSDG(UNDESA, 2015, p. 41).

Using the conceptual lens of criticality, this chapter will provide a history of Uganda's electrical infrastructure that not only explains how it was developed, but moreover why it was developed the way it was. This illuminates criticality networks that explain the historical rationale behind investments in the energy sector of the different decision makers. It shows the values, and barriers they associated with electricity provision. Moreover, by providing a long term historical perspective of this development, this analysis also highlights the potential of electricity that was not regarded critical for Uganda's development. To phrase it differently: even if the grid was only regarded critical because it was regarded necessary for the society to run smoothly - conforming to political definition of critical infrastructures - a historical study still helps to reveal who were considered to be part of this society, and what was actually meant with it 'running smoothly'. This analysis of the criticality of Uganda's electricity sector will furthermore help to evaluate the UNs contemporary effort to achieve universal access to modern energy.

For these reasons, and in order to provide a mostly chronological narrative, this chapter is divided into four parts. The first subchapter will discuss the origins of the Ugandan electricity provisions which occurred under colonial rule of the British

empire. Thereafter the post-colonial development of this critical infrastructure, a period that saw extreme internal political unrest and the interference of multiple IGOs, predominantly the World Bank. The third subchapter provides a history on the UNSDGs in general and SDG 7 in particular, to explain how energy access became one of the UNs main points of interest. In the last section of this chapter, the contemporary frameworks to assess energy access will be discussed within the context of criticality.

3.1 1894 - 1962: On the Origin of Electricity - by Means of Colonial Selection

When trying to conceptualize the history of energy, one is easily tempted to assume that its contemporary phase entails a transition from fossil fuels to renewable energy, and that this development started considerably recent. This argument would then be based on relatively recent events where renewable energy has become synonymously with green energy or sustainable energy. Therewith almost directly referring to reducing the human contributions to global warming, which only started to gain recognition halfway through the seventies of the last century (Broecker, 1975). This chapter will nevertheless make clear that notions of renewable energy can be found throughout the history of the Ugandan electricity grid.

This section has gratefully incorporated work from Dr. Jonas van der Straeten, who has written extensively on the history of electricity in East Africa. Especially his 2017 dissertation has been a great source of information. While Van der Straeten used this research to inter alia explain path dependencies and illuminate the entanglement of political and technological discourse, it has been used here to analyse the criticality of Uganda's electrical infrastructure during its colonial period.

Mentions of renewable energy in Uganda can be found as far back as the year 1922. In a report from the Water-Power Committee of the Conjoint Board of Scientific Societies (WPC) on water-power in the British empire, chairman sir Dugald Clerk argued that the consumption of fossil fuels needed to deteriorate and that it might be advantageous for Britain to consider its position in a "*coalless and oilless world*" (Clerk and Gibson, 1922, p. v). Clerk's argument is naturally not related to global warming but to the belief that their black resources are limited in volume and will become scarcer and thus more expensive. He furthermore argued that earth can be considered as a huge solar engine that runs continuously, as the sun turns water into vapor which then rains down to be vaporized again. Through hydraulic converters, the power from this 'huge solar engine' can be converted into electrical energy (Clerk and Unwin, 1915, p. 600). If Britain is able to store this energy, Clerk argued, water-power can facilitate the same amount of energy as coal-fired stations but in a more cost effective way (Clerk and Gibson, 1922, p. vii). In 1922, 33 per cent of the motive power in Britain's colonies was obtained through water, and the expectation was that this number would grow due to the expected price increments of coal and oil (Clerk and Gibson, 1922, p. vii-ix). This expectation was furthermore combined with the anxiety that the British manufacturing industry, metallurgy in particular, would be surpassed by the rest of the 'western world' (Straeten, 2017, p. 51).

The WPC was appointed in 1917 with the instruction to report on what was being done at that time to ascertain the amount and distribution of water-power in the

British Empire (Clerk and Gibson, 1922, p. 1). They described the needs of the Empire both with respect to recovering from the first world war and the utilization of its natural resources for which ample supply of cheap energy is required. Here it should be noted that only three energy sources were regarded as viable for fuelling the Empire i.e. coal, oil (either from fields or shale), and hydroelectric. And where the first two were expected to become more expensive as the supply would 'inevitably' decrease, hydropower plants should be able to run indefinitely. Clerk furthermore argued that hydroelectric conversion was preferable over fossil fuel methods due to the low (thermal) efficiencies of the latter. At the time, the most efficient engine had an indicated efficiency of $40\,\%$, which Clerk thought to be economically unsustainable given the expected tariff boosts of fossil fuels (Clerk and Unwin, 1915, p. 618-623).

Recovering the British Empire from the consequences of the War meant something different for the colonies than the United Kingdom (UK). For the 'tropical dependencies' it meant quarrying the latent wealth of natural resources. Britains African dependencies were even told that their goal now was not to provide work for the workless but to increase revenue (Stammer, 1967, p. 194). The WPC argued that this task is directly connected to developing the water-power resources of the colonies. Utilizing the southern parts of the Empire required railroads, fertilizers, irrigation schemes, and mineral deposits, all of which would be easier enabled through an abundance of cheap energy (Clerk and Gibson, 1922, p. 4, 6). Building the large water dams was thus seen as beneficial for the electricity grids as it would prepare them for the impending price increase of the solid and liquid energy carriers, while developing the grid itself was seen as critical for extracting Uganda's resources.

In 1924, a few years after the publication of the WPCs report, the British Electrotechnical and Allied Manufacturers' Association (BEAMA) organized what they called The First World Power Conference. In accordance with Clerk's indications, the vast majority of contributions there were concerned with water power resources (Straeten, 2017, p. 59). This strong belief that the fossil fuels would need to be replaced by renewable solutions was far from novel. Back in 1908 the would-be prime minister Winston Churchill published 'My African Journey', a report of his travels through East Africa, in which he included many observations with regard to the hydropower potentials for Uganda. When visiting the Ripon Falls, Churchill envisioned a future where "*this splendid bay may be crowned with long rows of comfortable tropical villas and imposing offices, and the gorge of the Nile crowded with factories and warehouses*" (Churchill, 1909, p. 119). He continued visualizing how easy it would be harness the Nile and let its journey begin by 'leaping through a turbine'. With little effort and small costs, he mused, could the level of the Victoria Nyanza be raised by roughly two meters to increase the available water power and allow passage to larger ships. It would simultaneously help to convert the swampy foreshore into dry land and enable the 'incalculable destruction of mosquitoes'[2](Churchill, 1909, p. 120), a species that he earlier coined the defenders of Uganda that realized their powers of evil with the arrival of the white man (Churchill, 1909, p. 94).

Nevertheless Britain was lagging behind the rest of Europe, not just in percentages but also with respect to their expertise in building and maintaining hydro-power dams. According to the WPCs report, just $0.6\,\%$ of Britain's power was generated by through hydropower which was in stark contrast to continental Europe and the United States that realised $27\,\%$ and $24\,\%$ of their industrial power through hydro electrics

FIGURE 3.1: Churchill standing on an observation ladder in Uganda (Churchill, 1909, p. 183)

respectively (Clerk and Gibson, 1922, p. vii). While the percentage of Britain's hydro-electric power in its colonies was considerably higher with an almost shocking $33\,\%$, it should be noted that this is taken from a total of just 6 million brake horse power, considerably lower than 13.3 million industrial horse power that was generated in the United Kingdom. More importantly given the context of this thesis, is that almost 3.4 million of these 6 million colonial horse power was generated in Canada (Clerk and Gibson, 1922, p. 3). Out of Britain's 'tropical' colonies, India was the only one with industrial hydro power. Meaning that not only Britain was lagging with respect to the rest of Europe and the United States, Britain's African colonies were also lagging with respect to the British empire.

One of the major difficulties in building hydro electric power in Uganda and its neighbouring countries was the high seasonal flow variation of most African rivers. It required the colonial officials multiple decades and several failed hydro dams, to fully understand how taming the 'tropical' rivers differed from their northern European counterparts (Showers, 2011, p. 197). Another obstacle could be characterized as political unwillingness. When Douglass Spencer, a manager of the Hydro Electric Department at W.G. Armstrong Whitworth's Company, tried to use the same arguments in 1921 as the WPC to organize an Empire-wide conference on developing and analysing the hydro power potentials for the empire he was dismissed by the colonial office (Straeten, 2017, p. 64). The Colonial Office argued that Spencer should first find something for which the empire should want the power. Finding political will was moreover difficult due to the relative novelty, in combination with the geographical inflexibility of the technology. The risk of failure was relatively large, and the industrial areas were located far away from the potential sites of hydro dams (Straeten, 2017, p. 64).

3.1.1 The prioritization of infrastructure

Halfway through the 1920's Britain began investing more in the infrastructure of its colonies in East-Africa. New policies were made in which Britain promised investments of multiple millions of British Pounds into irrigation dams, harbours, railway networks, and roads (Straeten, 2017, p. 66). All of this allegedly based on the so-called 'dual mandate' that stated a moral responsibility for the colonizer to support the well-being of the indigenous people, and capitalize the colonies' resources for the benefit of all (Lugard, 1922). In reality, little money was spend on overseas infrastructure and the budget that was made available here was not meant for electricity (Straeten, 2017, p. 66). Colonial governments were furthermore tied to strict spending limits imposed by the British government, making whatever initiatives they may have had for the electrical grid ever more difficult.

None of this stopped Douglas Spencer from promoting his ideas for developing hydro-power in the British colonies. Next to writing major articles in the Financial Times, The Electrical Review, and The Engineer, he contacted the colonial office again in 1927. In both the articles and his correspondence with the colonial office he argued for the surplus value of adding electro-metallurgy and electro-chemistry to the scientific research topics for the British colonies, and investments in Britain's tropical grids in general. Spencer argued that the development of the Empire was going too slow, and that they were sitting on vast amounts of unutilized estates. He envisioned an electrical infrastructure for the empire that mirrors our modern conception of the grid i.e. a vast network spanning nations, connecting many different power plants, municipalities, and industries (Straeten, 2017, p. 68).

Electricity would bring prosperity according to Spencer, who saw this argument already materialized in Canada, the US, and Europe. He furthermore argued for development scheme that can be characterized as 'technology first'. In Norway, he illustrated, the Rjukan hydro dam was built not because of the dense population or already existing industry, but because of its generative potential. By taking a similar approach to the East-African colonies, vast amounts of power would be generated with which raw materials could be treated and turned into products. Utilizing the African rivers' potential would be a first necessary step in creating prosperity for the whole Empire. The Colonial office was however less enthusiastic, and sent Spencer to the Empire Marketing Board which was founded only a year before in 1926 with the goal to promote the idea of 'buying Empire' (Straeten, 2017, p. 71).

The lackluster response to Spencer does not seem to be a unique or isolated event, but rather congruent with the colonial governing body's conception of electrical grids. While engineers such as Douglas Spencer and Dugald Clerk saw great potentials in harnessing the East-African rivers, their messages rarely, if ever, got translated into policies for the empire's African dependencies. At the end of 1920's, the empire's Dual Mandate received a new official push through the 1929 Colonial Development Act. This act "*authorise[d] the making of advances for aiding and developing agriculture and industry [...] and to amend the Palestine and East Africa Loans Act, 1926*" (HMSO, 1929, p. 1). While developing agriculture and especially industry would nowadays almost necessarily involve a reliable electricity provision, the Colonial Development Act did not include loans for electricity infrastructures. While the "*production, distribution and supply of electricity*"(HMSO, 1929, p. 2) was mentioned as one of the fourteen means to promote the commerce of industry in

the United Kingdom, only 2 % of the loans were handed out to develop the electricity infrastructure. Instead the loans, which totalled a combined £10 million, that got allocated to the 'Colonial Development Fund' were mostly spent on 'internal transport and communication' (30 %), public health (16 %), water supplies, mineral resources, scientific research, and agriculture (10 %, 9 %, 7 %, and 6 % respectively) (Abbott, 1971, p.74).

International economist George C. Abbott argues that if the Colonial Development Act is to be seen as an outcome of the Dual Mandate, this should be done as understanding it as "*doing something for the colonies while at the same time serving the interests of the United Kingdom*" (Abbott, 1971, p. 70). This is indeed confirmed by His Majesty's Stationery Office (HMSO) who stated that the act was intended for "*the purpose of aiding and developing agriculture and industry in the colony or territory, and thereby promoting commerce with or industry in the United Kingdom*" (HMSO, 1929, p. 1). Speaking on behalf of the Secretary of State for Dominion Affairs and the Colonies, Lord Passfield even argued that "*the principal motive for the introduction of this measure is connected with the lamentable condition of employment in this country, and this is an attempt to stimulate the British export trade*" (House of Lords, 1929). The objective of the act should therefore be seen primarily as an attempt to support United Kingdom itself, and less so to 'support the well-being of the indigenous people'.

Situating the Act into its historic context may require two crucial observations. Firstly, the Bill was introduced during the United Kingdoms great depression[3], which was most dominantly marked by a significant rise of unemployment and a collapse in export (Richardson, 1969, p. 3-4). Coincidingly, the Bill was introduced shortly after the establishment of a new government that needed to find answers to both these problems. Second, a careful reading of the Development Act shows that it was thought to function according to the then popular Keynesian idea of 'the multiplier effect' (Abbott, 1971, p. 72). This concept can be summarized as the belief that any form of government spending could create cycles of economic prosperity and employment rises. This was especially apparent through the doctrine that all materials used for developing the colonies should originate from within the Kingdom's territories, therewith affirming the 'buying empire' mandate. Combined these two temporal conditions were materialized in the Bill, which essentially meant that 'colonial development' entailed that investing in the dependencies was done for the main purpose of reducing the unemployment rates back home while simultaneously increasing British export. Only through this outdated trickle down theory *avant la lettre* could colonies like Uganda benefit from the 1929 development loans.

3.1.2 The Owen Falls Dam

But whichever the intentions of the development loans may have been, the outcomes for the Ugandan electricity infrastructure were minuscule. It would take another 34 years before the first large electric power plant in Uganda - the Owen Falls dam - would be built and finished in 1953. The construction of this dam was preceded by a two decade (mostly political) discussion on the scale and form electricity generation should have. Harold Odam, the head of the East African Power and Lighting Company (EAP&L) proposed three thermal generation sites allocated to the cities Jinja, Kampala, and Entebbe in 1936. This scheme allowed the three cities to be powered

on a short notice, and left the option open to later increasing the electricity production through building a hydro generation site on the Nile near Jinja. But EAP&Ls vision of electricity infrastructure development did not align with that of Uganda's governor who wanted to build a single large hydro dam (Gore, 2008, p. 366).

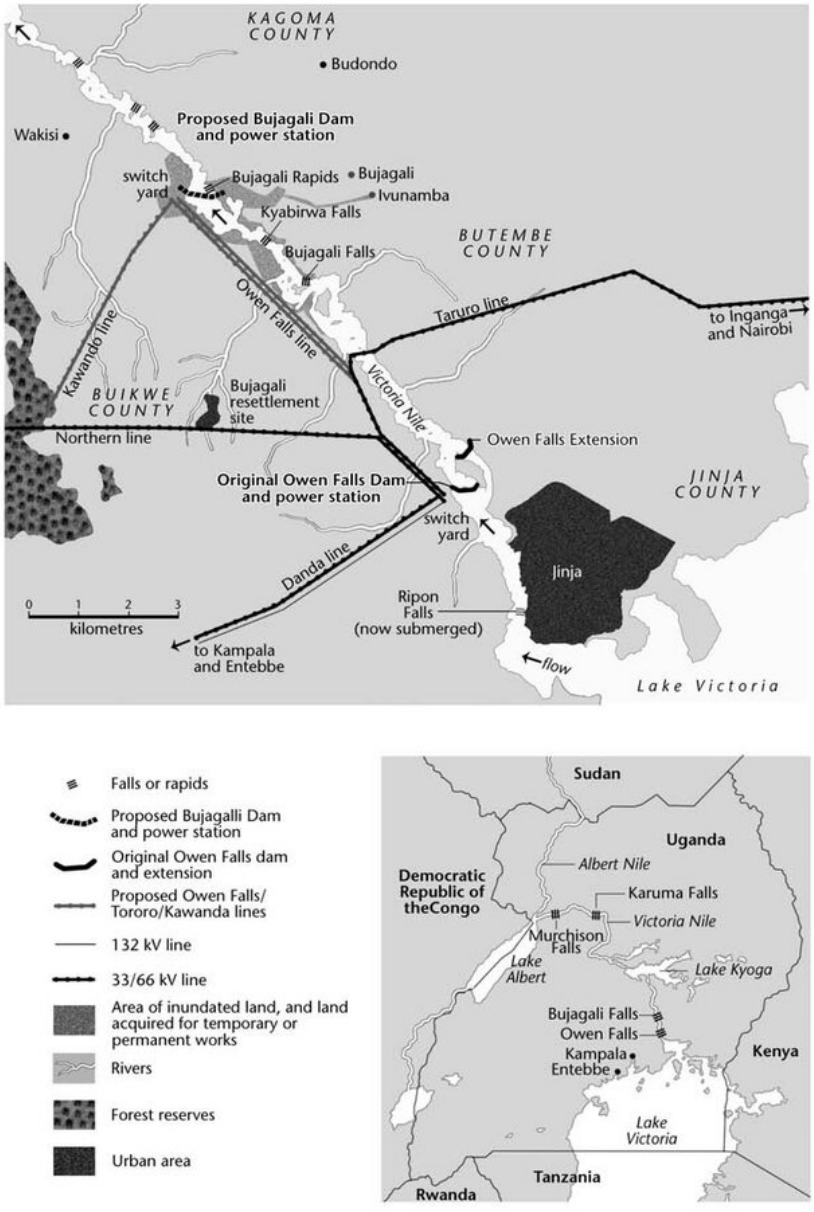


FIGURE 3.2: Map of Uganda's existing and proposed large hydro-electric facilities (Gore, 2008)

The core disagreement between EAP&L (a private firm) and the governor seemed to be on whether electricity infrastructure should be built ahead of demand or not (Hayes, 1983, p. 288). EAP&L was hesitant with developing large capacity electrical infrastructure because there was no guarantee that there would be enough demand to make profit. This was in line with a survey performed in 1935 by 'the most outstanding external expert advisor of the Colonial Office' (Straeten, 2017, p. 129) Charles Redvers Westlake, which found that there was too little potential electricity consumption to make a large hydro dam economically feasible (Wilson, 1967,

p. 2). Uganda's governors[4] on the other hand, were very enthusiastic about building hydropower on the Nile. Their ideas of building ahead of demand shows clear similarities with the tenets of the multiplier effect and trickle down economy that had already been prominently vocalized by the Empire. In this case however, Odam got the right of way and EAP&L was allowed to build the three proposed commercial services, which were taken into service in 1938.

Uganda's electricity infrastructure policies changed after the second world war, most notably through the establishment of the UEB, a state-owned enterprise, in 1948. While the EAP&L was not immediately dissolved, the UEB was given a monopoly on the generation and distribution of electricity within Uganda and quickly took over EAP&Ls operations. Notably, Westlake, who previously functioned as an external expert for the Colonial Office, was now appointed head of the UEB. Together with Uganda's governor he created a new vision for Uganda's future development. Large scale hydro electricity generation was embedded as the foundation of this vision, with the construction of the $60\,\mathrm{MW}$[5] Owen Falls Dam near Jinja as its first material milestone (Gore, 2008, p. 367). Seemingly ignoring Westlake's earlier survey, which saw no potential demand for such a large capacity supply, the nation's development was now linked to its electricity infrastructure who's success was itself dependent on the veracity of the multiplier effect.

Queen Opens Owen Falls Dam

JINJA (Eastern Uganda), April 29.—Queen Elizabeth, accompanied by the Duke of Edinburgh, pressed a button today to open the sluice gates of the £22.000,000 Owen Falls Dam.

British, Dutch, Italian, Danish, African and Indian workmen who built the 2725 ft long structure, cheered as a torrent of water was released down the Nile.

In her speech, the Queen declared that not only would the dam produce power for Uganda, but was also designed to store water for Egypt.

Work started on the dam more than six years ago and it will be several years before it is completed.

FIGURE 3.3: Queen Elizabeth opened the Owen Falls Dam in 1954 (The Morning Bulletin, 1954)

The Owen Falls dam shows that, under colonial rule, the criticality of Uganda's electrical infrastructure lay foremostly in supporting agricultural export, with developing industry next in order - albeit as subordinate to the 'needs of the Empire'. While the 1946 Uganda Development Plan did go in depth on Uganda's hydroelectric potential or electricity provision in general, it did note that the provision of hydro-electricity was fundamental to developing the nation's agriculture (Worthington, 1946, p. 101). Gail Wilson notes that this emphasis on agriculture came from the fact that roughly all Uganda's export in the past came from agriculture and that there was little hope for it to change soon (Wilson, 1967, p. 1). Still, the governor stated that hydro-electricity should encourage the expansion of secondary industry near Jinja[6]. As for many hydro-electricity was deemed analogous to cheap power, and abundant power was thought to attract (automatized) industry. The formation of the UEB furthermore showed that the development and maintenance of electricity infrastructure was now considered to be a task that should be undertaken by the government rather than private firms.

At the end of 1954, when the first two turbines had just started spinning, nearly all the power sold by the UEB was generated at the Owen Falls (Wilson, 1967, p. 7). Where European nations were building their infrastructure foremostly to supply themselves, Colonial Britain was looking at a larger map and intended the Owen Falls to supply its other East-African protectorates as well. The long lasting effects of such decisions were still visible two decades later when Uganda shut off its neighbouring

state Kenya whose electricity supply was for $30\,\%$ dependent on the Owen Falls at the time[7](Okoth, 1992, p. 86). This does not only show the enormity of the dam's capacity, but moreover that there was little understanding of electricity being a resource to be used by private citizens. While the UEB stood out among the other African electricity undertakings by their ambition to also service small and seasonal businesses, their provision to Uganda's rural population was very limited. As is still the case today, the dominant factor in preventing grid extension are the high costs of it. Even at short distances this needed justification through (potential) revenue, but capital costs of high voltage lines grow with distance, making it very difficult to reach non-industrial locations such as rural populations. In 1960, out of the rural consumers that were able to receive a mains connection, at least $85\,\%$ was used for agricultural purposes such as cotton ginning (Wilson, 1967, p. 85).

Surprisingly, the Owen Falls Dam was not only critical because of the electricity it was generating. As a closer look into the 1946 Uganda Development Act shows that the Empire's hydro-electric power in Uganda was not only critical aiding the needs of the United Kingdom directly, but also indirectly through Egypt, another British colony. The Act defended large capital expenditure on the White Nile as it would simultaneously allow Egypt to control the river's flow and the water storage near its source i.e. Jinja (Worthington, 1946, p. 105). This control should be taken quite literally as the Empire had - without Uganda's permission - granted Egypt the rights to veto any construction on the Nile in Uganda. Back in 1929, the British had allocated these rights to Egypt under the Anglo-Egyption Treaty to allow them to control the flow and level of water of the Nile, therewith protecting its production (Secretary of State for Foreign Affaris, 1929, p. 2, 3). This meant that the UEB had to ask permission from Egypt to build the dam, and that an Egyptian engineer had to be present during the construction to give instructions on the water flow (Monitor - Uganda Edition, 2016).

3.1.3 Criticality in colonial Uganda

In accordance with Hård's notion of critical infrastructures under colonial rule (see chapter 1), it is safe to say that the electrical infrastructure in early colonial Uganda was predominantly built to help exploit its natural resources (see Figure 3.4). Nevertheless, the lackluster reactions to the proposals made by sir Dugald Clerk and later by Douglas Spencer simultaneously show that the infrastructure was not yet regarded critical as such. Or to phrase it different, the financial and technical obstacles for building hydro-power in Uganda rendered the infrastructure non-critical. While little energy provision that was built and funded through the 1929 Colonial Development Act can be understood as a realization of the Dual Mandate, it would only indirectly support Uganda's population through the multiplier effect. The poor outcomes for Uganda's citizens however show that this argument was not actually materialized. Electricity in this period thus started to get linked to to the economical development of the British Empire, with the UK in the first place, and Uganda as an arguable second. It was however clear that the needs of Uganda were part of the needs of the Empire. Moreover, construction of infrastructure in Britain's 'protectorates' was predominantly being justified under the guise of reducing unemployment in the UK and to promote the idea of 'buying empire' (Abbott, 1971). Ugandan infrastructure as such was critical in the sense that it was deemed necessary for getting the colony to its full potential of sustaining its colonisers. Electrical infrastructure however was only given a marginal role within this supply line of the UK.

The construction of the Owen Falls dam strengthened electricity infrastructure as a critical node within this network of economic growth for the Empire. Even though the generated electricity was partly intended to support production in Uganda, this production was not intended to support the economy of Uganda but that of Britain instead. Up to half of the electrical energy was transmitted to Britain's neighbouring 'protectorate' Kenya, where the Empire required its commercial interests there. Moreover, the dam's criticality was also non-electrical as it had a secondary function in which it helped to safeguard the water provision of Egypt's agriculture. Uganda's electrical infrastructure was thus critical for the Empire, but less so for the East African nation itself. Uganda was highly underdeveloped at the emanation of its independence. Even though its generation capacity was exceptionally high, it was not intended to support local businesses nor to supply urbanites let alone the rural population. More transmission and distribution within Uganda would be required before it would become critical for its own society.

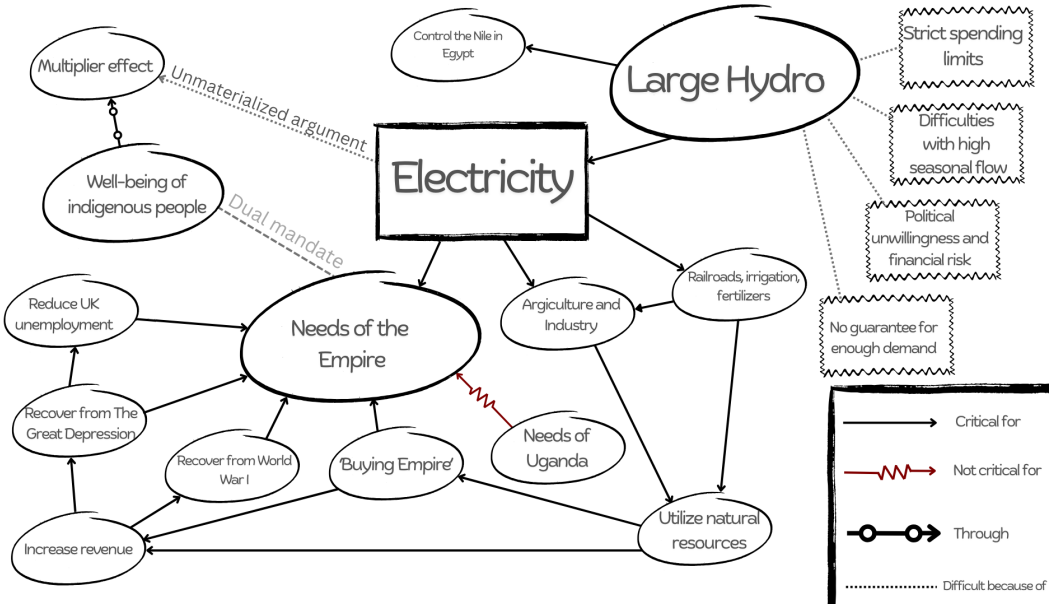


FIGURE 3.4: The criticality of Uganda's Electricity according to the British Empire.

3.2 1962 - 2015: The Will to Power

Uganda became independent in 1962 and therewith certainly gained freedom and political power over itself. While the first two decades of Uganda's post-colonial era were mostly marked by corruption, civil wars, uprisings, and the brutal dictatorship under Idi Amin, this did not stop the World Bank from investing in Uganda's infrastructure (Toussaint, 2015, p. 1). Even though the Bank initiated many major projects for Uganda's electricity networks, these projects came with policy requirements that supported the Bank's own interests and heavily interfered with Uganda's sovereignty. Aside from this duality, the period between 1962 and 2015 is furthermore marked by a crucial transformation in the criticality of Uganda's electricity which gradually became more associated with household energy access.

3.2.1 The World Bank

The World Bank was, and still is, one of the most influential actors in the development of electricity infrastructure and energy distribution in post-colonial Uganda. As of 2024, the World Bank is highly involved in Uganda's projects of energy access through handing out loans and providing business models of which the latest example is the Electricity Access Scale-up Project (EASP), a 638 million US dollar grant intended to provide electricity to 5.7 million people and 700 public institutions (World Bank, 2022). The EASP was preceded by the ERT, a three phase project with similar goals to the EASP (World Bank Group, 2024) (see section 3.2.2). Additionally, ESMAP, a daughter organization of the World Bank partnering with over 20 development partners (all from the Global North (ESMAP, n.d.)), plays a major role in the global endeavor of achieving universal energy access (see section 3.4.2).

Uganda officially joined the International bank for Reconstruction and Development (IBRD) (now the World Bank) in 1963, less than one year after gaining its independence. While analysing the history of the World Bank would go beyond the scope of this thesis, a short overview of it does fit here. Especially so because it helps to illuminate, and provide insight in, the rationale in which the World Bank prioritizes its development projects in Uganda. This description will lean most thoroughly on Eric Toussaint's critical history of the World Bank (Toussaint, 2015), especially in relation to their operations in the 'developing countries'.

In order to understand (the criticisms of) the operations carried out by the World Bank it is important to note that it was not founded on the mission to reduce poverty or to support human rights as is often believed. In fact, the Bank was founded on the twofold mission to firstly help to rebuild war-torn Europe after the second World War, and secondly to stimulate economic growth in the Global South (Toussaint, 2015, p. 17). Where it should be noted that many of the countries covered by this secondary mission were still under the colonial rule of the countries covered by the primary. This double-edged mission should be understood from the perspective of the United States who had established the Bank. In essence, the World Bank was founded as a predictive measure under the Roosevelt administration to prevent the world economy from falling into a new depression after WWII (Toussaint, 2015, p. 9). Strikingly, the Bank made stark differences in loan requirements and interest rates between the European nations and the nations in the Global South. While Europe received money mostly free of requirements through the Marshall Plan[8], Southern nations had (and have) to pay high interest rates and adhere to strong demands with respect to their business climate. In contrast to European nations such as post-war West Germany nations that the World Bank considers to be 'developing' are moreover not allowed to pay their debts back in their own currency, nor are they allowed to manufacture what they can also import, and where Germany only had to spend $5\,\%$ of their export revenue on paying back their debts countries in 'sub-Saharan Africa' like Uganda need to spend at least $8.7\,\%$[9](Toussaint, 2015, p. 41).

Large amounts of the loans handed out to the colonial powers in western Europe were used to extract resources from their colonies whose profits were then used to rebuild and develop their own economies. The loans were not intended to support to colonies or protectorates themselves, if they turned out to be it was more so as a side effect. Especially during the first two decades of its existence, the investments of the World Bank in 'Southern countries' were solely focused on making them more

profitable. Up until 1962 the Bank had only loaned them money for roads, ports, dams, and agriculture, while loans for projects that would have positively affected the social dimension of development such as education, public health, and access to clean drinking water stayed fully absent (Toussaint, 2015, p. 21). Arguably more distressingly, when the colonies became independent the money that was loaned to their oppressors to deplete their natural resources was transferred to the newly independent nations (Toussaint, 2015, p. 39). For Uganda this inherited debt created a negative balance of 11.7 million British pounds (Davis, 1962, p. 410), in 1966 Uganda still had an outstanding debt of almost 92.7 million USD (Tolley and Bruce, 1966, p. 12), of which 7.8 million USD was directly loaned from the IBRD. Interestingly, the debt service payments were primarily made by the UEB (Davis, 1962, p. 452).

It is clear that the loans given by the World Bank to the 'developing countries' were mostly in the interests of the World Bank and the occupying nations. Still the loans to the Global South are very lucrative to the World Bank whose profits are in the several billions USD per year (Toussaint, 2015, p. 21). When the Marshall Plan was handed out to Europe a proposal was made by the 'Southern countries' to have a new UN body, the Special United Nations Fund for Economic Development (SUNFED), enacted in which they would have equal votes and that would give out loans to support their economic development. Strongly opposing this idea, the industrialized countries successfully canceled this proposal and handed this position to the World Bank (Toussaint, 2015, p. 30).

In another analysis of the relations between the World Bank and Uganda, Jon Harald Sande Lie coins the term *developmentality* - a clear reference to Foucault's notion of *governmentality*[10]- to describe how the World Bank exercises power within the aid it provides to Uganda (Lie, 2015). Developmentality has all the attributes of governmentality, but with the additional aspect that the World Bank actively shapes the environment in which it can exert its governmental power. The World Bank is selective in which countries it will operate, and wants them to already have the conducive policies the Bank and its group of donors prefer to operate with (Harrison, 2001, p. 672). In 1999, the World Bank adopted the Comprehensive Development Framework (CDF) which was foremostly materialized by the Poverty Reduction and Strategy Paper (PRSP) models that client governments had to develop before they could receive loans. The PRSP would theoretically have given the recipient country the control over grant implementation policies by letting them determine the goals, phasing and timing of the associated projects. But the PRSP also marked a new strategy for the World Bank who would now hand over its role as project leaders, and instead take on the role in which it gives its approval to client governments budget (Lie, 2015, p. 727). As the Bank would ultimately only select those projects it was willing to support, this new role meant that the Bank would keep a close eye on the government's PRSP strategy development. For scrutinizing and steering the strategy document at its development stage would increase the chances of a project to be financed. This also had effects on other smaller projects and donors, because the PRSP model was a government document and all other development projects now had to be complementary to it. Summarized, client governments such as Uganda now had to develop their own PRSP model that had to be in the center of all domestic development projects (whether externally supported or not) in which they 'freely' had to to adopt the Bank's good governance package of increased government transparency and accountability, with checkboxes on human rights abuses,

multiparty democracy, political decentralisation, and corruption (Lie, 2015, p.728).

The influence of the World Bank and its associated donors in the policy-making of Uganda's development programs was further echoed by representatives the government, one of whom who e.g. stated that "*Donors say we should develop our own strategy and that we should have ownership [of] it and be in the lead. So my basic question to the donors when they come with this ownership talk is: why are you here? Obviously they don't trust us and would like to control us*" (Lie, 2022, p. 124). Likewise, at the finalizing stage of Uganda's fifth PRSP document, one government official reflected on how the World Bank downgraded Uganda's prior budget execution from 'on track' to 'partially met': *"It's always like that. The whole setting is just a charade and pretence. They [the Bank] start hard, to set the agenda, but we all know that everybody is interested in reaching an agreement. And we know the Bank can't push too strong conditions since they need our consent when working through government. And political conditions would be against their mandate . . . The bilaterals are different. They tend to be more pushy – also on politics . . . You don't say no to a donor. But saying yes, or not saying no, does not mean we agree. [...] If we had said right up we couldn't do it, they would [have] made it a condition. Now we were criticized for not performing well enough and asked to improve efficiency instead"* (Lie, 2022, p. 144-145).

3.2.2 Electricity and The World Bank

The British Empire left a significantly underdeveloped nation at the dawn of Uganda's independence. Even though its electricity production exceeded that of its neighbouring countries, the other critical infrastructures lagged to such a degree that Uganda could hardly make any use out of its jump-started electricity infrastructure. In fact, in 1961, only about half of the capacity of the Owen Falls was being used, including a $22.000\,\mathrm{kW}$ bulk supply that was being sold to Kenya under a multi-year contract (International Bank for Reconstruction and Development, 1961, p. 2).

While Uganda has been regarded as one of the prime examples of a healthy collaboration between The Bank and a recipient nation, tensions between the two parties can be traced back to the first decade of Uganda's independence. One of the first actions taken by the Uganda government on it's energy provision was done through the 1961 Electricity Act, which reinstated the UEB and thus de-privatised the electricity sector (Uganda, 2000). The World Bank started it's funding of Uganda's electricity infrastructure through a 8.4 million USD grant called *Power I* (see Figure 3.5). And even though the Bank continued to hand out grants to Uganda's governments (authoritarian or not), they were increasingly unhappy with the UEBs progress and corruption charges. The Banks frustrations eventually led to Robert Blake - World Bank Country Programme Manager for Uganda - commenting that the UEB was unreformable, which eventually led to the 1999 Electricity Act which in turn unbundled the UEB and privatised Uganda's energy sector again (Gore, 2008, p. 362).

With $95\,\%$ of its expenditure, the Power I grant was almost entirely allocated to the expansion of transmission and distribution facilities of the Owen Falls. Transmission lines were to be extended from Soroti to Gulu, and from Kampala to Hoima and Masindi, while simultaneously connecting smaller towns en route. Fort Portal would also be connected to Owen Falls hydro plant in order to facilitate tea estates,

factories and cotton ginneries in its vicinity as well as the copper mines in the nearby Kilembe (International Bank for Reconstruction and Development, 1961, p. 3, 4). Even though the Bank mentioned how smaller towns could be connected through the Power I plan, it only did so in relation to facilitating industry. If connecting households was part of their motivation, they ommited to mention it.

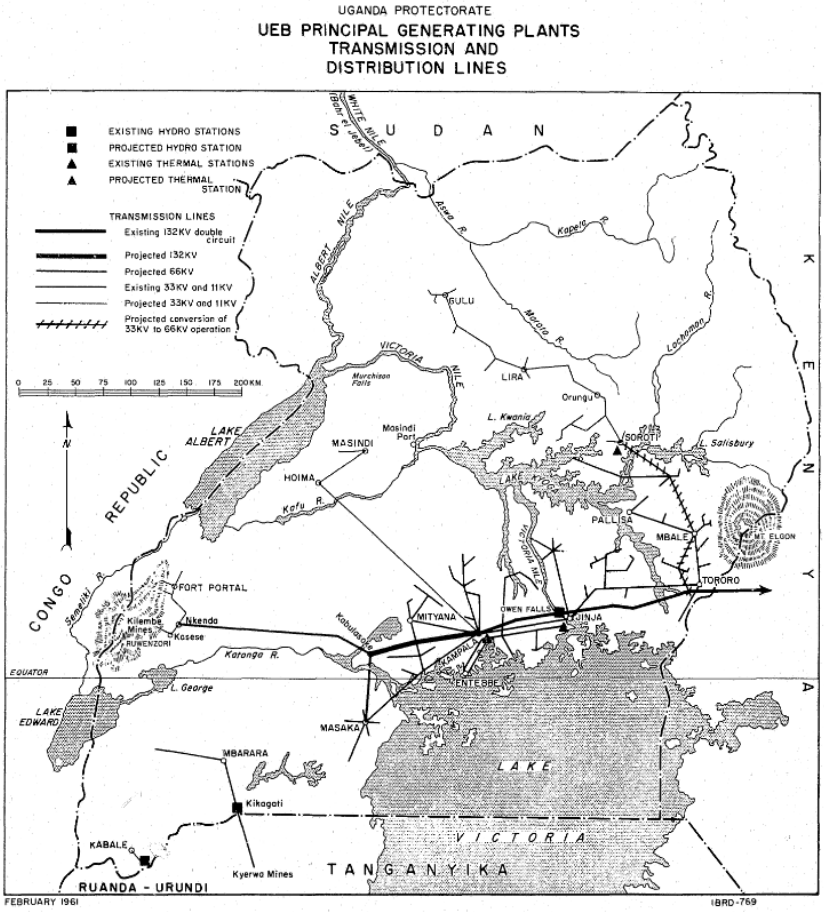


FIGURE 3.6: Map of UEBs plans for the grid extension under the 1961 Power I grant (International Bank for Reconstruction and Development, 1961, p. 4)

The second World Bank grant for Uganda's electricity infrastructure came in 1986 through the 40.3 million USD Power II project (World Bank, 1995, p. 3). The grid was, at the time, in a dismal state due to neglect of maintenance during the dictatorial reign of General Idi Amin and the ensuing Ugandan Bush War. The aim of the Power II project was therefore not to build new transmission lines and extend the electrical grid, but rather to repair and refurbish the existing infrastructure. The project had three main components. First the rehabilitation and uprating of ten turbo generator units and their associated gates, and structural repairs to the power house, and the gates of the Owen Falls. Second the rehabilitation of transmission and distribution systems[11], including the provision of ancillary items and studies. Lastly the grant included technical assistance to the Ministry's Energy Department. However, due to increasing project costs and new requirements of transmission and distribution networks, the second component was later restricted to focus on Uganda's capital city,

Kampala (World Bank, 1995, p. 5).

UGANDA OBTAINS LOAN

Gets $8,400,000 to Expand Power From World Bank

The International Bank for Reconstruction and Development (World Bank) made an $8,400,000 loan yesterday to the Protectorate of Uganda for the extension of the electric power transmission and distribution systems of the Uganda Electricity Board.

Belgium, the Netherlands and fourteen banks in the United States will participate in the loan to the extent of $4,315,000. The loan is for a term of twenty years and bears interest of 5¾ per cent. Britain is guarantor of the loan.

Participating banks are:

Continental Illinois National Bank and Trust Company of Chicago; the Northern Trust Company, Chicago; the First National Bank of Atlanta; the National Shawmut Bank of Boston; United California Bank, Los Angeles; Central National Bank of Cleveland; Chemical Bank New York Trust Company; Banque Lambert, S. C. S., Brussels; the Toronto-Dominion Bank-New York Agency; Girard Trust Corn Exchange Bank, Philadelphia; the First Pennsylvania Banking and Trust Company, Philadelphia; Hope & Co., Amsterdam; Nederlandsche Credietbank, N. V., Amsterdam; Bankierskantoor Staal & Co., N. V., The Hague.

FIGURE 3.5: One of the first loans granted to Uganda by The World Bank (The New York Times, 1961)

Considering the restorative nature of Project II, it can be assumed that the criticality of the electricity infrastructure experienced little development. In fact, the Bank stated that the primary objective of the project was to prevent the electricity infrastructure from developing into an economic bottleneck (World Bank, 1995, p. 13). While the limited financial capacity of Uganda, and its recent political instability, definitely played a role in the frugal aims of Power II, the Bank showed to be relatively satisfied with the results of the project and did not mention its failure to achieve household electrification. They did however include technical assistance for a household energy survey in the major towns of Uganda as part of the third component of Power II, but it should be noted that this was limited and mostly done to assess whether it would be financially interesting. In fact, both the Ugandan Government and The Bank saw the recommendations from the study to be inadequately justified and thus failed to implement a household energy strategy (World Bank, 1995, p. 14, 16–17). The Bank was however satisfied with the structural repairs and upgrading of the Owen Falls power house and dam, whose damages were now taken care of and whose capacity had been increased to $168\,\mathrm{MW}$[12]. They furthermore emphasised how the rehabilitation of Kampala's transmission and distribution networks could meet the growing demand for the economy, and how the overall project resulted in an estimated economic internal rate of return (EIRR) of 14 per cent (World Bank, 1995, p. 5-8). Nevertheless, the Bank also showed its discontent with the UEBs weaknesses with regard to its institutional and financial performance, and its lack of commercial orientation (World Bank, 1995, p. 24-25). The Bank moreover accentuated that these problems would be addressed in the new Power III project, including possible privatisation of (part of) Uganda's energy sector (World Bank, 1995, p. 8).

The third energy project of the World Bank in Uganda, Power III, started in 1992 and was again primarily aimed at repairing the existing infrastructure and enhancing its performance, under the overall objective of increasing the state's economic performance. One of the main reasons for the bad state of Uganda's energy provision was due to the continuing drop of Lake Victoria's water level, which reduced it's output capacity from $380\,\mathrm{MW}$ to only $120\,\mathrm{MW}$ (World Bank, 2008, p. ix). A secondary aim of this project was to improve the power sector's efficiency, in particular the UEBs financial situation, through policy reforms, institutional strengthening and the implementation of cost-reflective tariffs. Most notably is that this was the first major World Bank energy project in Uganda in which household electrification was mentioned as an objective, albeit a secondary one (World Bank, 2002, p. 2). The project even mentions the division of rural and urban electrification, and acknowledges that the latter would be less expensive and more feasible than the former. At the time, the Bank, through an assessment of ESMAP, argued that Uganda's only energy solutions were hydropower and yet untapped geothermal potential due to the low pressence of hydrocarbon resources and other fossil fuels. The landlocked

status of Uganda made it furthermore exceedingly expensive to import such energy carriers (ESMAP, 1996). Considering that it would roughly take another two decades before PV energy generation would become technologically viable and economically feasible[13], it was reasonable for the Bank and the UEB to focus on hydro power generation, and transmission and distribution to the urban population.

Even though the Key Performance Indicators (KPIs) of the Power III project did not contain any indexes directly related to electrification rates, it was arguably ahead of its time with respect to energy access and household electrification. Where it would take the UN until 2002 before they would link household electrification directly to human development (see Section 3.3), the Bank and the Ugandan government showed to already be concerned with the electrification of rural Uganda during this project that started in 1992. Moreover, as will be shown in section 3.2.2, the government would later increase its efforts to provide rural during the ERT project by creating a Rural Electrification Fund to subsidize the capital costs of new rural connections, and establishing a maximum tariff to prevent the tariff levels (which were reflective to the electrification costs) from reaching unreasonably high levels. In 2001, the Bank would coincidingly acknowledge that the low electrification rate of rural Uganda was at a problematic 1 per cent (World Bank, 2002, p. 31-32).

The Power III project marked one of the most outspoken dissatisfactions of the Bank with the UEB. In a Project Performance Assessment Report (PPAR) for Power III from 2008, the Bank mentioned the "*non-performance*" of the UEB as one of the three main reasons for carrying out the assessment[14](World Bank, 2008, p. ix). The Bank argued that, notwithstanding the physical outputs, the key-objective of enhancing the state utility performance was negligible. The UEBs arrears kept increasing, and its financial covenants were never met. In the end, the International Evaluation Group World Bank (IEGWB) rated the outcome of the project as unsatisfactory, the performance of the UEB as highly unsatisfactory, and the Bank's supervision of the project as moderately satisfactory. The Banks' overall performance was rated unsatisfactory as the IEGWB argued it should have been more carefully in scrutinizing the contractor's qualifications (World Bank, 2008, p. xi-xii). Eventually, the discontent of the Bank with the UEB would be one of the motivations for Uganda's 1999 Electricity Act in which the UEB would be formally disbanded in order to privatise Uganda's energy sector (*Uganda Electricity Act, 1999* 1999).

The Bujagali Falls

Uganda's new Electricity Act, and the unbundling of the UEB coincided with the construction of the Bujagali Dam, marking another major event in the history of Uganda's electricity infrastructure. According to Chrisopher Gore, these three events were interdependently linked with each other. The possibility of multiple dams on the Victoria Nile at Jinja was already hinted at by Churchill when he was contemplating the Nile starting with a leap through a hydro-power source (see section 3.1)[15]. Long before the construction of the Owen Falls dam, the Bujagali site was deemed to be the best location for a hydro-power source, but later abandoned due to the superior accessibility of the Owen Falls. Both in 1957 and 1986, consultant's reports suggested Bujagali again to Uganda's respective governments (Gore, 2008, p. 370, 383). In 1984, ESMAP gave five recommendations with regard to the development of Uganda's electricity grid, one of which pointed at the construction of a new dam for

electrical energy export in order help the economy recover from the intense national instability under Idi Amin (ESMAP, 1984, p. 14). More crucially, private companies such as the Canadian Acres International Ltd, the South African-based Madhvani Group, and USA-based Applied Energy Services (AES) International started to show interest in investing in a new hydro dam at the Bujagali site throughout the first half of the 1990's (Gore, 2008, p. 383, 384). The AES would eventually win the contract from the other competitors through an opaque and controversial process (Lilley, 2003). The procedure went without a bidding process, and the agreement between AES and the government remained secret.

To understand the origins of the Bujagali Falls hydro-dam it is imperative to note that the perceived purpose of electricity started to shift during the 1990's and the early 2000's. Electricity was now also started to get linked to human development as additional to economic growth (see 3.3). In Uganda this shift started to take shape with the establishment of Rural Electrification Fund (REF) institutions, specifically the Rural Electrification Board (REB) and the Rural Electrification Agency (REA). Each as a result of the 1999 Electricity Act, that explained rural electrification as necessary to achieve equitable distribution of access to electricity (*Uganda Electricity Act, 1999* 1999, sec. 62-64). As mentioned in chapter 2.2, providing electricity connections to the rural population is inter alia difficult due to the low population densities, the vast distances between cities and rural communities, and the high share of rural in comparison to urban populations. Back in 2002, only $1\,\%$ of Uganda's rural population had access to any amount of electricity. This is not to say that the electricity in Uganda's cities was plenty, as the overall electrification rate of Uganda's 27 million population was calculated at only 4-5 per cent (Gore, 2008, p. 359), the urban electrification rate can be estimated at roughly 20-26 per cent. In fact, Uganda's electricity infrastructure was at such a dismal state that, in 2006, the Minister of Energy declared they were experiencing a power supply crisis[16](Gore, 2008, p. 359).

Taken together the combination of Uganda's power crisis, the newfound pertinence of household electricity, as well as the fairly recent stability in Uganda[17]created the incentive that a new energy generation site had to be constructed quickly, while the long history of the Bujagali Falls ensured where it had to happen. According to Gore, the desire to quickly construct was so great that alternatives to the Bujagali site were easiliy neglected (Gore, 2008, p. 376). Moreover, the pre-investments made to e.g. conduct studies on the location had accumulated to such an amount that abandoning the project was argued to be more expensive than actually going forward with it (Gore, 2008, p. 384). Arguably crucial for the success of the Bujagali was the unbundling of the UEB and thus privatizing Uganda's electricity infrastructure. This is partly because of the World Bank's overall dissatisfaction with the UEB, but also due to the UEBs deficit in revenue collection which at times was as low as 50 per cent (Gore, 2008, p. 381). This figure needed to get up drastically in order for the private sector to invest in the Bujagali dam. The 1999 Electricity Act was thus interlinked with the newly proposed dam. The electricity sector had to be reformed in order for the Bujagali dam to be successful, and the dam had to be profitable in order for this privatisation to be successful (Gore, 2008).

Funded by AES, the Bujagali Hydropower Plant was to be commissioned in 2006 (World Bank, 2002, p. 2). Construction however only started in 2007, and the dam was eventually finished near the end of 2012. Aside from the technical difficulties that seemingly always delay large projects such as these, AESs retraction from the

project in 2003 is arguably the most significant reason of the deferral. While under investigations for of bribery and corruption, the AES pulled out of the project citing economic reasons (Jinja City, n.d.). The unrevealed deal between the AES and the government was disclosed in the end of 2002 by cause of an order by the Ugandan High Court after the World Banks independent investigative unit (Lilley, 2003). Through a financial bond, the Ugandan government could seize AESs local assets worth a total of 75 million USD for them not being able to deliver financial closure. The Bujagali project however got stalled for the following five years. A new consortium, Bujagali Energy Limited (BEL) won the bidding contest and started construction in 2007 (Jinja City, n.d.). The 250 MW Bujagali dam was eventually commissioned in 2012 (Kasita, 2012a).

Corruption was far from the only controversy of the Bujagali project. A Relocation and Compensation Plan was made in 1992 to account for the resettlement of the 330 households near Bujagali (World Bank, 2002, p. 4, 8). Already in 2001, an official request was made by the National Association of Professional Environmentalists (NAPE), the Save Bujagali Crusade and other local institutions and individuals. Their concerns were with directives, policies and procedures that were allegedly not complied with. These included environmental assessment, natural habitats, indigenous peoples, involuntary resettlement, safety of dams, management of cultural property, economic evaluation of investment operations, poverty reduction, disclosure of operational information, project monitoring and evaluation, and project supervision (World Bank, 2002, p. 14). The requesters argued that the Bujagali Hydropower project would likely result in social, economic, and environmental harm to the local population. The World Bank subsequently made an action plan that addressed the areas where the Bank - according to the Inspection Panel that was registered for this specific request - had fallen short on these issues. This plan got approved by the Board of Executive Directors in June 2002 (World Bank, 2002, p. 15). This was however not sufficient according to NAPE and the Save Bujagali Crusade who still castigated the unfair purchase agreement and the absence of a fair bidding process. They additionally stated that their environmental concerns were still not addressed and the hydro-electric lobbyists had frustrated efforts to explore other clean energy sources viz. geo-thermal and solar power (New Vision, 2003). The Crusaders furthermore asserted the social and cultural significance of the Bujagali Falls to the Busoga Kingdom[18]. Leaders of the Busoga Kingdom furthermore argued that societal and financial costs - 6000 people would be affected, and Bujagali ecotourism brought in 600,000 USD per year - far outweighed that benefits of the (then estimated) 200 MW Owen Falls extension (Linaweaver, 1999). As summarized by International Rivers the dam would "*flood a 10–mile swath of the Nile corridor, including the Bujagali Falls, a spectacular series of rapids which are a popular retreat for tourists and whitewater rafters. It is also likely to harm water quality, increase water–borne illnesses, increase water hyacinth infestations and harm fisheries. Almost 200 hectares of productive agricultural land will also be lost to the project, amounting to an annual loss of 675,000 USD at current prices, according to project documents. Potential resettlers have complained that their lands have been undervalued in project appraisals.*" (Linaweaver, 1999). Concerns about the dam were not weakened by time, NAPE was still decrying the deal in 2008, citing the World Bank Inspection Panel they argued that the dam would not help Uganda's citizens but would make them poorer instead. According to NAPE, the project deal was much in favor to the project developers who did not have to bear the risks of environmental damage, excessive project costs, nor of e.g. low amounts of rainfall that would

reduce the power outage of the hydroelectric dam (International Rivers, 2008). In other words, if the electricity produced by the dam would turn out to be excessively expensive, these costs would fall onto the power purchaser (i.e. Ugandan citizens) not the seller. NAPE furthermore critiqued the World Bank for poorly advising the government in the negotiations of the Public Private Partnership (PPP), better consultations would have saved a net 200 million USD. Moreover, the resettlement plans of the Bank and AES had been derailed after the pull-out of AES, which eventually ended up in involuntarily resettlement. The affected communities now had less opportunities to generate revenue through the agricultural activities they had practiced before (Mdone, 2015). To make matters even worse, there were also religious concerns that were hardly taken into account by the project developers. The Bujagali Falls has great spiritual significance for the 250 traditionalist clans from the Busoga region, but their spiritualist leader and Bujagali oracle, Budhagali Nabamba (Figure 3.7), was not consulted on the impact of the dam on their shrines (Centre for Public Impact, 2017). A different spiritualist, Benedicto Nfuudu, would later relocate the budhagali spirits to new shrines a year before the dam would be commissioned (The East African, 2011). Nabamba accused his replacement to be an imposter who got bribed for 100 million Ugandan Shillings to perform theatrical traditional rites. Nfuudu and cultural leader Badru Waguma opposedly called Nabamba an imposter without any powers over the Bujagali (New Vision, 2005), and were grateful for the government's attention to the importance of the water spirits (The East African, 2011). Budhagali thereafter dragged Nfuudu and Ntembe to court over the relocation of the spirits, and set one of Nfuudu's shrines ablaze when the court did not adhere to his request (Kapo, 2019). Seemingly unaware of all the controversy, president Museveni lauded the new dam, assuring at the dam's commissioning that the Ugandan people would not be experiencing power cuts anymore (New Vision, 2012). The project would eventually be appraised at 860 million USD. Moreover, the electricity prices in Uganda have actually increased since the construction of the dam, as of 2017 Uganda has the highest average costs for hydro electricity in Africa, rendering it inaccessible for many Ugandans (Centre for Public Impact, 2017).

Energy for Rural Transformation

The Poverty Eradication Action Plan was launched in 1997 by the Ugandan government as a way of prioritizing poverty eradication (see Table 3.1). The plan had a strong focus on rural areas as that is where $96\,\%$ of Uganda's poor population lived at the time. While electricity was not specifically mentioned as one of the PEAPs indicators, it was recognized that modern energy was critical in rendering the indicators and allowing people to participate in the prospected economic growth, improve human capabilities and meet basic human needs. For these reasons, the ERT programme was developed by the Bank and government. The ERT plan was initially a 400 million USD 10-year public-private partnership in which the government would create an environment for the private sector to invest in the electrification of Uganda's rural population (Bbumba, 2002, p. 2). Achieving access to electricity for rural Uganda would later turn out to more expensive and much more time consuming.

FIGURE 3.7: Bujagali oracle Nabamba Budhagali (The Independent, 2019)

TABLE 3.1: Indicators of the PEAP (Bbumba, 2002, p. 1)

Indicator	**Status**	**Targets (Year)**
Population living in absolute poverty (%), 2000	35	<10(2017)
Infant mortality rate per 1000 live births.	97	78(2002)
Under 5-mortality rate per 2,000 live births.	147	118(2002)
Maternal mortality rate per 100,000 1996-2000	506	400(2002)
Stunted children, below 4 years (%), 1995.	39	34(2002)
Access to safe water (%of rural population), 1998	41	100(2015)
Access to sanitation (%of rural population), 1998	45	100(2015)
Population per doctor, 1997	18700	
Births attended by a trained health personnel (%), 1996	38	
Net primary school enrolment ratio	85	200(2003)
Adult literacy %, 1995	65	

The ERT program consisted out of three phases, where the precedent phase had to be completed before its subsequent could start. The first phase, ERT I, would start in 2002 and predominantly focused on creating an environment in which the private sector could invest in rural electrification (World Bank (Africa Energy Group), 2009a, p. 15-20). After its completion the World Bank considered the first ERT phase as moderately satisfactory. They were mostly pleased with the REA, and the REB that were turning into key institutions and were performing their responsibilities as legally prescribed. The Bank nevertheless had concerns regarding the autonomy of the autonomy of the REA and the REB who they regarded as too closely related to the government[19]. The REF was however operational and had been used by the World Bank, Swedish International Development Cooperation Agency (SIDA) and the Japanese Government (World Bank (Africa Energy Group), 2009a, p. 15). Aside

from building potential for the private sector, the outcomes from phase I was fairly disappointing. Especially the Uganda Microfinance Limited (UML) faced difficulties with finding demand for SHSs, while they got allocated with 297 thousand USD, only $17\,\%$ of this amount was utilized for loans. Similarly, the same amount got allocated for the provision of working capital loans to solar vendors, in this case $55\,\%$ was utilized (World Bank (Africa Energy Group), 2009a, p. 15). Independent grid systems weren't as successful as expected either, at the time of phase I's evaluation one independent grid was completed with the other one still under construction. The first independent grid encompassed an upgrade to the rural Kisiizi hospital from $60\,\mathrm{kW}$ to $300\,\mathrm{kW}$. This hospital was one of Uganda's most important rural health centres. The existing $60\,\mathrm{kW}$ micro-hydropower plant had become insufficient over the years as the staff had increased and other energy-intensive activities (such as welding, x-rays, maise grinding, and electric water heating) were taking place on the hospital grounds. Energy poverty had increased to the level where "*electric cooking and other non-essential electricity demands*" had been restricted for years (Africa Regional Office, 2001, p. 67).

FIGURE 3.8: Kisiizi hospital, situated deep in the south western mountains of Uganda. Its service area comprised much of south-western Uganda (Africa Regional Office, 2001, p. 67).

This sub-project was mostly delayed due to technical difficulties, and was commissioned at the start of 2009, although 300 household connections were still underway (World Bank (Africa Energy Group), 2009a, p. 16). The other grid was a $3.5\,\mathrm{MW}$ hydro plant at Nyagak, in the north-west of Uganda, and was meant to replace a heavy fuel oil (HFO) plant and supply the whole West Nile region (World Bank (Africa Energy Group), 2009a, p. 16). This plant would eventually be commissioned in September 2012. Upon opening of the dam, president Museveni explained

that the area could not be connected to the national grid due to the high connection costs and the low demands. The local leaders however told that the connection costs with the new dam were still much too high for the rural population and called on the government to subsidize the connections, as only 5000 people of the 2.3 million population seemed able to afford electricity now (Okello, 2012).

FIGURE 3.9: President Museveni opens the Nyagak dam by pouring earth into a hole holding an electricity pole (Okello, 2012).

Other more successful aspects of ERT phase 1 program were energy systems provided to water facilities, health clinic, schools and agriculture. The Bank was satisfied that the respective target values had been 'substantially met' through the provision of 20 solar water pumping systems, 79 solar dc vaccine fridges, 261 and 220 stand alone solar PV energy packages for staff houses and medical buildings respectively, and 94 out of the intended 129 educational institutions had been electrified. The Bank specifically notes that electrified health centers saw an increase of patients using their services at night. The agricultural sector was seen as the chief beneficiary of this first ERT phase, although predominantly for the large consumers. The Bank mentioned the Kayoza tea factory, honey processing, flower companies, milk cooling, maize processing and fish landing sites as examples of agricultural practices that had been electrified now. At the same time, they were also openly questioning whether it would be interesting to target smaller agricultural consumers

as it wasn't clear whether this would be cost effective. Lastly, phase I also encompassed construction of grid connected electricity generation from renewable sources. The Kakira Suger Works Cogeneration Project (located near Jinja) was the only actually commissioned example here, it was generating 22 MW from bagasse[20]of which it could export 12 MW (Kakira Sugar, 2023; Power Technology, 2021). Three small hydro plants of 9 MW, 13 MW, and 18 MW were still to be commissioned in Buseruka, Bugoye, and Mpanga respectively (World Bank (Africa Energy Group), 2009a, p. 16-18). Overall, the Bank and the government attributed the 'start upt difficulties' to the unexpected low demand for SHSs and furthermore concluded that the private sector led model turned out to be too premature for an economy like that of Uganda where the government still had a big role to play in creating capacity, and providing services to its citizens (World Bank (Africa Energy Group), 2009a, p. 20, 30).

With regard to criticality, it is interesting to note that the Bank started to go beyond poverty alleviation but also mentioned other areas of impact. Among them were gender aspects, where their 'completion and results' report noted that they had anecdotal indications that access to electricity provided women with more time for productive activities because they had to spend less time in collecting fresh water and could moreover extend their business hours into the evenings. Artificial lighting furthermore effected into more women attending pre-natal clinics and health centers for childbirth. Other aspects the Bank now associated with household electrification were crop yield and agro-processing, water and sanitation, health, the expansion of Information and Communication Technology (ICT) services such as television, mobile telephony, and internet access, and education. But while the Bank could indicate that the cash income of electrified households had increased in comparison to households in a control site, it was difficult to assess them as most of these services only became operational at the end of ERT I. (World Bank (Africa Energy Group), 2009a, p. 21, 24).

The second phase of the ERT programme started in 2009 and had three main components, Rural Energy Infrastructure, ICT and Energy Development, and Cross-sectoral linkages and Impact monitoring. The last component here was concerned with financing PV packages for remote health, water, and education facilities, as well as providing technical assistance, capacity building, and safeguarding operating costs to cross sectoral ministries. The funds for the rural energy infrastructure (53.4 million USD in total) primarily went to extending the main grid to ($62.4\,\%$) to rural Uganda and adding an expected 30 MW of renewable energy generation capacity. Projects in this segment would be constructed under ownership of the government and then handed out to the private sector, as they were not regarded mature enough to configure the projects themselves. A much smaller portion of 9.6 million USD (or roughly $18\,\%$) was allocated to off-grid renewable energy investments, which included household PV systems, electrification of institutional customers, and independent grid systems. With the intend to improve the disappointing household electrification of phase I, this subcomponent included consumer finance for the household sales where the risks would be taken by the lender. The expected consumers were still quite limited however, with 20.000 for household PV services, and 2000 consumers for independent grids, the electrification target for the rural population was only at $6\,\%$ (at a baseline of $4\,\%$). Other subcomponents here were aimed at providing technical assistance and training, facilitating access to commercial finance for investors and sponsors, and supporting the private sector to meet the agreed targets and achieve financial closure (World Bank (Africa Energy Group), 2009b, p. 5-7).

ERT II was supposed to last for four years and thus end in 2013. Implementation challenges however made the government agree with the Bank on a three year extension, setting the closing date in June 2016 (Rural Electrification Agency, 2014, p. 4, 5). With respect to rural household electrification, phase II ran into similar problems as its antecedent. In phase I the Bank argued there was a demand problem for household solar, this time they acknowledged that there was an affordability barrier. Especially the connection costs and the internal wiring posed a large financial burden for poor households. The REA and Electricity Regulatory Authority (ERA) revised the design standards and even reduced the size of conductors to decrease the costs, but it took the ERA so long to determine the new fees that they only notified the Service Providers (SPs) six months after the project was finalized. In the meantime, the SPs had charged customers with prices between four and seven times more (World Bank (Africa Energy Group), 2017, p. 15). The ERT II phase also implemented an Output-Based Aid (OBA) Facility for Uganda which became operational in 2012. This facility was able to subsidize standard household connections for those who were able to afford their house wiring[21], and load limited connections with so-called ready-boards[22]for lower-income households (World Bank (Africa Energy Group), 2017, p. 11). The OBA thus targeted poor households that were nevertheless able to afford the energy they would consume, but couldn't afford the capital costs. The Bank furthermore came to the conclusion that pay-as-you-go or similar sales models were curcial to address this barrier (World Bank (Africa Energy Group), 2017, p. 18). There were also issues related to affordability, but from the supply side. The SPs faced problems with covering their operation and maintenance costs, which put the sustainability of the infrastructure at risk. Theoretically this could be covered by increasing the tariff, but this would then increase the affordability barrier as well. So even though the criticality of the infrastructure had moved beyond just growing the economy, being able to make a profit was still intrinsically linked to it.

Apart from affordability issues, ERT II also encountered challenges due to inadequate selection of SPs who lacked financial and technical capacity, resulting in significant delays. When the project got extended, additional financing was allocated to appropriate the materials in bulk and deliver them directly to the SPs. This time it was insufficient storage and inventory management that would create substantial delays, especially with regard to determining standardized costs and specification of connection materials. Near the end of phase II, it was furthermore found that the procured materials were not going to be depleted for years at the electrification pace of that time. The SPs were then requested to submit realistic road maps to show how they would fully utilize the materials in the third phase of the ERT (World Bank (Africa Energy Group), 2017, p. 11, 12, 15–18).

With respect to grid extension to rural areas, the REA was responsible for twelve line extensions. The SPs however argued that these networks were not robust enough and that the quality of both the materials and workmanship was insufficient. SPs were furthermore unhappy with the REAs slow pace of grid extension, arguing that it negatively affected the electrification pace. Again the Bank pointed toward the need for standards for the construction of this part of the infrastructure (World Bank (Africa Energy Group), 2017, p. 16).

The third and last phase of the ERT programme lasted from 2015 until June 2023 (World Bank Group, 2024), culminating the delay of the full programme to a total of twelve years. While intended to close in 2020, ERT III was extended thrice. The first

two extensions were made to allow time for the completion of the grid extension and intensification, and because of delays due to insufficient staffing, COVID-19 related restrictions, governmental reorganizations, general elections, and a new framework that had to be made to ensure compliance with the Banks policy on involuntary resettlement. The last extension was made due to ongoing impact of the institutional changes and non-compliance with the implementation of the safeguard policies for forests and involuntary resettlement[23](Independent Evaluation Group, 2024, p. 4, 5).

Akin to it's preceding phase, ERT III had three components: On-grid Energy Access, Off-Grid Energy Access, and Institutional Strengthening and Impacts Monitoring. It is noticeable that this was the first time that the collocation Energy Access was being used to describe the goals of an ERT phase, indicative for the affiliation between the the Bank and the UN who launched their SDGs in the same year as ERT III. A fortiori, the original Project Development Objective (PDO) of the ERT programme 'increasing access to electricity in rural areas of Uganda' was now supplemented with an additional Global Environmental Objective (GEO) 'to reduce greenhouse gas emissions' (World Bank (Africa Energy Group), 2015, p. 14), making it fully compliant with SDG 7. This phase furthermore seemed to make a slightly stronger connotation between electrification and human development than before as it listed 'reducing poverty and boosting shared prosperity' as the first point of interest in its strategic context (World Bank Group, 2024, p. 1). The fifth point discussed how household access to electricity was amongst the lowest in Africa, with $14\,\%$ overall electrification, and $7\,\%$ in rural Uganda. The four points were discussing economic growth (and how this would result in a trickle-down effect), industrial sector growth, and the governments aim to transform Uganda from an agrarian society to a modern and prosperous country by 2045 (World Bank (Africa Energy Group), 2015, p. 1, 2).

Affordability for household electrification remained a key issue in this last ERT phase. This time the project designers tried to address this by making the government pre-finance the installation costs, and letting the consumers pay it back through financing schemes such as pay-as-you-go and fee-for-service business models, and by subsidizing the tariff for the first $15\,\mathrm{kWh}$ of the monthly household consumption (World Bank (Africa Energy Group), 2009b, p. 9, 17, 28). The adoption of household PV solutions (that was remarkably low during ERT II), was now being tried to grow through pico solar solutions which require significantly less maintenance than SHSs, and could (according to the Bank) be remotely monitored and maintained (World Bank (Africa Energy Group), 2009b, p. 28).

Interestingly, the Bank organized meetings with countries that had recently successfully achieved rural energy access before the start of phase III (World Bank (Africa Energy Group), 2015, p. 22). Among them was Vietnam who had been able to go from a $2.5\,\%$ household electrification in 1975 to $96\,\%$ in 2011 (Asian Development Bank, 2011, p. v). While it would go beyond the scope of this thesis to fully analyse why Vietnam was successful in achieving *energy access for all* where Uganda wasn't, there are a few differences that stand out. Firstly, the government of post-war Vietnam continuously made it their top-priority to achieve rural electrification, created a first tax base by electrifying key industries, used that to subsidize low-energy consumers, and therewith created a second tax base as the standards of living grew at the household level (Asian Development Bank, 2011, p. v, 4). Moreover, Vietnam only had one (state owned) utility that allowed for centralized planning. They furthermore organized community meetings for villages in the pre-electrification

phase, which resulted in community contributions, allowed them to swiftly electrify complete villages and avoid expensive time-consuming disputes over right-of-way and possible damages, and even helped in capacity building (Asian Development Bank, 2011, p. 6). Uganda on the other hand had completely unbundled the UEB which resulted in the highly bureaucratic situation that eight different ministries and institutions were responsible for component 2 alone. Per example, the Ministry of Education, Science, Technology and Sports (MoESTS) was implementing PV systems for schools, the Ministry of Health (MoH) was doing this for health centers, and PV systems for water pumping stations fell under the responsibility of the Ministry of Water and Environment (MoWE) (World Bank (Africa Energy Group), 2015, p. 25). Similarly the Bank berated the cumbersome connection procedures which presented a significant strain on new customers. The implementation report summarized the application procedure as follows: " *(i) applicant submits application to a nearby SP office together with (a) completion of wiring certificate by a certified wireman, (b) passport photograph, (c) proof of ownership such as a land title, tenancy agreement and photo of landlord, and (d) no objection letter from neighbor where line is crossing; (ii) the applicant invites the commercial officer of the SP to the site to prepare a site sketch map; (iii) the applicant is given an invoice and pays inspection fee; (iv) installation inspector visits premises to test installation; (iv) if accepted, the applicant pays connection fees (if not, the applicant has to make another payment for inspection until accepted); and (v) once connection fees are paid, connection works are scheduled* (World Bank (Africa Energy Group), 2015, p. 27)."

An overview of both the urban and rural electrification rates between 1991 and 2022 is given in Figure 3.10. Apart from the relatively low electrification percentages, the strong correlation between rural and urban electrification stands out. The main cause for this interaction seems to be the strong focus on on-grid connection which received almost six times as much funding (144.6 million USD) as the off-grid component (25 million USD) (World Bank (Africa Energy Group), 2015, p. ix). Naturally, when the main grid is being intensified (through short grid extensions to medium and low voltage networks) its capacity increases and barriers for urban household connections will simultaneously be decreased. While the reports don't give direct reason for this discrepancy, a likely explanation are the relatively high profits that can be made from on grid connections. Where component 1 (on-grid access) had an EIRR of $39\,\%$, component 2 (off-grid access) was nearly half of that with 'only' $20\,\%$ (World Bank (Africa Energy Group), 2015, p. 31). Which shows that the infrastructure's criticality was still very much related to the nation's economic growth.

3.2.3 Criticality in post-colonial Uganda

Especially in the first decades of Uganda's independence, the World Bank seemed to have perpetuated the same type of criticality for Uganda's electricity supply as had the Empire (see Figure 3.11). This is to say that the vast discrepancy between the financial support of western European countries like the UK and 'southern countries' such as Uganda indicates that the former were given a much higher priority than the latter. Where the US and the Bank acknowledged that Europe could not economically recover if they had to pay back the full amount of their loans, the Bank made no such argument for the development of Uganda. And even for the relatively small amount that Europe had to pay back, they could do so in their own currency under relatively low interest rates, both these favours were not granted to Uganda.

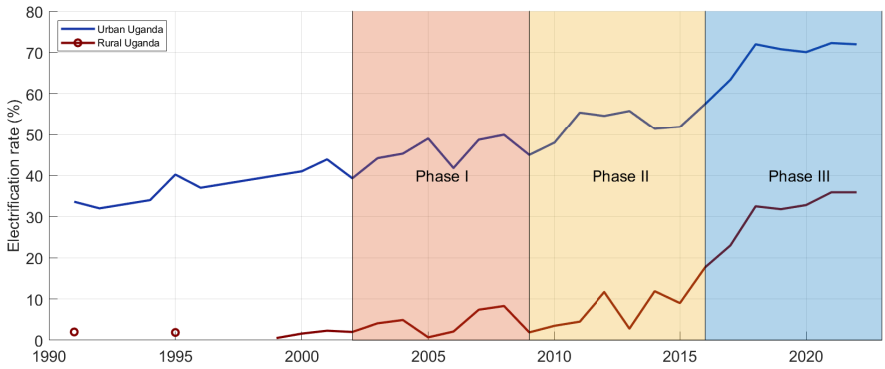


FIGURE 3.10: Electrification rate of urban and rural Uganda from 1991 until 2022, with data retrieved from (World Bank Group, 2022c) and (World Bank Group, 2022b) respectively. Note that while highly significant, this graph should not be interpreted to mean that the ERT programme was the sole reason for the electrification rates in Uganda between 2002 and 2023.

This priority hierarchy between recovering the 'North' and the 'South' echoes the colonial rule where investments in Uganda's development was done primarily in the interest of Europe. The Bank even admitted that Uganda was highly indebted to foreign lenders and that this problematically decelerated economic growth (Warnock and Conway, 1999, p. 15).

Uganda's infrastructure was furthermore not critical for the Bank, as failure would not have severe (economical) consequences for them. But through their CDF and PRSP model - which Lie recognises as *developmentality* - the Bank nevertheless had a lot of influence on Uganda's development and thus its electrical infrastructure. Especially the privatisation of the energy sector might be one of the Banks most detrimental influences on Uganda's electrification. Even though the UEB was indeed not performing well, it is certainly questionable if the drastic measure of privatisation was the best course. While privatisation may have its merits, the bureaucratic difficulties and underqualified SPs throughout the ERT phases show that it was one of the main causes of the vast delays. Moreover, the case of Vietnam has shown that their public owned energy sector was crucial for their highly successful rural electrification programme. It is indicative that Uganda became the playground of 'first world countries' that were lingering in their Cold War ideologies of e.g. *trickle-down economics* and *the promise of privatisation*. As e.g. Ashworth has pointed out, the Cold War rhetorics helped to generate the false idea that the 'first world' had quickly developed through free markets and non-interference by the government (Ashworth, 2008, p. 258, 259). These ideas were indeed projected by US based development agencies onto 'developing countries' to make them shift from centralized and government-controlled, to privatised economies (McPherson, 1987, p. 20). Unfortunately, empirical evidence has shown no association between privatising utilities and economic gain, higher capacity nor higher labor efficiency. Some even argue that the World Bank projects in Uganda have actually done severe economical damage to Uganda, and that the privatisation of their energy sector has made Uganda poorer (Serumaga, 2017). Instead it is regulatory quality that is associated with better quality and accessibility to the service (Estrin and Pelletier, 2008, p. 80, 81).

The Bank's low risks towards Uganda's electrical infrastructure did not render it non-critical per se, as for Uganda the Power I project already showed the linkage between electricity and their (own) economic growth. This does entail however, that other nodes of today's criticality network were still invisible. This did not change with the Power II project, as it was almost exclusively concerned with repairing and upgrading the Owen Falls dam. Its successor however started to extend the criticality of Uganda's electrical infrastructure. Specifically because household electrification made its entrance here as one of Uganda's priorities with expanding the transmission network. While Uganda may not have gotten the results it was aiming for, it is nevertheless an important milestone.

The low prioritization of non-economic goals by project designers kept restraining house-hold electrification or other human-centred objectives. For even though human development was one of the incentives for building the Bujagali dam, it was clear that it was tertiary, after economic growth, and the privatisation of the energy sector. Simultaneously, the long battle fought by Budhagali and stakeholder organizations such as NAPE also show that the criticality that local populations ascribe to the falls could be in conflict with the criticality that the government ascribed to the dam. For the former, the falls were critical for their livelihoods, and spiritual interests. The government saw the dam as critical for a larger population who would be served with recovering the nation from its political unrest, and to successfully privatise the energy sector.

After the unbundling of the UEB, the first ERT phase had to focus on creating a good environment for private investors to operate in Uganda's electricity sector. Nevertheless, it can be argued that the current understanding of electricity's criticality in Uganda started with the first phase of the ERT project. As aspects of gender equality, access to ICT services, public health, and the social effects of artificial lighting were now being mentioned as positive outcomes of rural electrification. Notwithstanding the delays and other challenges that were encountered, criticality in this sense got stronger during the subsequent project phases, and marked a stark contrast with the pre-1992 focus on industry and economic growth. The Bank and the government showed to be concerned with affordability of electricity for low-income households, and tried to address this through various means such as pre-financing and pay-as-you-go schemes.

3.3 1992 - 2015: Genealogy of SDG 7

The 2002 World Summit on Sustainable Development was held with the goal of adopting a political declaration and implementation plan that covers activities and measures to achieve sustainable development that takes into account respect for the environment. Crucially, it was the first time that access to energy was considered as an instrument to battle poverty on such a large stage. The summit was a follow-up on the 1992 United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, in Rio de Janeiro and a predecessor of the 2012 Earth Summit, also in Rio. The 1992 UNCED - itself a follow-up to the 1972 UN conference in Stockholm on Human Environment - was organized with the intent to help member states of the United Nations to deal with environmental and development issues deemed too big to handle for individual nations. According to the

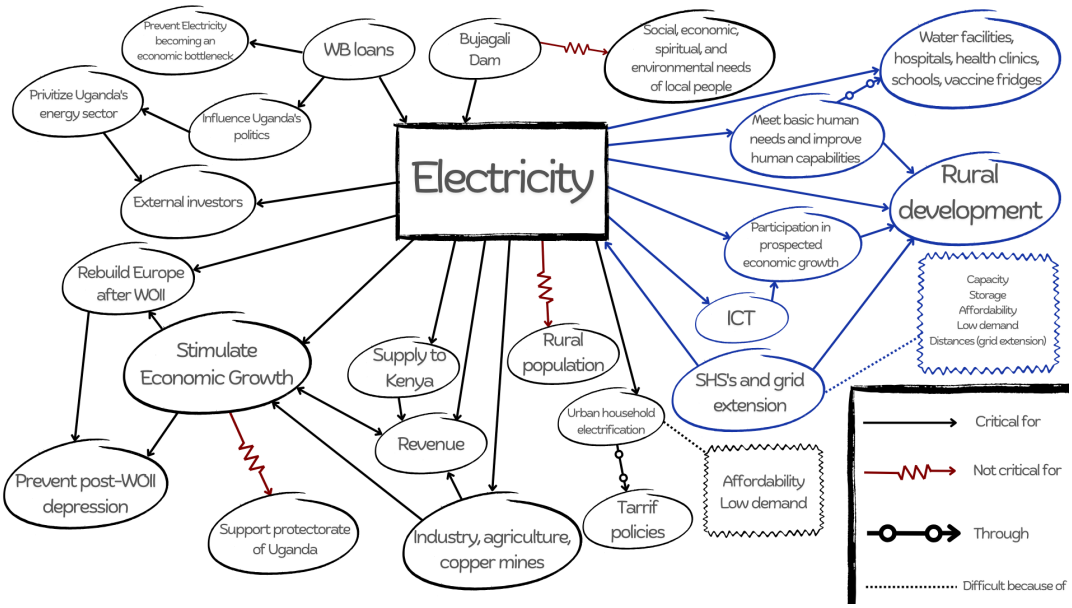


FIGURE 3.11: The criticality of Uganda's Electricity according to the World Bank, colours are added to emphasize the shift in criticality that came with the launch of the ERT programme. The black bubbles depict criticality between 1961 and 1992, while the blue bubbles should be associated with criticality from 1992 onwards.

UN, this conference highlighted "*how different social, economic, and environmental factors are interdependent and evolve together, and how success in one sector requires action in other sectors to be sustained over time*" (United Nations, 1992b). Among the more tangible outcomes of this conference are the Rio Declaration with 27 principles on sustainable development (see Appendix C.2), a non-binding program on sustainable development called Agenda 21, the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity, the Declaration on the principles of forest management, and the creation of the Commission on Sustainable Development.

The official documents of the UNCED primarily show an increasing understanding of the importance of environmental sustainability and a growing concern for the adverse effects of non-sustainable consumption patterns and the emissions of greenhouse gasses. The Rio Declaration (see appendix C.2) forefronts this throughout the document by promising e.g. environmental policies that should prevent environmental damage through resource exploitation (principle 2), the conservation, protection, and restoration of the health and integrity of Earth's ecosystem (principle 7), the reduction and elimination of unsustainable patterns of production and consumption (principle 8), public awareness on environmental issues (principle 10), the enactment of effective environmental legislation (principle 11), that states will develop national law regarding liability and compensation for the victims of pollution and environmental damage (principle 13 and 16), and that a lack of scientific certainty will not be used to postpone cost-effective measure to prevent environmental degradation (principle 15) (United Nations, 1993, p. 6).

The Agenda 21 shows what can cautiously be seen as the conception of SDG 7 (see appendix C.3. It includes a chapter on combating poverty in which a relatively

small section hints to a correlation between energy and poverty by arguing that "*a specific anti-poverty strategy is* [...] *one of the basic conditions for ensuring sustainable development*" and that "[an] *effective strategy for tackling the problems of poverty, development and environment simultaneously should begin by focusing on resources production and people*" (United Nations, 1992a, pr. 3.2). Overall the chapter is mostly concerned with economic growth, rights for women, the role of youth, indigenous people, local communities, democratic participation and improved governance. The word 'energy' is however not mentioned in this chapter.

The agenda also contains a chapter on promoting sustainable agriculture and rural development that is somewhat related to issue of energy access. While not directly mentioning anything related to the electrical grid it mentions how rural areas are often undeveloped and voices the preference of an optimal use of natural resources and renewable energy in rural agriculture (UNCED, 1992, pr. 14.18.f). Moreover it expresses concerns over the highly priced and unstable energy supplies in developing countries. It mentions how the main energy sources in the rural areas of developing countries consists of fuelwood, crop residues together with animal and human energy. Crucially, it states that more energy input is required for increased productivity and income-generation, that this should be done through a mix of fossil and renewable energy sources, and that the attainment of sustainable rural development is intimately linked with energy demand and supply patterns (United Nations, 1992a, pr. 14.92).

The interim of the first 1992 Earth summit and 2002 summit in Johannesburg served as the cradle of the MDGs. The World Summit in on Social Development of 1995 in Copenhagen acknowledged that despite its merits, globalization had led to environmental risks, threats to human well-being, and a growing inequality throughout the world. Very much in line with the Rio Declaration and Agenda 21, the summit made a list of commitments intended to represent a consensus on putting "*people at the centre of development*" (United Nations, 1995b, p. 6). The declaration consists of ten commitments focused on eradicating poverty, social development, human dignity, and fostering stable and just societies (United Nations, 1995a). The ten commitments included the creation of an environment to enable social development for 'developing countries' (commitment 1), poverty eradication and full, freely chosen, productive employment (commitment 2 and 3), gender equality (commitment 5), and access to education and health care (commitment 6) (United Nations, 1995a, p. 6-13). The ten commitments were however considered too ambiguous, especially in combination with the outcomes of other UN summits on other related subjects such as - education (1990, Jomtien), children (1990, New York), human rights (Vienna, 1993), and women (Beijing, 1995). As a response the Development Assistance Committee (DAC) of the OECD published the 1996 'Shaping the 21st Century' report that provided an encompassing vision and strategy that included the goals from the other UN summits (DAC, 1996). The report proposed six "*ambitious but realisable*" (ibid) goals, divided in three categories:

TABLE 3.2: Goals from OECDs 'Shaping the 21st Century' (DAC, 1996, p. 2)

Economic well-being

1. a reduction by one-half in the proportion of people living in extreme poverty by 2015

Social development

2. universal primary education in all countries by 2015

3. demonstrated progress toward gender equality and the empowerment of women by eliminating gender disparity in primary and secondary education by 2005

4. a reduction by two-thirds in the mortality rates for infants and children under age 5 and a reduction by three-fourths in maternal mortality, all by 2015

5. access through the primary health-care system to reproductive health services for all individuals of appropriate ages as soon as possible and no later than the year 2015

Environmental sustainability and regeneration

6. the current implementation of national strategies for sustainable development in all countries by 2005, so as to ensure that current trends in the loss of environmental resources are effectively reversed at both global and national levels by 2015

The report stresses throughout the document that elevating 'poor people' and 'poor countries' should have a profound influence on *shaping the 21st century*, and that international cooperation can be effective to this endeavor (DAC, 1996). It furthermore gives three distinct motivations for global development assistance. It argues that international development aid is done for the humanitarian reason of reducing suffering and poverty, for non-altruistic reasons of reducing migration and environmental stresses, and lastly because issues of population growth, nuclear proliferation, illicit drug control, environmental protection, and respect for borders can only be handled through international cooperation (DAC, 1996, p. 6).

It must have been difficult for the initiated not to have felt like experiencing a déjà vu when the so-called development goals of the 'Millennium Declaration' were put together in 2000, at the Millennium Summit in New York. After the 27 principles from the Rio Declaration and the Agenda 21 action plan from 1992 got distilled into six goals of the 1995 World Summit, and some of these six goals had been repeated at their respective idiosyncratic summits, they now got reiterated again in the form of 'values and principles' and 'key objectives' (United Nations, 2000). The values and principles were as broadly accepted as motherhood and apple pie, and just as vague as in the preceding declarations. They were listed as freedom, equality, solidarity, tolerance, respect for nature, and shared responsibility (United Nations, 2000, p. 2). The objectives were similarly uncontroversial, but interesting nevertheless. This time they were seven-fold and given as:

TABLE 3.3: Key Objectives of the United Nations Millennium Declaration (United Nations, 2000, p. 2-9)

1. Peace, Security and Disarmament
2. Development and Poverty Eradication
3. Protecting our Common Environment
4. Human Rights, Democracy and Good Governance
5. Protecting the Vulnerable
6. Meeting the Special Needs of Africa
7. Strengthening the United Nations

Parallel to the UN Millennium Summit the International Monetary Fund (IMF), OECD, and the World Bank created the 'international development goals' which they enumerated in the publication of *A Better World for All: Progress toward the International Development Goals* (OECD, IMF, World-Bank, 2000). The international goals were almost exactly the same as the goals from the 'Shaping the 21st Century' report, with its major novelty being the division of goal 4 which was now breached into two separate goals of reducing child mortality and maternal mortality.

Recognizing that having separated sets of global development goals did not increase the chances of them being achieved, the UN merged the objectives from the UNs Millennium Declaration and the International Development Goals in the annex of the 2001 'Road map towards the implementation of the United Nations Millennium Declaration' into the famous MDGs (Annan, 2001, p. 55). While it would take another year before access to energy would receive dedicated attention by the UN at the Johannesburg conference, the MDGs (re-)emphasized the values the UN associates with energy consumption.

TABLE 3.4: Millennium development goals as recorded in the 'Road map towards the implementation of the United Nations Millennium Declaration' (Annan, 2001, p.56-58)

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

Kofi Annan, then secretary general of the UN, introduces the road map by acknowledging that the targets of the millennium declaration were nothing but derivations from earlier global conferences of the preceding decade and international laws and norms that had been set after the second world war. More importantly, Annan turns this acknowledgement into an admission of failure, and argues that what is needed *"is not more technical or feasibility studies. Rather, States need to demonstrate the political will to carry out commitments already given and to implement strategies already worked out"* (Annan, 2001, p. 7). Annan stated that hard decisions needed to be taken, the first he mentioned was a cut in energy consumption, the second a cut in carbon emissions. This remissive focus on energy can be found

on more occasions in the document, albeit in a less direct manner. Examples of this for instance the discussion on eradication of hunger which argues for promotion of environmental awareness among farmers and simple technologies for agriculture (Annan, 2001, p. 20), and to increase energy efficiency[24](Annan, 2001, p. 57).

It might be helpful to restate that energy access is not an end in itself, but rather a means towards human development and associated capabilities. And while this means is not directly mentioned in the pre-2002 UN documents, many of the ends that would later be connected to it have been articulated here first. The Roadmap, therewith the MDGs, e.g. states that poverty can be combated through the provision of social services (Annan, 2001, p. 19), that mothers and young children have access to health care services (Annan, 2001, p. 21), that the health care services are strengthened in order combat HIV/AIDS (Annan, 2001, p. 24), that they are committed to an open, equitable and non-discriminatory trading and financial system (Annan, 2001, p. 25), that information and communication technologies should be universally available (Annan, 2001, p. 31), and to promote gender equality and the empowerment of women (Annan, 2001, p. 25). All of these examples are either directly or indirectly connected to SDG 7, and there is now a general academic consensus that access to (modern forms of) energy is required to achieve them (see e.g. (Ouedraogo, 2013; Youssef et al., 2016; Acheampong, Erdiaw-Kwasie, and Abunyewah, 2021)).

In order to understand how the global conferences reshaped the criticality of energy provision, it is helpful to observe other efforts of the UN outside this vacuum. The last decade of the 21st century was arguably most prominently marked by the end of the Cold War, remnants of which can be found throughout the documents discussed in this chapter. The most direct reference to this era might be principle 18 of the Rio Declaration which demands that states should immediately notify other States in the case of disasters that are likely to produce harmful effects on the environment of these states (United Nations, 1993, p. 6), clearly referencing the Chernobyl nuclear disaster in the former Soviet Union. The more stressing principium in these documents however is the rationale that the age of international conflicts was coming to an end, that a world wide consensus was achieved on Democracy as the preferred state of government, and that creating international ties was the most effective way to solve disputes and prevent wars (see e.g. (Fukuyama, 1989) and (Annan, 2001, p. 7-9)). The UN was probably the most obvious and prominent candidate to materialize this new project. This can be observed through the influx of world summits on development and environment near the end of the last century (United Nations, 2023b), but also through the number of active peacekeeping missions the UN took on which skyrocketed after 1987 (see Figure 3.12).

Reading the General Assembly's resolution on the 2002 World Summit in Johanesburg, one would be easily excused for thinking that the summit was nothing but a continuation of the UNs global development goals. They mostly reiterated the goals of the Rio declaration and Agenda 21, and reaffirmed their commitment to the MDGs (United Nations, 2003). It nevertheless also endorsed the Johannesburg Declaration on Sustainable Development, which itself showed a crucial development in the criticality of household electricity. Like the previous UN summits, the Johannesburg summit can be distilled into reaffirming the UNs commitments made in the Rio declaration, Agenda 21, and the MDGs in accordance with the UNs three pillars of sustainable development i.e. economic development, social development, and

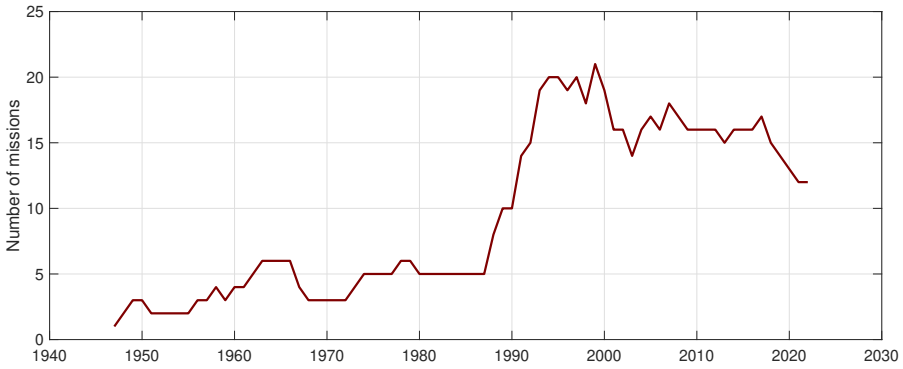


FIGURE 3.12: Number of active United Nations peacekeeping missions per year, data retrieved from (Our World in Data, 2021a)

environmental protection (United Nations, 2002, p. 1). Notwithstanding this trinity of sustainability, the Johannesburg Declaration states that eradicating poverty is the "*greatest global challenge facing the world*" (United Nations, 2002, p. 9). One of the more interesting drivers for this goal was the belief that globalisation posed the risk of entrenching global disparities, and that 'the poor' might stop being committed to their democratic systems if the UN did not intervene (United Nations, 2002, p. 3).

The Declaration articulates the Nussbaumian argument that human dignity requires material possessions, particularly clean water, sanitation, shelter, health care, food security, biodiversity and energy (United Nations, 2002, p. 3). Out of these, access to energy received the most attention. The UN declared to take joint efforts to improve access to reliable and affordable energy services sufficient enough to achieve the MDGs (United Nations, 2002, p. 11). If anything, the goal of improving energy access was more focused on poverty alleviation than SDG 7. While it mentions that energy should be sustainable and 'environmentally sound', it's emphasised less here than in the KPIs of SDG 7 (see section 3.4). In fact, they underscore the need for diverse and decentralised energy systems that are socially acceptable and e.g. address the need for capacity building appropriate for rural and isolated areas (United Nations, 2002, p. 12, 45). While sustainable energy consumption is mentioned with regard to e.g. waste reduction and desertification, its relation to energy access is still marginal (United Nations, 2002, p. 18, 31).

The UNs goal of ensuring universal access to modern energy was gaining momentum since the 2002 Earth Summit. In 2011, then UN secretary-general Ban Ki-moon shared launched the Sustainable Energy for All (SE4ALL) initiative in a vision statement. Ki-moon was clear here, "*without access to electricity, it is not possible to achieve the MDGs*" (Ki-moon, 2011, p. 2). The document was made in the context of the upcoming summit in Rio de Janeiro on sustainable development (also known as Rio+20). The secretary-general argued that energy could lead the way in 'connecting the dots' between all the topics of this summit, including growth, food security, climate change, health, women's empowerment, and poverty (Ki-moon, 2011, p. 3). The initiative has three objectives that should all be reached by 2030: universal access to modern energy services, doubling the rate of improvement in energy efficiency, doubling the share of renewable energy in the global energy mix (Ki-moon, 2011, p. 4). Uganda was following the initiative during ERT III, by having the following goals: $98\,\%$ electricity access, $99\,\%$ access to clean cooking, $3.5\,\%$ improvement

in energy intensity per year, $90\,\%$ share of renewable energy in final power consumption, and $36\,\%$ share of renewable energy in thermal energy consumption; each by 2030 (World Bank (Africa Energy Group), 2015, p. 48).

The Rio summit turned out to be crucial for the development of SDG 7, specifically due to its outcome document called 'The Future We Want' (United Nations, 2012, p. 1). The document acknowledged that the progress made since the 1992 UNCED was unsatisfactory, especially with regard to poverty eradication (United Nations, 2012, p. 5). Parallel to reiterating their commitment to Agenda 21 and the MDGs, the UN made a call for more holistic and integrated set of sustainable development goals (United Nations, 2012, p. 5, 6, 8, 48). This set would not replace, but nevertheless be fully compliant with the Rio Declaration, the MDGs, and Agenda 21, and provide a development agenda 'beyond 2015' (United Nations, 2012, p. 48). Moreover, two out of four high-level round-table discussions at this summit called for specific attention to the topic of universal energy access (United Nations, 2012, p. 67, 72). Scaling up investment and political will for 'Sustainable energy for all' furthermore came out as one of the ten recommendations of Rio+20 (United Nations, 2012, p. 75).

After Rio+20, the UN set out to establish the Open Working Group (OWG) to develop the SDGs (Open Working Group, 2014b). The OWG, consisting of representatives from 70 countries, published their final proposal in 2014 (United Nations Development Programme, 2022). In this proposal, the OWG worked out the request of *The future we want*, to propose follow-ups to the MDGs. Here they conveyed particularly strong concerns with poverty and climate change, and proposed the seventeen SDGs that would be launched at the 2015 summit in New York (Open Working Group, 2014a, p. 1-5). The resolution adopted at this summit started with the premise that the seventeen goals are "*critical [for] humanity and the planet*" with special interest to the topics people, planet, prosperity, peace and partnership (United Nations, 2015a, p. 2, 3). They declared that eradicating poverty was the greatest global challenge, and that the SDGs were grounded in the Universal Declaration of Human Rights (UDHR), international human rights treaties, the Millennium Declaration, and the 2005 World Summit Outcome[25](United Nations, 2015a, p. 3, 4). Importantly, they argued that the adverse effects of climate change undermined the ability to achieve universal sustainable development (United Nations, 2015a, p. 5). This emphasis and the UNs historical commitment to environmental protection explains the bifurcation of SDG 7 into achieving universal energy access and mitigating climate change (see table 2.1.

3.3.1 Criticality in SDG 7

Through the continuous efforts of the UN, electrical infrastructure has significantly gained in criticality. The 1972 Stockholm conference started a process in which the UN started to assume the mantle of responsibility in global sustainable development. This movement gained significant momentum with the 1992 Earth Summit, where reducing poverty, supporting economies, and protecting earth's ecosystems became critical for the UNs ambition of global sustainable development. Many of the secondary goals with universal energy access - such as preventing deforestation, and promoting gender equality and public health - can be traced back to the outcome documents of the first Rio summit. The primary goals of eradicating poverty and reducing the causes and effects of climate change have been at the forefront of the

UNs rationale throughout the post-Rio era.

It's interesting to note that the development of the criticality of modern energy here did not sprout from the respective infrastructure. In other words, the values and goals the UN associates with SDG 7 did not gradually appear because of novel features of electricity, as was the case in chapters 3.1 and 3.2. They had already become a highly interlinked *critical* web before it was almost suddenly linked to modern energy. Nevertheless, the continuing reiteration and rephrasing of the same - or similar goals and values does tell a story of the criticality of electricity infrastructure.

Arguably because of this antecedent criticality, universal energy access couldn't be phrased as a goal by itself. Energy is not just a medium to combat poverty or promote equality, it also poses a danger to environmental sustainability, and the trifold of sustainable development prevents to put energy access in the centre of SDG 7. As can be seen in Figure 3.13, this criticality of electricity according to the UN problematically resembles that of the British Empire and the World Bank in the sense that Uganda's infrastructure should also serve the needs of the 'Global North'. Uganda essentially has to focus on preventing greenhouse gas emissions because high-income countries have polluted the atmosphere to such a degree that everyone is in danger (see Figure 3.14). Uganda is thus again serving the needs of external actors while developing its own infrastructure. To summarize, it is 'renewable energy' and not 'energy' as such that is critical for the UN.

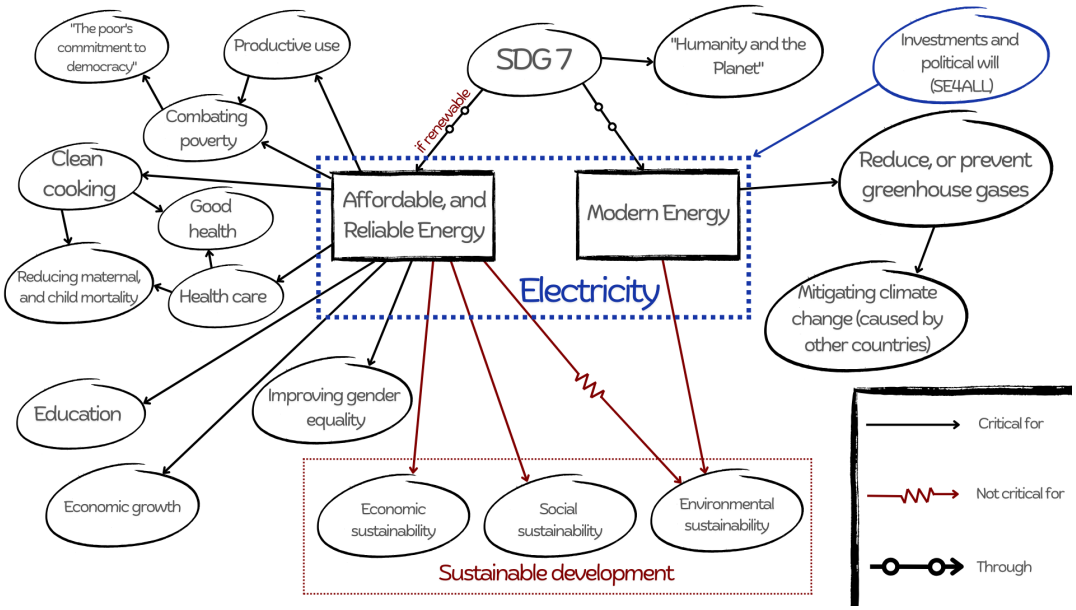


FIGURE 3.13: The criticality of Electricity according to the UN, colours are solely used to improve readability.

3.4 2015 - Present: Sein und Light

It is probably too early to say whether the year 2015 has been another turning point in the electrification of Uganda and the 'Global South' as a whole. But it can certainly be observed that 2015 served as a milestone in the framing of energy poverty due to two distinct, though related events. Firstly because of the launch of the UNSDGs

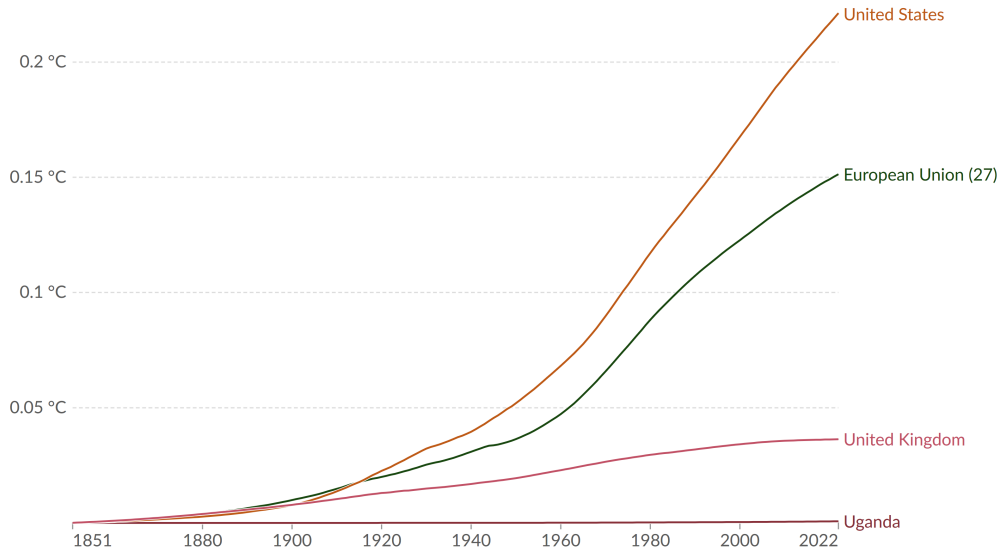


FIGURE 3.14: Contribution to global mean surface temperature rise from fossil sources, 1851 to 2022. The global mean surface temperature change as a result of a country or region's cumulative emissions of carbon dioxide, methane, and nitrous oxide. This is for fossil fuel and industry emissions only – it does not include land use or agriculture (Our World in Data, 2022; Jones et al., 2023).

where energy access was finally adopted in the UNs objective of global 'sustainable development'. Secondly, due to ESMAP who almost simultaneously released their MTF which provided new metrics for assessing energy access as a spectrum instead of a Boolean variable. This chapter has thus far provided a story on the criticality of Uganda's electricity starting with the establishment of the 'Uganda Protectorate' until the launch of the SDGs. This section will instead focus on the metrics that are used to assess the progress made in household electrification, and discuss the extend to which this reflects the criticality of energy access.

3.4.1 Sustainable Development Goal 7

Roughly two years after the New York summit, the UN published the framework that brought indicators to the individual goals and targets of the SDGs (United Nations, 2017, p. 4). For SDG 7, this entailed that its five targets were now accompanied with six indicators (see Table 3.5). Here, the lettered targets - 7.a and 7.b - are supportive to the main (numbered) targets. Corresponding to the analysis of the previous section, the targets of SDG 7 oozes concerns with fossil fuels. In fact, only one of the six indicators is directly related to energy access, with the rest either partially or solely concerned with reducing greenhouse gasses.

As argued in Section 3.3.1, the friction between energy access and environmental protection in SDG 7 places undeserved responsibilities on energy poor countries like Uganda. While the UN recognizes that achieving the SDGs is more challenging for 'poor nations' and that they may need assistance in the form of international public finance, they nevertheless argue that their governments need to implement the Agenda within their own countries (United Nations, 2015a, p. 6, 11). The fact that most of SDG 7, and other SDGs are concerned with solving problems created by

TABLE 3.5: Targets and indicators of Sustainable Development Goal 7 - Ensure access to affordable, reliable, sustainable and modern energy for all (United Nations, 2017, p. 11).

Target	**Indicator**
7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 - Proportion of population with access to electricity 7.1.2 - Proportion of population with primary reliance on clean fuels and technology
7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 - Renewable energy share in the total final energy consumption
7.3 - By 2030, double the global rate of improvement in energy efficiency	7.3.1 - Energy intensity measured in terms of primary energy and GDP
7.a - By 2030 enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	7.a.1 - International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems
7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support	7.b.1 - Installed renewable energy-generating capacity in developing countries (in watts per capita)

'developed countries' is omitted. The idea that these latter countries have a higher responsibility in fulfilling Agenda 2030, is only mentioned through the argument that they have more (financial) capacity, not because they have a historical responsibility (United Nations, 2015a, p. 8, 11).

Focusing purely on the metrics of SDG 7, a problematic flaw lies with indicator 7.1.1 which reduces energy access to simply having a connection. As outlined earlier in section 2.2, connections severely vary in serviceability. Having access to electricity, does simply not entail having access to everything that has rendered modern energy critical for the UN. While this issue is partially addressed by indicator 7.1.2, which measures the proportion of people that have access to clean cooking technologies, it still fails to address whether the connection has any impact on areas such as productive employment, gender equality, child mortality, and deforestation (United Nations, 2024a, p. 1).

3.4.2 The multi-tier framework

The MTF was published in 2015 by ESMAP and brought a more accurate way to frame energy access. Understanding that electricity access should instead be regarded as a spectrum of service levels experienced by households, businesses, and institutions, ESMAP launched the MTF to help analyse countries' energy statuses and their concomitant policy making processes.

ESMAP writes that the MTF came out as a result of a culminative effort involving consultation and inputs of multiple agencies including the European Commission (EC), Department for International Development (DfID), The World Bank, and the World Health Organization (WHO), and should *"prove to be a tool for measuring and goal-setting, investment prioritization, and tracking progress"* (Bhatia and Angelou, 2015, p. iv). This tool branches energy access into six successive tiers, where tier 0 illustrates situations where people do not have access to electricity, and people in tier 5 have an electricity connection that offers enough electricity to power simple clean cooking appliances (see Table 3.6. The main feature of the MTF is then to measure access to energy in terms such as Watts, affordability, safety, and availability instead of the traditional yes-no metric of SDG indicator 7.1.1.

TABLE 3.6: Multi-tier matrix for measuring access to household electricity supply (Bhatia and Angelou, 2015)

			Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Attributes	1. Peak Capacity	Power capacity ratings (in W or daily Wh)		Min 3 W Min 12 Wh	Min 50 W Min 200 Wh	Min 200 W Min 1.0 kWh	Min 800 W Min 3.4 kWh	Min 2 kW Min 8.2 kWh
		OR Services		Lighting of 1,000 lmhr/day	Electrical lighting, air circulation, television, and phone charging are possible			
	2. Availability (Duration)	Hours per day		Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs
		Hours per evening		Min 1 hr	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4 hrs
	3. Reliability						Max 14 disruptions per week	Max 3 disruptions per week of total duration <2 hrs
	4. Quality						Voltage problems do not affect the use of desired appliances	
	5. Affordability					Cost of a standard consumption package of 365 kWh/year <5% of household income		
	6. Legality						Bill is paid to the utility, prepaid card seller, or authorized representative	
	7. Health & Safety						Absence of past accidents and perception of high risk in the future	

To recognize different areas of energy use, the overarching framework subdivides the MTF intro three locales of energy access: households, productive engagements, and community facilities. Due to the focus of this thesis, this section will focus on the household indices of the MTF. Do note however that similar analyses can be made with respect to the other two loci of energy access. The MTF matrix for household electricity has seven key metrics that need to be determined in order to attribute

one of the six tiers to the respective systems. The capacity of an electricity supply describes how much electrical power (in Watts) or energy (in Watt hours per day) is available, for Tier 1 and 2, the household MTF also defines capacity through services of lighting, air conditioning, television, and phone charging. Secondly, the availability of household electricity describes the amount of time the energy is serviceable. The affordability of the energy service only starts playing a role from tier 3 onwards and states that electricity should not cost more than 5% of the household income at a standard consumption rate of roughly 1 kWh per day. For the last two tiers, the reliability, quality, legality, and safety of the system should be assessed as well. The reliability and quality of the energy service are strongly correlated with the availability, and describe how often the system is expected to be unable to service appliances due to brownouts and blackouts respectively. Lastly, the legality is concerned with payment methods, and the safety of the system aims interest at preventing hazardous situations such as electric shocks and fires.

Stemming from the understanding that some electrical appliances can have strong empowering consequences without requiring the capacity or availability of tier 1, the household electricity index has a separate matrix for electricity services (Table 3.7). This index recognizes modern lighting and phone charging as critical first applications (Bhatia and Angelou, 2015, p. 7). Essentially, the electricity services index contrasts itself with the electricity supply index by only regarding the services that can be used by a household instead of the amount of energy that is being supplied to a household.

TABLE 3.7: Multi-tier matrix for household electricity services (Bhatia and Angelou, 2015)

	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Tier criteria		Task lighting AND Phone chargin	General lighting AND Phone Charging AND Television AND Fan (if needed)	Tier 2 AND Any medium-power appliances	Tier 3 AND Any high-power appliances	Tier 2 AND Any very high-power appliances

Emphasizing the surplus values of cooking solutions and space-heating, the household energy index includes them as additional sub-indices separate from electricity. The household access to cooking solutions has as many metrics as energy matrix, it measures indoor air quality (in particulate matter and carbon monoxide), cookstove efficiency, preparation time (for fuel acquisition per week and stove preparation per meal), safety (either analogous to IWA tiers, or by a twelve month absence of accidents that require professional medical attention), lastly the affordability (total costs lower than $5\,\%$ of household income), the quality of primary fuel (no variations in produced heat due to impurities), and the availability of primary fuel are defined only for the highest tier.

The household heating matrix then measures in capacity (how amount of space that is being heated), duration (starting at tier 3 where heating can be used at least $50\,\%$ of the time when needed), quality (how long the temperature is comfortable), convenience (with respect to fuel collection time), affordability, reliability (starting at tier 3 with less than 7 disruptions per day), indoor air quality (identical to the metric for cooking solutions), and safety (only defined for tier 5 with the 12 month absence

of severe accidents).

While being careful not to oversimplify the MTF for household energy access and its subindexes, ESMAP moved away from a binary understanding of energy access to one in which more precise metrics are used to e.g. measure availability, luminous flux, air quality, power, or the ability to charge a phone. It would be hard to argue that measuring access to electricity doesn't give a much more comprehensive understanding of energy poverty than the Boolean question of whether there is an electricity connection or not. However, examining what has made electricity critical for the UN, it can be observed that the MTF is far from holistic. That is to say, it is certainly possible for households to have reached Tier 5 without being able to freely choose their productive employment or to have access to education, health care, or the street lights that would render their commutes safer.

Chapter 4

Conclusion

The story of electricity infrastructure in Uganda has shown that - contrary to what the often associated terms of 'poor countries' and 'Global South' may imply - the problem of energy poverty is not fatalistic. While the high dispersion of the Ugandan population has definitely turned out to be one of the major obstacles in achieving nation wide access to energy, focusing on it would be to give an inadequate and a very much incomplete account of reality. Moreover, it would falsely shift all the responsibility to Uganda, that never had sovereignty over their electricity infrastructure. The notion of criticality has been used in this paper to analyse the historical development of Uganda's electrical infrastructure in a way that went beyond material artefacts and financing structures. It revealed that what was critical for international actors was different from what was critical for Uganda. It also showed that the increasing criticality of electricity strongly correlated with an increased urgency to achieve universal energy access. Using these insights, this chapter will answer the two research questions articulated in chapter 1.

4.1 How can a historical account of a specific electricity infrastructure enrich debates on energy justice?

If anything, this thesis was an effort to show how Uganda - even with its difficult geographical situation - is not wholly responsible for state of its household electrification rate. Instead, by understanding infrastructures as the result of a historical process rather than just the status quo, and by associating the responsibility to solve the injustices within the infrastructure with the actors that have steered its development, energy justice can become more adequate.

It was the British Empire who was responsible for the development of this infrastructure, from its infant state until eight years after the construction of the Owen Falls dam. During this period, the British were incipiently hesitant to start developing hdyro-power stations because it was not thought to be economically interesting. Later when they initiated the construction of the Owen Falls, this was done for the interests of the United Kingdom. Throughout most of their colonial period, power generation in Uganda had to reduce unemployment in Britain and help them recover from recession and war. The British rule over other African countries moreover linked Uganda's first major dam to the economic interests of (colonial) Egypt and Kenya. Among other associated injustices, this meant that Uganda could not fully utilize its generative power at the onset of their independence.

Later, when Uganda became independent, it had to take over the loans that had previously been agreed on by the World Bank and the British Empire. After that,

the Bank kept providing loans for projects while simultaneously being highly involved in the design of these projects. The failure of reaching reaching universal energy access should thus for a significant part be attributed to the Bank. A fortiori, the privatisation of Uganda's energy sector was done under the strong influence of the World Bank, of whom Uganda had become very dependent. For a large period of post-colonial Uganda, the main interest of the World Bank was to serve the needs of Europe and the US, and developing Uganda's electrical infrastructure was a neo-colonial method to do so. Only from 1992 onwards, with the start of the ERT programmes, did the Bank actively start to serve the needs of Uganda's households, albeit somewhat cautiously.

While the launch of SDG 7 may imply a critical shift in which the international community would finally see access to electricity as a human right and a goal in itself, the targets and indicators of this SDG tell a different story. In a way, the UN here resembles the neo-colonialism of the World Bank, the same way as the Bank resembled the colonial Empire. Even though energy access is now seen as necessary for human well-being, the needs of these energy-poor are now juxtaposed with the atonement for the greenhouse gas pollution of roughly the same nations that had been responsible for their low electrification rates.

The notion of *embodied energy injustices* from (Healy, Stephens, and Malin, 2019) allowed to illuminate a spatial dimension of energy justice. By looking at the full supply chain of modern energy - from delving the required energy carriers and other crucial materials to the ultimate dissipation of energy by the end users - energy justice can be spatialised. It brings a wider account of the burdens and benefits that are being unfairly distributed. The benefits of the system certainly go to its users and the stakeholders that are making profit from the infrastructure. The burdens are, however, mostly allocated to the communities that have to deal with the pollution and other damages to the ecosystems they inhabit. Spatialising energy justice in this way broadens its distributive mode, but also recognition justice as it reveals stakeholders that would otherwise have been overlooked. In a similar way, by tracing the life-story of the electrical infrastructure of a nation such as Uganda - from its genesis to the unjust system that it has evolved into - the same two modes of energy justice can be historicised. Here the benefits of the unjust infrastructure have gone to the British Empire that utilized Uganda's resources for their own gain, the World Bank that has used interest rates to profit from Uganda's underdeveloped infrastructure, the (mostly foreign) project implementers that were appointed to e.g. develop the Owen Falls and Bujagali dams, and the limited population of Uganda that have actually been connected to the grid. And even though household energy access has significantly gained in criticality with SDG 7, it is again done so in relation with the interests of the 'Gobal North'. Acknowledging the temporal dimension of energy justice in this way furthermore strengthens recognition justice as it reveals stakeholders that would have stayed invisible if the current infrastructure would have been regarded as a given.

Taken together, historical accounts of specific electricity infrastructures can enrich debates on energy justice by critically examining the benefits and burdens that have been distributed and by revealing the historical agents that have shaped - or have been affected by - this distribution. A significant portion of the benefits of Uganda's electrical infrastructure have gone to the Empire and the Bank, while the

burdens have always been allocated to Uganda. With SDG 7 the burdens and benefits of electricity are again not fairly distributed. Adding a temporal dimension to energy justice is thus to recognise that the burdens and benefits of energy are not only distributed now, or in the future, but have already been distributed and that redistribution can be justified.

The 1995 Copenhagen declaration of the UN stated that it would "*place the needs, rights and aspirations of people at the centre of* [their] *decisions and joint actions*" (United Nations, 1995a, p. 122). But seeing how SDG 7 only supports energy access if it simultaneously helps to mitigate the climate crisis, it becomes a genuine question which people the UN was actually aiming at. While mitigating climate change is a need shared by the global population, the responsibility for causing it is a burden that should rest with the nations that have actually contributed to it. This is not an argument for fossil energy, but if the UN wants to solely promote renewable energy in SDG 7 - as they should - this should be beneficial to the energy poor instead of a requirement. The burden of making sure that energy systems for the unelectrified are 'modern' should be allocated away from those who have not contributed to this requirement. A criticality network that accounts for the temporal dimension of energy justice as well as the values that the UN associates with universal energy access may look like as depicted in Figure 4.1.

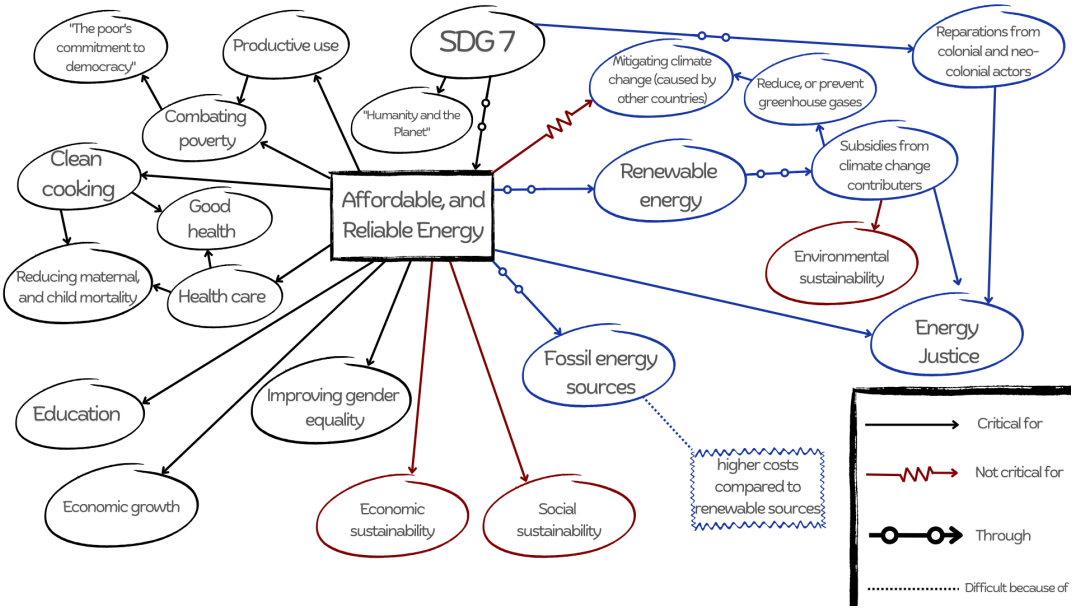


FIGURE 4.1: Criticality of Electricity according to the UN that accounts for the temporal dimension of energy justice. Blue colour is added to emphasize the difference with Figure 3.13.

4.2 How can criticality be used to operationalise energy justice in the effort to achieve universal energy access?

The concept of criticality that has been used to analyse the history of Uganda's electrical infrastructure is different from the conventional meaning of it. Where the political understanding of criticality has its merits in e.g. national defense strategies,

the story of Uganda's electrical infrastructure has shown how the STS perspective of adding non-material aspects can create a more effective notion of the criticality of infrastructures that are still under construction. The difference between the understanding of criticality in political discourse and in STS literature might be distilled to a difference of status quo versus potentiality. In other words, in the former understanding something is critical because its failure would have severe negative consequences for a society, while the for the latter it is critical because its emergence would have highly positive effects to a society. Uganda's potential electricity generation was thus non-critical for the Empire because they only ascribed the value of economic benefit to it, while it was simultaneously not deemed to be profitable. Both these aspects work as explanations for the very limited development of Uganda's electrical infrastructure during this era. Contrastingly, it can be observed that the rural electrification rate of Uganda gained significant momentum during the ERT programmes when the criticality web of electricity increased as well. Thus indicating a strong correlation between the criticality of electricity and the development of its associated infrastructures. For the purposes of this argument, the history of the Global Development Goals (in the context of electricity) can be seen as an effort to expand the *criticality network* of electricity provision. And as more values got connected to this network, the urgency to achieve universal access to modern energy increased as well.

Even though little progress has been made in between 1992 Earth Summit and the launch of MDGs with respect to (especially rural) household electrification, it is telling that it had become important enough to start mapping it. The start of the ERT program coincided with the 2002 World Summit in Johannesburg where household electrification started to get regarded as critical for the global development goals. And while Uganda's household electrification rate was already rising from that point onwards, a much steeper inclination can be observed after the launch of the SDGs of 2015. This correlation makes sense, not just because the World Bank has strong ties with the United Nations, but moreover because this process was essentially one of increasing the criticality of energy access. In other words, when more values are linked to an infrastructure, the incentive to further develop that infrastructure rises. Goals of reducing poverty, achieving universal primary education, promoting gender equality, reducing mortality rates, and improving access to health care, can be found throughout the history of global development goals. But these goals had to be connected to electricity - electricity had to become critical for them - in order to dramatically increase international attention to the topic of universal energy access.

This insight can be useful to increase the momentum of achieving universal energy access. While the formal goal of SDG 7 is to "*ensure access to affordable, reliable, sustainable and modern energy for all*" the associated targets are only partially concerned with ensuring energy *for all*. Moreover, the genealogy of SDG 7 shows that energy access is not an end in itself but rather a means to e.g. improve gender equality, access to health care, education and the prevention of environmental damage. Even though the MTF was is an improvement on the metrics to assess energy access, it is inadequate because it doesn't account for these actual goals. To really operationalise energy access, the critical components of electricity should be part of the metrics with which its success is being measured. This would prevent the provision of electricity as an 'end in itself', and instead focus efforts to targeted and purposeful objectives.

Appendix A

Notes

[1]The energy trilemma is about balancing energy security, environmental stability, and energy equity (World Energy Council, 2024).

[2]The mbwa fly would actually be eliminated with the opening of the Owen Falls Dam in 1954 (Wilson, 1967, p.7), therewith fulfilling Churchill's dreamed vision.

[3]I'm using Cole and Ohanian's definition here, they argue that United Kingdom experienced 'their' great depression in the late interbellum (Cole and Ohanian, 2002).

[3]Westlake nevertheless agreed with the governor on the building ahead of demand strategy (Hayes, 1983, p. 288).

[4]Both Sir Phillip Mitchel and Sir John Hall, who served as Uganda's governors between 1935-1940 and 1945-1952 respectively, argued for building ahead of demand through the development of large hydro electricity on the Ugandan Nile.

[5]The original Owen Falls Dam consisted of four turbines, each bringing a capacity of $15\,\mathrm{MW}$ (Kasita, 2012b)

[6]Although not necessarily in Uganda, as a significant part would be exported to (British) Kenya.

[7]Another example of this bilateral dependency created by Colonial Britain was the fact that Britain wanted East African manufacturing businesses to accumulate in Kenya. In 1958, 404 out of 474 companies in East Africa were located in Kenya. Later, when both countries became independent in 1962, $60\,\%$ of East Africa's gross product income resulting from manufactured goods was produced by Kenya (Okoth, 1992, p. 74).

[8]The Marshall plan totalled to over 13 billion USD, of which 1.5 billion consisted of loans and the rest of free grants. The UK, France, Italy, Germany, and The Netherlands were granted the most financial support, in that order.

[9]As of 2004, this percentage was even higher for nations in Latin America at $20\,\%$, and before that, in the 1990's, it was even exceeding that (Toussaint, 2015, p. 41).

[10]Foucault's notion of *governmentality* is defined as the *conduct of conduct*. It describes how governments have transformed into complex bureaucracies that strive to achieve stable, wealthy, docile societies that use their political power (e.g. prisons, asylums, schools) to shape the population's self-interest and self-regulation, thereby guiding their conduct (Li, 2007, p. 275, 276).

[11]While the objective was initially to rehabilitate the whole grid, this scope was later adjusted to only rehabilitate the networks in Kampala. In their 'lessons learned' section, the Bank lauds itself for its flexibility in modifying their own project goals, which then allowed to actually achieve them (World Bank, 1995, p. 35). Not making this up.

[12]The number of four generators that were initially installed back in 1954 had been increased to ten generators by 1968, creating a total capacity of $150\,\mathrm{MW}$. However, by 1981, four of these generators were out of service. The increase to $168\,\mathrm{MW}$ output capacity that was achieved through rewinding the alternators with more efficient insulating materials (World Bank, 1995, p. 6, 9–10).

[13]The Bank estimated the costs of adding 300,000 connections to be in the range of 200 and 500 million USD i.e. roughly 1167 USD per household. In 2008 the equipment, and installation costs of an SHS was estimated at 535 Euro (Carrasco, Narvarte, and Lorenzo, 2013, p. 3). At the commencement of Power III, in 1992, a PV panel was priced at $9.92\,\$/\mathrm{W}$; in 2001, at the end of the project they costed $5.97\,\$/\mathrm{W}$, in 2022 this number decreased to only $0.26\,\$/\mathrm{W}$ (Data, 2023).

[14]The other two were the continuing (and rapidly) decreasing water level of Lake Victoria, and a disagreement between the IEGWB and Regional Operations on the performance ratings for the project at completion.

[15]Gore states that Churchill was specifically contemplating the Bujagali Falls as the spot for Uganda's first hydro-dam, while citing Hayes' 1983 book An Informal History of EAP&L (Gore, 2008, p. 366). I

have found no mention of the Bujagali falls in either Hayes' An Informal History nor Churchill's My African Journey.

[16]Adding insult to injury, the average system losses of Uganda's energy system were determined at a shocking $41.5\,\%$. Most of these losses occurred in distribution ($36.7\,\%$), with the rest taking place in transmission and generation sections of the energy system. It should be noted that these losses are both technical and non-technical, thus including both inefficiencies and aspects such as energy theft (Gore, 2008, p. 361).

[17]Not disregarding the military conflicts with - and the brutalities of - the Lord's Resistance Army, the overthrow of the Obote regime by Museveni during the Ugandan Bush War softly marked the end of the internal wars that had plagued Uganda for almost two decades. During the 1990s the income poverty moreover fell from $56\,\%$ to $35\,\%$ (Hickey, 2005, p. 997)

[18]The Busoga Kingdom is one of four constitutional monarchies of Uganda, Jinja is one of the Busoga's eleven districts.

[19]Per example, the REA was operating under the Ministery of Energy, and the chairman of the board was also the permanent secretary for the Ministery (World Bank (Africa Energy Group), 2009a, p. 15).

[20]Bagasse is the fibrous remainder of sugercane crushing processing, in this case it is used as a fuel for biothermal energy generation. This use of end-use was furthermore intended to prevent open field burning of bagasse, which at the time amounted to over 50 truckloads a day (Africa Regional Office, 2001, p. 5).

[21]The bank noted it as a problem that the wiremen were free to charge whichever the wanted from the households, and that this made it too expensive for some rural customers. They furthermore argued that standardizing wiring costs would be difficult as the wiring requirements may differ between households and the materials used by wiremen were not consistent. The Bank ultimately argued that the ERA needs to provide minimum standards and should ensure that licensed wiremen would be properly trained (World Bank (Africa Energy Group), 2017, p. 16).

[22]These are basically grid-connected SHSs i.e. they have wall-sockets on the distribution boards themselves

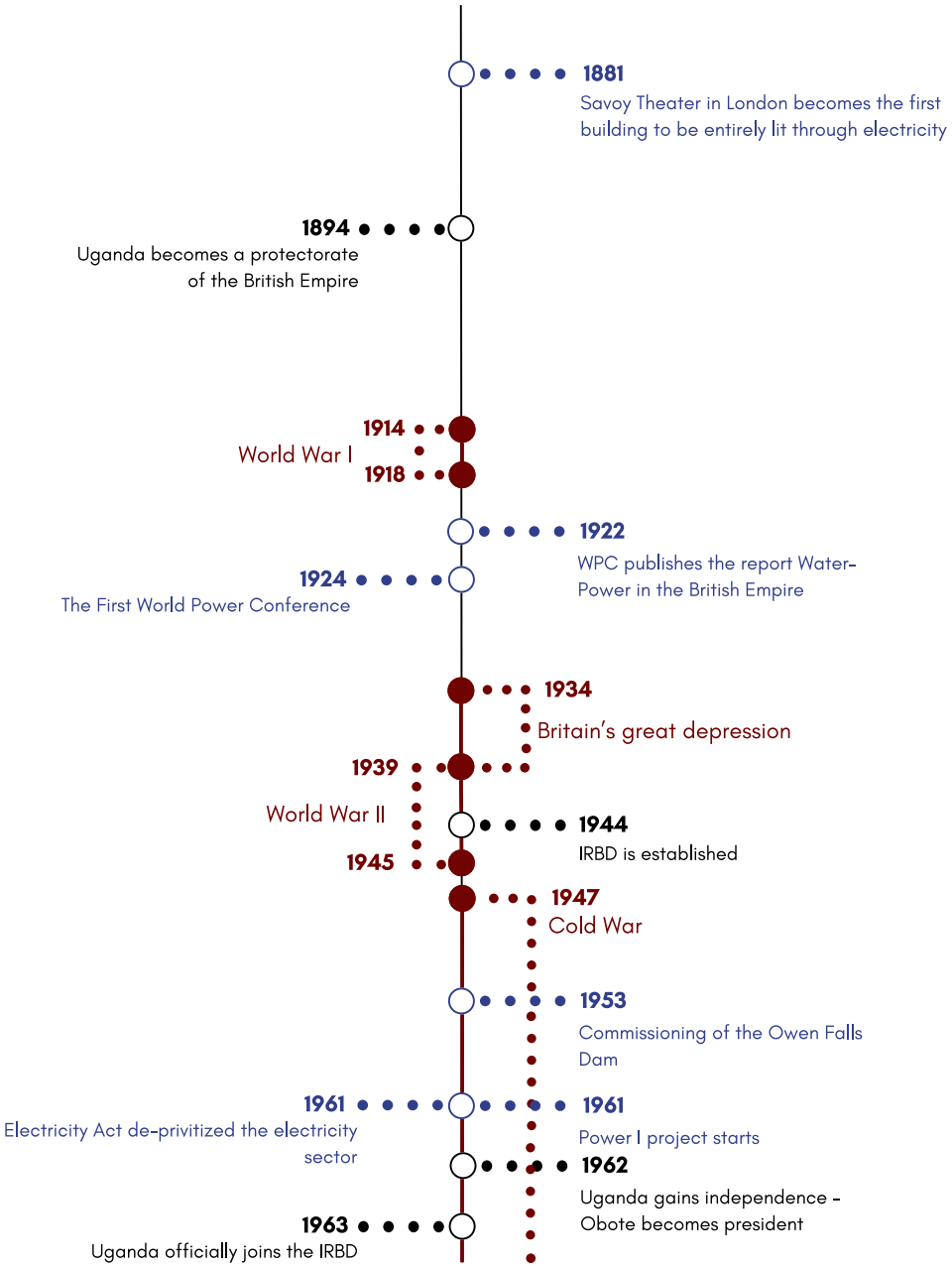
[23]The involuntary replacement policy of the Bank required displaced persons to be fully compensated (through a Bank-approved resettlement plan) and be fully assisted with the resettlement. If the relevant persons rejected the offer, the land and its relevant assets can only be taken after a compensation equal to 110 % of the original offer has been deposited to them (World Bank, 2001, p. 3).

[24]measured as a proxy through GDP per unit of energy use.

[25]This summit articulated the responsibility to protect populations from genocide, war crimes, ethnic cleansing and crimes against humanity (United Nations, 2005, p. 30).

Appendix B

Timeline



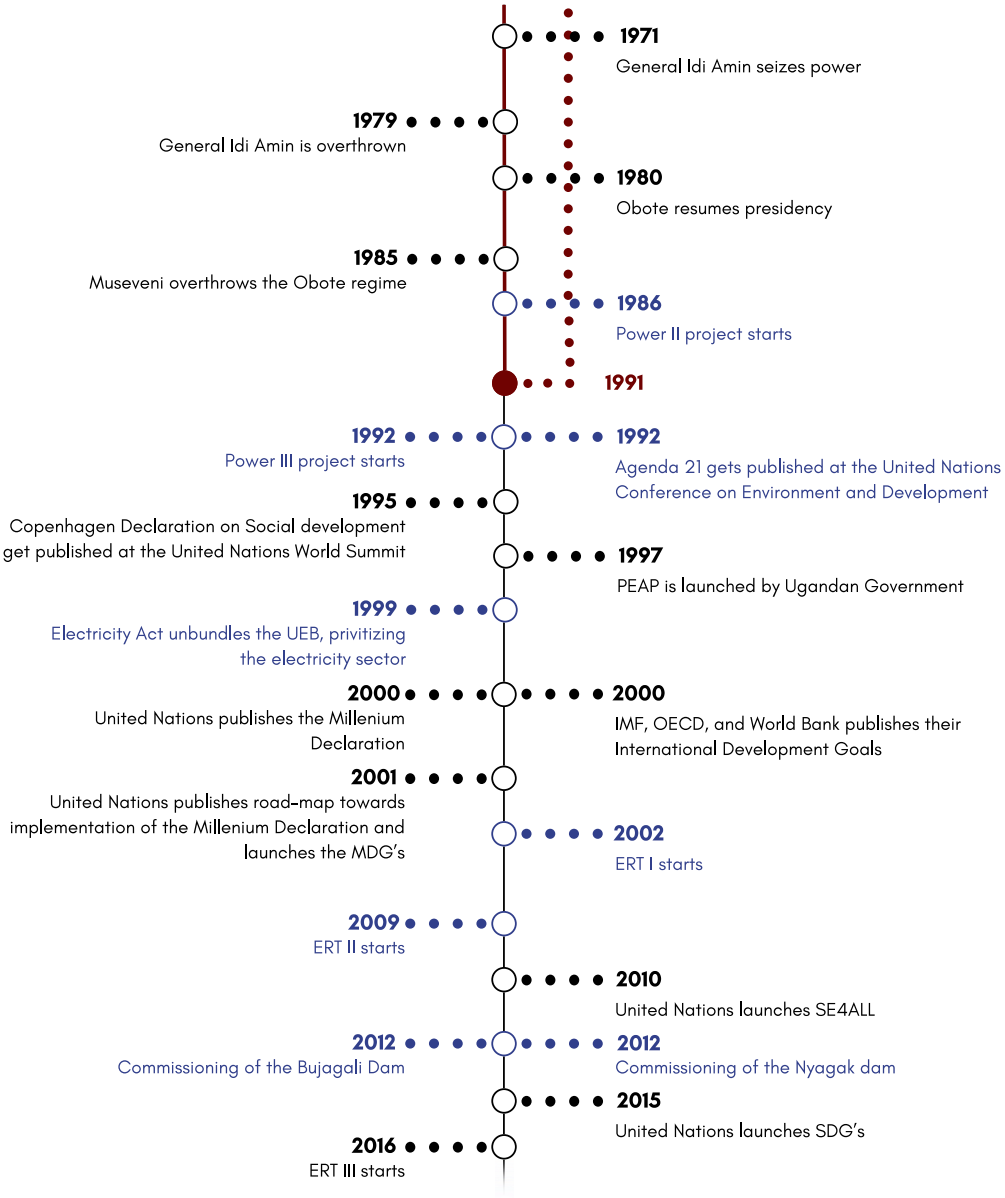


FIGURE B.1: Timeline of events discussed in this thesis. Design by Dasha Nemashkalo.

Appendix C

United Nations Global Development Goals

C.1 Principles of the 1972 Stockholm Conference on Human Environment

PRINCIPLE 1 Man has the fundamental right to freedom, equality, and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being. He bears a solemn responsibility to protect and improve the environment for present and future generations. In this respect, policies promoting or perpetuating apartheid, racial segregation, discrimination, colonial, and other forms of oppression and foreign domination stand condemned and must be eliminated.

PRINCIPLE 2 The natural resources of the earth, including the air, water, land, flora, and fauna, and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

PRINCIPLE 3 The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.

PRINCIPLE 4 Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperiled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development.

PRINCIPLE 5 The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind.

PRINCIPLE 6 The discharge of toxic substances or other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of all countries against pollution should be supported.

PRINCIPLE 7 States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

PRINCIPLE 8 Economic and social development is essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are

necessary for the improvement of the quality of life.

PRINCIPLE 9 Environmental deficiencies generated by the conditions of underdevelopment and natural disasters pose grave problems and can best be remedied by accelerated development through the transfer of substantial quantities of financial and technological assistance as a supplement to the domestic effort of the developing countries and such timely assistance as may be required.

PRINCIPLE 10 For the developing countries, stability of prices and adequate earnings for primary commodities and raw materials are essential to environmental management since economic factors as well as ecological processes must be taken into account.

PRINCIPLE 11 The environmental policies of all States should enhance and not adversely affect the present or future development potential of developing countries, nor should they hamper the attainment of better living conditions for all, and appropriate steps should be taken by States and international organizations with a view to reaching agreement on meeting the possible national and international economic consequences resulting from the application of environmental measures.

PRINCIPLE 12 Resources should be made available to preserve and improve the environment, taking into account the circumstances and particular requirements of developing countries and any costs which may emanate from their incorporating environmental safeguards into their development planning and the need for making available to them, upon their request, additional international technical and financial assistance for this purpose.

PRINCIPLE 13 In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve the environment for the benefit of their population.

PRINCIPLE 14 Rational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment.

PRINCIPLE 15 Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic, and environmental benefits for all. In this respect, projects which are designed for colonialist and racist domination must be abandoned.

PRINCIPLE 16 Demographic policies which are without prejudice to basic human rights and which are deemed appropriate by Governments concerned should be applied in those regions where the rate of population growth or excessive population concentrations are likely to have adverse effects on the environment of the human environment and impede development.

PRINCIPLE 17 Appropriate national institutions must be entrusted with the task of planning, managing, or controlling the environmental resources of States with a view to enhancing environmental quality.

PRINCIPLE 18 Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance, and control

of environmental risks and the solution of environmental problems for the common good of mankind.

PRINCIPLE 19 Education in environmental matters, for the younger generation as well as adults, giving due consideration to the underprivileged, is essential in order to broaden the basis for an enlightened opinion and responsible conduct by individuals, enterprises, and communities in protecting and improving the environment in its full human dimension. It is also essential that mass media of communications avoid contributing to the deterioration of the environment, but, on the contrary, disseminate information of an educational nature on the need to protect and improve the environment in order to enable man to develop in every respect.

PRINCIPLE 20 Scientific research and development in the context of environmental problems, both national and multinational, must be promoted in all countries, especially the developing countries. In this connection, the free flow of up-to-date scientific information and transfer of experience must be supported and assisted to facilitate the solution of environmental problems; environmental technologies should be made available to developing countries on terms which would encourage their wide dissemination without constituting an economic burden on the developing countries.

PRINCIPLE 21 States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

PRINCIPLE 22 States shall cooperate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.

PRINCIPLE 23 Without prejudice to such criteria as may be agreed upon by the international community, or to standards which will have to be determined nationally, it will be essential in all cases to consider the systems of values prevailing in each country, and the extent of the applicability of standards which are valid for the most advanced countries but which may be inappropriate and of unwarranted social cost for the developing countries.

PRINCIPLE 24 International matters concerning the protection and improvement of the environment should be handled in a cooperative spirit by all countries, big and small, on an equal footing. Cooperation through multilateral or bilateral arrangements or other appropriate means is essential to effectively control, prevent, reduce, and eliminate adverse environmental effects resulting from activities conducted in all spheres, in such a way that due account is taken of the sovereignty and interests of all States.

PRINCIPLE 25 States shall ensure that international organizations play a coordinated, efficient, and dynamic role in the protection and improvement of the environment.

PRINCIPLE 26 Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction. States must strive to reach

prompt agreement, in the relevant international organs, on the elimination and complete destruction of such weapons.

(United Nations, 1973, p. 3-5)

C.2 Principles of the 1992 Rio Declaration on Environment and Development

PRINCIPLE 1 Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

PRINCIPLE 2 States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

PRINCIPLE 3 The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

PRINCIPLE 4 In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

PRINCIPLE 5 All States and all people shall co-operate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.

PRINCIPLE 6 The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.

PRINCIPLE 7 States shall co-operate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.

PRINCIPLE 8 To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

PRINCIPLE 9 States should co-operate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies

PRINCIPLE 10 Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making

information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

PRINCIPLE 11 States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.

PRINCIPLE 12 States should co-operate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. Unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country should be avoided. Environmental measures addressing transboundary or global environmental problems should, as far as possible, be based on an international consensus.

PRINCIPLE 13 States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also co-operate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

PRINCIPLE 14 States should effectively co-operate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe environmental degradation or are found to be harmful to human health.

PRINCIPLE 15 In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

PRINCIPLE 16 National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

PRINCIPLE 17 Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

PRINCIPLE 18 States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.

PRINCIPLE 19 States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.

PRINCIPLE 20 Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development.

PRINCIPLE 21 The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all.

PRINCIPLE 22 Indigenous people and their communities, and other local communities, have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.

PRINCIPLE 23 The environment and natural resources of people under oppression, domination and occupation shall be protected

PRINCIPLE 24 Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and co-operate in its further development, as necessary.

PRINCIPLE 25 Peace, development and environmental protection are interdependent and indivisible.

PRINCIPLE 26 States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with the Charter of the United Nations.

PRINCIPLE 27 States and people shall co-operate in good faith and in a spirit of partnership in the fulfilment of the principles embodied in this Declaration and in the further development of international law in the field of sustainable development.

(United Nations, 1993, p. 3-8)

C.3 Agenda 21

Agenda 21 is a non-binding programme launched at the 1992 UN Earth Summit in Rio de Janeiro. It is an important document for understanding the genealogy, and critical background of the UNSDGs. Given my love for polar bears, and the fact that this programme is close to 500 pages long, only the table of content will is given here.

TABLE C.1: Content table of Agenda 21 (United Nations, 1993, p. 9-11)

C.4 Millennium Development Goals

TABLE C.2: Goals, targets, and indicators of the MDGs, as recorded in the 'Road map towards the implementation of the United Nations Millennium Declaration' (Annan, 2001, p. 56-58)

Goals and targets	*Indicators*
Goal 1. Eradicate extreme poverty and hunger	
Target 1. Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	1. Proportion of population below $1 per day 2. Poverty gap ratio (incidence x depth of poverty) 3. Share of poorest quintile in national consumption
Target 2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger	4. Prevalence of underweight children (under five years of age) 5. Proportion of population below minimum level of dietary energy consumption
Goal 2. Achieve universal primary education	
Target 3. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	6. Net enrolment ratio in primary education 7. Proportion of pupils starting grade 1 who reach grade 5 8. Literacy rate of 15-24-year-olds
Goal 3. Promote gender equality and empower women	
Target 4. Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015	9. Ratio of girls to boys in primary, secondary and tertiary education 10. Ratio of literate females to males of 15-to-24-year-olds 11. Share of women in wage employment in the non-agricultural sector 12. Proportion of seats held by women in national parliament
Goal 4. Reduce child mortality	
Target 5. Reduce by two thirds, between 1990 and 2015, the under-five mortality rate	13. Under-five mortality rate 14. Infant mortality rate 15. Proportion of 1-year-old children immunized against measles
Goal 5. Improve maternal health	
Target 6. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	16. Maternal mortality ratio 17. Proportion of births attended by skilled health personnel
Goal 6. Combat HIV/AIDS, malaria and other diseases	
Target 7. Have halted by 2015 and begun to reverse the spread of HIV/AIDS	18. HIV prevalence among 15-to-24-year-old pregnant women 19. Contraceptive prevalence rate 20. Number of children orphaned by HIV/AIDS

Goals and targets	*Indicators*
Target 8. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	21. Prevalence and death rates associated with malaria 22. Proportion of population in malaria risk areas using effective malaria prevention and treatment measures 23. Prevalence and death rates associated with tuberculosis 24. Proportion of tuberculosis cases detected and cured under directly observed treatment short course
Goal 7. Ensure environmental sustainability	
Target 9. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources	25. Proportion of land area covered by forest 26. Land area protected to maintain biological diversity 27. GDP per unit of energy use (as proxy for energy efficiency) 28. Carbon dioxide emissions (per capita) [Plus two figures of global atmospheric pollution: ozone depletion and the accumulation of global warming gases]
Target 10. Halve by 2015 the proportion of people without sustainable access to safe drinking water	29. Proportion of population with sustainable access to an improved water source
Target 11. By 2020 to have achieved a significant improvement in the lives of at least 100 million slum dwellers	30. Proportion of people with access to improved sanitation 31. Proportion of people with access to secure tenure [Urban/rural disaggregation of several of the above indicators may be relevant for monitoring improvement in the lives of slum dwellers]
Goal 8. Develop a global partnership for development	

Goals and targets	*Indicators*
Target 12. Develop further an open, rule-based, predictable, non-discriminatory trading and financial system Includes a commitment to good governance, development, and poverty reduction — both nationally and internationally **Target 13.** Address the special needs of the least developed countries Includes: tariff and quota free access for least developed countries' exports; enhanced programme of debt relief for HIPCs and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction **Target 14.** Address the special needs of landlocked countries and small island developing States Through the Programme of Action for the Sustainable Development of Small Island Developing States and the outcome of the twenty-second special session of the General Assembly **Target 15.** Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term **Target 16.** In cooperation with developing countries, develop and implement strategies for decent and productive work for youth **Target 17.** In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries **Target 18.** In cooperation with the private sector, make available the benefits of new technologies, especially information and communications	*[Some of the indicators listed below will be monitored separately for the least developed countries (LDCs), Africa, landlocked countries and small island developing States]* **Official development assistance** 32. Net ODA as percentage of OECD/DAC donors' gross national product (targets of 0.733. Proportion of ODA to basic social services (basic education, primary health care, nutrition, safe water and sanitation) 34. Proportion of ODA that is untied 35. Proportion of ODA for environment in small island developing States 36. Proportion of ODA for transport sector in landlocked countries **Market access** 37. Proportion of exports (by value and excluding arms) admitted free of duties and quotas 38. Average tariffs and quotas on agricultural products and textiles and clothing 39. Domestic and export agricultural subsidies in OECD countries 40. Proportion of ODA provided to help build trade capacity 41. Proportion of official bilateral HIPC debt cancelled **Debt sustainability** 42. Debt service as a percentage of exports of goods and services 43. Proportion of ODA provided as debt relief 44. Number of countries reaching HIPC decision and completion points 45. Unemployment rate of 15-to-24-year-olds 46. Proportion of population with access to affordable essential drugs on a sustainable basis 47. Telephone lines per 1,000 people 48. Personal computers per 1,000 people [Other indicators to be decided]

C.5 Sustainable Development Goals

TABLE C.3: United Nations Sustainable Development Goals United Nations, 2015a, p. 14

Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Bibliography

Abbott, George C (1971). “A Re-Examination of the 1929 Colonial Development Act”. In: *Review* 24 (1), pp. 68–81. URL: https://about.jstor.org/terms.

Acheampong, Alex O, Michael Odei Erdiaw-Kwasie, and Matthew Abunyewah (2021). “Does energy accessibility improve human development? Evidence from energy-poor regions”. In: DOI: 10.1016/j.eneco.2021.105165. URL: https://doi.org/10.1016/j.eneco.2021.105165.

Africa Regional Office (Oct. 2001). *Uganda, Energy for Rural Transformation Project - Project Appraisal Document*. URL: https://publicpartnershipdata.azureedge.net/gef/PMISGEFDocuments/Climate%20Change/Uganda%20-%20Rural%20Energy/PAD.pdf.

African Studies Center (2009). *Uganda - History*. accessed on August 5, 2024. URL: https://www.africa.upenn.edu/NEH/uhistory.htm.

Akallah, Jethron Ayumbah (June 2022). “Wells and Boreholes: Resilient Water Provision in Nairobi”. In: *HoST - Journal of History of Science and Technology* 16 (1), pp. 48–72. ISSN: 16467752. DOI: 10.2478/host-2022-0004.

Anditi, Christer et al. (June 2022). “Addressing gender dimensions in energy innovations: A gender analysis framework for informal urban settlements in Africa”. In: *Energy Research and Social Science* 88, p. 102476. ISSN: 22146296. DOI: 10.1016/j.erss.2021.102476.

Annan, Koffi (Sept. 2001). *A /56/326 - Road map towards the implementation of the United Nations Millennium Declaration - Report of the Secretary-General*. URL: https://www.un.org/millenniumgoals/sgreport2001.pdf.

Ashworth, William J (2008). “THE GHOST OF ROSTOW: SCIENCE, CULTURE AND THE BRITISH INDUSTRIAL REVOLUTION”. In: *Science History Publication* 46 (3), pp. 249–274. DOI: 10.1177/0073275308046003O1.

Asian Development Bank (2011). *Viet Nam’s Success in Increasing Access to Energy through Rural Electrification*. URL: https://www.adb.org/sites/default/files/publication/28952/rural-electrification-vie.pdf.

Bbumba, Hon. Sydia N.M. (Oct. 2002). *WORKSHOP ON MODERN ENERGY SERVICES AND POVERTY REDUCTION - STRATEGY TO TACKLE ENERGY-RELATED ISSUES IN UGANDA*. URL: www.esmap.org%2Fsites%2Fdefault%2Ffiles%2Fesmap-files%2FWshp_uganda.pdf.

Bhatia, Mikul and Nicolina Angelou (2015). *Beyond Connections, Energy Access Redifined*.

Bouzarovski, Stefan and Neil Simcock (2017). “Spatializing energy justice”. In: *Energy Policy* 107, pp. 640–648. DOI: 10.1016/j.enpol.2017.03.064. URL: http://dx.doi.org/10.1016/j.enpol.2017.03.064.

Broecker, Wallace S (Aug. 1975). “Climatic Change: Are We on the Brink of a Pronounced Global Warming?” In: *Science* 189 (4201), pp. 460–463. URL: https://www.jstor.org/stable/1740491?seq=2.

Carrasco, L.M., E. Narvarte, and E. Lorenzo (2013). “Operational costs of A 13,000 solar home systems rural electrification programme”. In: *Renewable and Sustainable Energy Reviews* 20, pp. 1–7. URL: https://sci-hub.se/https://doi.org/10.1016/j.rser.2012.11.073.

Centre for Public Impact (July 2017). *The Bujagali Dam Project in Uganda*. Accessed on July 9, 2024. URL: https://www.centreforpublicimpact.org/case-study/bujagali-dam-project-uganda.

Churchill, Winston S. (1909). *My African Journey*. London: Richard Clay and Sons, Limited.

Clerk, Dugald and A.H. Gibson (1922). *Water-Power in The British Empire - The Reports of the Water-Power Committee of the Conjoint Board of SCientific Societies*.

Clerk, Dugald and Wiliam Cawthorne Unwin (1915). “The World’s Supplies of Fuel and Motive Power”. In: *Thomas Hawksley Lecture*, pp. 591–625.

Cole, Harold L and Lee E Ohanian (2002). “The Great U.K. Depression: A Puzzle and Possible Resolution 1”. In: *Review of Economic Dynamics* 5, pp. 19–44. DOI: 10.1006/redy.2001.0140.

Cozzi, Laura et al. (Nov. 2020). *The Covid-19 crisis is reversing progress on energy access in Africa*. URL: https://www.iea.org/articles/the-covid-19-crisis-is-reversing-progress-on-energy-access-in-africa.

Crookes, W. (1882). “The Cost of Electric Lighting by Incandesence”. In: *The Electrician* 9.

DAC, Development Assistance Committee (May 1996). *Shaping the 21st Century: The Contribution ofDevelopment Co-operation*. Accessed on August 24, 2024. URL: https://doi.org/10.1787/da2d4165-en.

Dahir, Abdi Latif (Sept. 2023). “Kenya Hit by Third Major Blackout in Four Months - The New York Times”. In: *The New York Times*. URL: https://www.nytimes.com/2023/12/11/world/africa/kenya-blackout.html.

Data, Our World in (2023). *Solar (photovoltaic) panel prices*. URL: https://ourworldindata.org/grapher/solar-pv-prices.

Davis, David H. (1962). *The Economic Development of Uganda - Report of a Mission Organized by the International Bank for Reconstruction and Development*.

Daysleeperrr (2015). *Persons per square kilometer*. URL: https://i.imgur.com/gBYMfWO.jpg.

ESMAP (n.d.). *Donors | ESMAP*. Accessed on March 29, 2024. URL: https://www.esmap.org/esmap_donors.

— (Aug. 1984). *Activity Completion Report No. 020/84*.

— (Dec. 1996). *Uganda Energy Assessment*.

Estrin, Saul and Adeline Pelletier (2008). “Privatization in Developing Countries: What Are the Lessons of Recent Experience?” In: DOI: 10.1093/wbro/lkx007. URL: https://academic.oup.com/wbro/article/33/1/65/4951686.

Felix, Bate (2021). *Africa needs renewable power for Great Green Wall to work, AfDB head says*. URL: https://www.reuters.com/business/cop/africa-needs-renewable-power-great-green-wall-work-afdb-head-says-2021-11-04/.

Fukuyama, Francis (1989). “The End of History?” In: *The National Interest* 16, pp. 3–18.

Gao, Xumiao et al. (Apr. 2022). “Global Identification of Unelectrified Built-Up Areas by Remote Sensing”. In: *Remote Sensing 2022, Vol. 14, Page 1941* 14 (8), pp. 1–21. ISSN: 2072-4292. DOI: 10.3390/RS14081941. URL: https://www.mdpi.com/2072-4292/14/8/1941/htmhttps://www.mdpi.com/2072-4292/14/8/1941.

Gore, Christopher (2008). "Electricity and privatisation in Uganda: The origins of the crisis and problems with the response". In: *ELECTRIC CAPITALISM RECOLONISING AFRICA ON THE POWER GRID*. Ed. by David A. McDonald. Cape Town: HSRC Press. Chap. 14, pp. 359–399. ISBN: 9780796922373. URL: https://www.researchgate.net/publication/301589114_Electricity_and_privatisation_in_Uganda_The_origins_of_the_crisis_and_problems_with_the_response.

Grant, Rebecca et al. (May 2021). "An Ecohealth approach to energy justice: Evidence from Malawi's energy transition from biomass to electrification". In: *Energy Research & Social Science* 75, p. 101875. ISSN: 22146296. DOI: 10.1016/j.erss.2020.101875.

Hård, Mikael (2022). "Introduction: The History of East Africa's Critical Infrastructure". In: *HoST - Journal of History of Science and Technology* 16.1, pp. 1–6. DOI: 10.2478/host-2022-0001.

Harrison, Graham (Sept. 2001). "Post-Conditionality Politics and Administrative Reform: Reflections on the Cases of Uganda and Tanzania". In: *Development and Change* 32 (4), pp. 657–679. ISSN: 0012-155X. DOI: 10.1111/1467-7660.00221.

Hasenöhrl, Ute and Jan Henri Kmeyerr (Jan. 2020). "The energy challenge in historical perspective". In: *Technology and Culture* 61 (1), pp. 295–306. ISSN: 10973729. DOI: 10.1353/tech.2020.0003.

Hayes, Charles (1983). *Stima: An informal history of the East African Power & Lighting Company*. Ed. by Marjorie Oludhe Macgoye. Nairobi: The East African Power and Lighting Company Lmited.

Healy, Noel, Jennie C. Stephens, and Stephanie A. Malin (Feb. 2019). "Embodied energy injustices: Unveiling and politicizing the transboundary harms of fossil fuel extractivism and fossil fuel supply chains". In: *Energy Research and Social Science* 48, pp. 219–234. ISSN: 22146296. DOI: 10.1016/j.erss.2018.09.016.

Heffron, Raphael J. and Darren McCauley (June 2014). "Achieving sustainable supply chains through energy justice". In: *Applied Energy* 123, pp. 435–437. ISSN: 03062619. DOI: 10.1016/j.apenergy.2013.12.034.

Hickey, Sam (2005). "The Politics of Staying Poor: Exploring the Political Space for Poverty Reduction in Uganda". In: *World Development* 33 (6), pp. 995 –1009. DOI: doi:10.1016/j.worlddev.2004.09.020.

HMSO (1929). *Colonial Development Act, 1929*. Chapter 5. London.

House of Lords (July 1929). *Colonial Development Bill Debate*. Accessed on: 2024-01-10. URL: https://hansard.parliament.uk/Lords/1929-07-23/debates/987b696b-4e9f-48f0-a6d5-2cfd15132568/ColonialDevelopmentBill.

Hughes, Thomas P. (1983). *Networks of Power - Electrification in Western Society, 1880 - 1930*. The Johns Hopkins University Press. ISBN: 0-8018-2873-2.

Högselius, Per et al. (Dec. 2013). *The Making of Europe's Critical Infrastructure: Common Connections and Shared Vulnerabilities*. Palgrave Macmillan, pp. 1–313. ISBN: 9781137358738. DOI: 10.1057/9781137358738.

IEA (Dec. 2020). *2020 Regional focus: Africa – Electricity Market Report*. URL: https://www.iea.org/reports/electricity-market-report-december-2020/2020-regional-focus-africa.

— (2021). *Uganda*. Accessed on August 4, 2024. URL: https://www.iea.org/countries/uganda.

— (June 2024). *Progress on basic energy access reverses for first time in a decade*. URL: https://www.iea.org/news/progress-on-basic-energy-access-reverses-for-first-time-in-a-decade.

Independent Evaluation Group (June 2024). *Implementation Completion Report (ICR) Review - Energy for Rural Transform III (P133312)*. URL: https://documents1.worldbank.org/curated/en/099062024185015481/pdf/P13331215c6f0f0ae19abc1573a2b5e5f38.pdf.

International Bank for Reconstruction and Development (Mar. 1961). *Press Release No. 667 - $8.4 million loan to Uganda*.

International Earth Science Information Network CIESIN Columbia University, Center for (2005). *Gridded Population of the World*. https://doi.org/10.7927/H49C6VHW.

International Rivers (Dec. 2008). *Uganda Dam Slammed by World Bank Appeals Body*. Accessed on September 25, 2023 - through WaybackMachine Internet Archive. URL: https://archive.internationalrivers.org/resources/uganda-dam-slammed-by-world-bank-appeals-body-3814.

Jenkins, Kirsten et al. (Jan. 2016). "Energy justice: A conceptual review". In: *Energy Research and Social Science* 11, pp. 174–182. ISSN: 22146296. DOI: 10.1016/j.erss.2015.10.004.

Jinja City (n.d.). *Bujagali Falls Hydropower Dam, Jinja, Uganda*. Accessed on July 7, 2024. URL: https://jinjacity.go.ug/projects/bujagali-falls-hydropower-dam-jinja-uganda.

Jones, Matthew W et al. (2023). "National contributions to climate change due to historical emissions of carbon dioxide, methane, and nitrous oxide since 1850". In: *www.nature.com/scientificdata* 10 (155), pp. 1–23. DOI: 10.1038/s41597-023-02041-1. URL: https://doi.org/10.1038/s41597-023-02041-1.

Kakira Sugar (2023). *Electricity*. Accessed on July 16, 2024. URL: https://kakirasugar.com/business/electricity/.

Kapo, Nelson Bwire (Oct. 2019). *Nabamba Budhagali: Brought by spirits, frustrated by man, called by God*. Accessed on July 10, 2024. URL: https://nilepost.co.ug/opinions/58353/nabamba-budhagali-brought-by-spirits-frustrated-by-man-called-by-god.

Kasita, Ibrahim (2012a). *Evolution of the 250MW Bujagali dam*. Accessed on October 9, 2012 - through WaybackMachine Internet Archive. URL: https://www.newvision.co.ug/news/636071-evolution-of-the-250mw-bujagali-dam.html.

— (Feb. 2012b). *Owen falls dam: Powering Uganda for five decades - New Vision Official*. URL: https://www.newvision.co.ug/news/1299372/owen-falls-dam-powering-uganda-decades.

Ki-moon, Ban (2011). *Sustainable Energy for all - A Vision Statement by Ban Ki-moon, Secretary-General of the United Nations*. URL: https://www.seforall.org/system/files/gather-content/SG_Sustainable_Energy_for_All_vision.pdf.

Kristof Lukitsch Marcel Müller, Chris Stahlhut (2018). "Criticality". In: *Key Concepts for Critical Infrastructure Research*. Ed. by Jens Ivo Engels. Darmstadt, Germany: Springer. Chap. 3, pp. 11–20.

Larkin, Brian (Oct. 2013). "The politics and poetics of infrastructure". In: *Annual Review of Anthropology* 42 (Volume 42, 2013), pp. 327–343. ISSN: 00846570. DOI: 10.1146/ANNUREV-ANTHRO-092412-155522/CITE/REFWORKS. URL: https://www.annualreviews.org/content/journals/10.1146/annurev-anthro-092412-155522.

Li, Tania Murray (2007). "Governmentality". In: *Anthropologica* 49 (2), pp. 275–281. URL: http://www.jstor.orgURL:http://www.jstor.org/stable/25605363.

Lie, Jon Harald Sande (Apr. 2015). “Developmentality: indirect governance in the World Bank–Uganda partnership”. In: *Third World Quarterly* 36 (4), pp. 723–740. ISSN: 0143-6597. DOI: 10.1080/01436597.2015.1024435.

— (Dec. 2022). *Developmentality*. Berghahn Books. ISBN: 9781782388418. DOI: 10.1515/9781782388418.

Lilley, Sasha (2003). *AES Backs Out of Bujagali Dam Project*. Accessed on June 17, 2017 - through WaybackMachine Internet Archive. URL: http://corpwatch.org/article.php?id=8250.

Linaweaver, Stephen (Apr. 1999). *Proposed Uganda Dam is Drowning in Difficulties*. Accessed on November 29, 2023 - through WaybackMachine Internet Archive. URL: https://archive.internationalrivers.org/resources/proposed-uganda-dam-is-drowning-in-difficulties-2033.

Lloyd, Arthur (n.d.). *The Savoy Theatre, Strand, WC2*. Accessed on August 12, 2024. URL: http://www.arthurlloyd.co.uk/SavoyTheatre.htm.

Lugard, Frederick (1922). *The Dual Mandate in British Tropical Africa*. William Blackwood and Sons. URL: https://ia801303.us.archive.org/31/items/cu31924028741175/cu31924028741175.pdf.

Mchome, Emanuel Lukio (June 2022). “Resilience from Below: Technicians, Repair and Maintenance Works in Post-socialist Dar es Salaam, 1985-2020”. In: *HoST - Journal of History of Science and Technology* 16 (1), pp. 73–98. ISSN: 16467752. DOI: 10.2478/host-2022-0005.

McPherson, M. Peter (1987). “The Promise of Privatization”. In: *PRIVATIZATION AND DEVELOPMENT*. Ed. by Steve H. Hanke. International Center for Economic Growth.

Mdone, Erskine (Apr. 2015). *Bujagali: How Not to Build a Dam Through a Public-Private Partnership*. Accessed on July 9, 2024. URL: https://nape.or.ug/bujagali-how-not-to-build-a-dam-through-a-public-private-partnership/.

Mills, Evan (Feb. 2016). “Identifying and reducing the health and safety impacts of fuel-based lighting”. In: *Energy for Sustainable Development* 30, pp. 39–50. ISSN: 09730826. DOI: 10.1016/j.esd.2015.11.002.

Monitor - Uganda Edition (Jan. 2016). *Building of Owen Falls dam begins in Jinja*. Accessed on August 7, 2024. URL: https://www.monitor.co.ug/uganda/magazines/people-power/building-of-owen-falls-dam-begins-in-jinja-1636524.

NASA (2023). *Earth at Night*. URL: https://science.nasa.gov/resource/earth-at-night/.

New Vision (Apr. 2003). *Anti-Bujagali power dam crusaders warn of more trouble*. Accessed on July 9, 2024. URL: https://www.newvision.co.ug/news/1269504/anti-bujagali-power-dam-crusaders-warn-trouble.

— (Sept. 2005). *Cultural heads rap Budhagali*. Accessed on July 10, 2024. URL: https://www.newvision.co.ug/news/1116229/cultural-heads-rap-budhagali.

— (Oct. 2012). *Museveni commissions Bujagali dam*. Accessed on October 11, 2014 - through WaybackMachine Internet Archive. URL: https://www.newvision.co.ug/news/636134-museveni-commissions-bujagali-dam.html.

OECD, IMF, World-Bank (2000). *A Better World for All: Progress toward the International Development Goals*. URL: www.paris21.org/betterworld.

Okello, Felix Warom (Sept. 2012). *Museveni switches on Nyagak*. Accessed on July 15, 2024. URL: https://www.monitor.co.ug/News/National/Museveni+switches+on+Nyagak/-/688334/1508300/-/32bm7z/-/index.html.

Okoth, Godfrey P. (Jan. 1992). *INTERMITTENT TENSIONS IN UGANDA – RELATIONS: HISTORICAL PERSPECTIVES*. URL: https://www.jstor.org/stable/24520421.

Open Working Group (2014a). *Introduction to the Proposal of the Open Working Group for Sustainable Development Goals*. Accessed on August 23, 2024. URL: https://sustainabledevelopment.un.org/content/documents/4518SDGs_FINAL_ProposalofOWG_19Julyat1320hrsver3.pdf.

— (2014b). *Open Working Group proposal for Sustainable Development Goals*. Accessed on August 23, 2024 - through WaybackMachine Internet Archive. URL: https://sustainabledevelopment.un.org/sdgsproposal/.

Ouedraogo, Nadia S. (Dec. 2013). "Energy consumption and human development: Evidence from a panel cointegration and error correction model". In: *Energy* 63, pp. 28–41. ISSN: 03605442. DOI: 10.1016/J.ENERGY.2013.09.067.

Our World in Data (2021a). *Number of UN Peacekeeping Missions*. Accessed on January 2, 2024. URL: https://ourworldindata.org/grapher/number-un-peacekeeping-missions?time=earliest..2021&showSelectionOnlyInTable=1.

— (2021b). *Share of the population with access to electricity, 2021*. Accessed on August 4, 2024. URL: https://ourworldindata.org/energy-access.

— (2022). *CO2 and Greenhouse Gas Emissions Data Explorer*. Accessed on August 25, 2024. URL: https://ourworldindata.org/co2-and-greenhouse-gas-emissions.

Peyghami, Saeed et al. (Sept. 2019). "Failure mode, effects and criticality analysis (FMECA) in power electronic based power systems". In: *2019 21st European Conference on Power Electronics and Applications, EPE 2019 ECCE Europe*, pp. 1–9. DOI: 10.23919/EPE.2019.8915061.

Power Technology (Dec. 2021). *Kakira Biomass Power Plant, Uganda*. Accessed on July 16, 2024. URL: https://www.power-technology.com/marketdata/kakira-biomass-power-plant-uganda/?cf-view.

Reinaud, Guy (Jan. 2022). *Fighting against deforestation and climate change in Africa with pyrolytic clean cookstoves*. URL: www.pronatura.org.

Richardson, H W (1969). "The Economic Significance of the Depression in Britain". In: *Source: Journal of Contemporary History* 4 (4), pp. 3–19.

Rural Electrification Agency (July 2014). *Energy for Rural Transformation III-(ERT III) Project - Environmental and Social Management Framework*.

Secretary of State for Foreign Affaris (May 1929). *Treaty Series No. 17 (1929) - Exchange of Notes Between His Majestry's Government in the United Kingdom and the Egyptian Government in regard to the Use of the Waters of the River Nile for Irrigation Purposes*.

Serumaga, Mary (2017). "The case for repudiation of Uganda's public debt". In: *Committee for the Abolition of Illegitmate Debt*. Accessed on August 12, 2024. URL: https://www.cadtm.org/The-case-for-repudiation-of-Uganda.

Shove, Elizabeth, Matt Watson, and Nicola Spurling (Apr. 2015). "Conceptualizing connections: Energy demand, infrastructures and social practices". In: *European Journal of Social Theory* 18 (3), pp. 274–287. ISSN: 14617137. DOI: 10.1177/1368431015579964. URL: https://journals.sagepub.com/doi/10.1177/1368431015579964.

Showers, Kate B (2011). "Electrifying africa: an environmental history with policy implications". In: *Geografiska Annaler. Series B, Human Geography* 93 (3), pp. 193–221.

Sovacool, Benjamin K. and Michael H. Dworkin (2014). *Global Energy Justice - Problems, Principles, and Practices*. Cambridge University Press.

Stammer, D.W. (June 1967). *British Colonial Public Finance*. URL: https://www.jstor.org/stable/27856263.

Straeten, Jonas van der (2017). "Transmitting Development - Global Networks and Local Grids in the Electrification of East Africa, 1906-1970". PhD thesis. Gesellschafts- und Geschichtswissenschaften, der Technischen Universität Darmstadt, pp. 1–316.

The East African (July 2011). *'Budhagali' water spirits find a new resting place*. Accessed on July 10, 2024. URL: https://www.theeastafrican.co.ke/tea/magazine/-budhagali-water-spirits-find-a-new-resting-place--1304240.

The Independent (Oct. 2019). *Traditionalists mourn Bujagali oracle Nabamba Budhagali*. Accessed on July 10, 2024. URL: https://www.independent.co.ug/traditionalists-mourn-bujagali-oracle-nabamba-budhagali/.

The Morning Bulletin (May 1954). In: *The Morning Bulletin*. Newspaper article.

The New York Times (Mar. 1961). "Uganda Obtains Loan - Gets $8,400,000 to Expand Power From World Bank". In: *The New York Times*. Newspaper article.

The Stage (Oct. 1881). "Savoy". In: *The Stage*. Newspaper article.

Tolley, Howard E. and Colin Bruce (Oct. 1966). *Economic Memorandum on Uganda*.

Toussaint, Eric (Nov. 2015). *The World Bank*. Ed. by Sylvain Dropsy. Pluto Press. ISBN: 9781849643764. DOI: 10.2307/j.ctt18fsbxs.

Uganda (Dec. 2000). *Electricity Act (1964 Revision)*. URL: https://ulii.org/akn/ug/act/ord/1961/17/eng@2000-12-31.

Uganda Electricity Act, 1999 (1999).

UNCED (June 1992). *Agenda 21*.

UNDESA (2015). *GLOBAL SUSTAINABLE DEVELOPMENT REPORT - 2015 EDITION - ADVANCE UNEDITED VERSION*. URL: https://sustainabledevelopment.un.org/content/documents/1758GSDR%202015%20Advance%20Unedited%20Version.pdf.

United Nations (1973). *A/CONF.48/14/Rev.1 - Report of the United Nations Conference on the Human Environment*. Accessed on August 24, 2024. URL: https://documents.un.org/doc/undoc/gen/nl7/300/05/pdf/nl730005.pdf.

— (1992a). *AGENDA 21*. URL: http://www.un.org/esa/sustdev/agenda21.htm..

— (1992b). *United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, 3-14 June 1992*. Accessed on August 11, 2024. URL: https://www.un.org/en/conferences/environment/rio1992.

— (1993). *A/CONF.151/26/Rev.1 (vol. I) - Report of the United Nations Conference on Environment and Development*. Accessed on August 24, 2024. URL: https://documents.un.org/doc/undoc/gen/n92/836/55/pdf/n9283655.pdf.

— (1995a). *A/CONF.166/9 - Copenhagen Declaration on Social Development - Annex I - Copenhagen Declaration on Social Development*. URL: http://www.un-documents.net/cope-dec.htm.

— (1995b). *A/CONF.166/9 - Report of the world Summit for Social Development - Copenhagen, 6-12 March 1995*. Accessed on August 25, 2024. URL: https://documents.un.org/doc/undoc/gen/n95/116/51/pdf/n9511651.pdf.

— (2000). "A/RES/55/2: United Nations Millennium Declaration". In: URL: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_55_2.pdf.

United Nations (2002). *A/CONF.199/20 - Report of the World Summit on Sustainable Development*. Accessed on August 21, 2024. URL: https://documents.un.org/doc/undoc/gen/n02/636/93/pdf/n0263693.pdf.

— (2003). *A/RES/57/253 - Resolution adopted by the General Assembly - on the report of the Second Committee (A/57/532/Add.1) - World Summit on Sustainable Development*. Accessed on August 21, 2024. URL: https://documents.un.org/doc/undoc/gen/n02/556/06/pdf/n0255606.pdf.

— (Oct. 2005). *A/RES/60/1 - Resolution adopted by the General Assembly on 16 September 2005*. URL: https://documents.un.org/doc/undoc/gen/n05/487/60/pdf/n0548760.pdf.

— (Aug. 2012). *A/CONF.216/16 - Report of the United Nations Conference on Sustainable Development*. URL: https://documents.un.org/doc/undoc/gen/n12/461/64/pdf/n1246164.pdf.

— (Oct. 2015a). *A/RES/70/1 - Resolution adopted by the General Assembly on 25 September 2015 - Transforming our world: the 2030 Agenda for Sustainable Development*. Accessed on August 24, 2024. URL: https://documents.un.org/doc/undoc/gen/n15/291/89/pdf/n1529189.pdf.

— (2015b). *Transforming our world: the 2030 Agenda for Sustainable Development*. General Assembly. URL: https://sdgs.un.org/2030agenda.

— (2017). *A/RES/71/313 - Resolution adopted by the General Assembly on 6 July 2017*. Accessed on August 17, 2024. URL: https://documents.un.org/doc/undoc/gen/n17/207/63/pdf/n1720763.pdf.

— (2023a). *Goal 7 - Ensure access to affordable, reliable, sustainable and modern energy for all*. Accessed on August 12, 2024. URL: https://sdgs.un.org/goals/goal7.

— (2023b). *United Nations Conferences*. Accessed on January 3, 2023. URL: https://www.un.org/en/development/desa/what-we-do/conferences.html.

— (Mar. 2024a). *SDG indicator metadata - Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology*. Accessed on August 26, 2024. URL: https://unstats.un.org/sdgs/metadata/files/Metadata-07-01-02.pdf.

— (2024b). *SDG Indicators — SDG Indicators*. Accessed on March 18, 2024. URL: https://unstats.un.org/sdgs/metadata/?Text=&Goal=7&Target=.

United Nations Development Programme (2022). *Sustainable Development Goals - Background on the goals*. Accessed on August 23, 2024. URL: https://www.undp.org/sdg-accelerator/background-goals.

Warnock, Frank and Patrick Conway (1999). *Post-Conflict Recovery in Uganda*.

Whiting, Kate (2021). *Cooking with polluting fuels is a silent killer - here's what can be done*. URL: https://www.weforum.org/agenda/2021/10/polluting-cooking-fuels-deaths-women-climate/.

Wilson, Gail (1967). "Owen Falls - Electricity in a Developing Country". In: *East African Studies* (27), pp. i–110.

Winner, Langdon (1980). "Do Artifacts Have Politics?" In: *Daedalus* 109 (1), pp. 121–136. URL: https://faculty.cc.gatech.edu/~beki/cs4001/Winner.pdf.

World Bank (Dec. 1995). *Project Completion Report - Uganda - Second Power Project*. URL: https://documents1.worldbank.org/curated/en/702091468341932123/pdf/multi-page.pdf.

— (2001). *BP 4.12 - Involuntary Resettlement*. Last revision in April 2013. URL: https://thedocs.worldbank.org/en/doc/171c4239aa97b62d02eb298f955a9f0a-0290012023/original/BP-4-12-Involuntary-Resettlement.pdf.

— (June 2002). *Implementation Completion Report on a Credit in the Amount of USD 125 Million to the Republic of Uganda For the Third Power Project*.
— (June 2008). *Project Performance Assessment Report - Uganda - Third Power Project (Credit No. 22680-UG); And Supplemental to Third Power Project Credit (No. 22681-UG)*.
— (2022). *Development Projects : Electricity Access Scale-up Project (EASP) - P166685*. URL: https://projects.worldbank.org/en/projects-operations/project-detail/P166685.
World Bank (Africa Energy Group) (Dec. 2009a). *Implementation completion and results report on a credit in the amount of US49.15andaGEFGrantofUS12.12 million to the republic of Uganda for an Energy for Rural Transformation Program in support of the first phase of the Energy for Rural Transformation Program*. URL: https%3A%2F%2Fdocuments1.worldbank.org%2Fcurated%2Fen%2F414141468108858762%2Fpdf%2FICR12880Revise1revious0records10111.pdf.
— (Mar. 2009b). *Project Appraisal Document on a Proposed Credit in the Amount of SDR 49.5 Million (US$75 Million Equivalent) and a Proposed Grant from the Global Environment Facility Trust Fund in the Amount of US$9 Million to the Republic of Uganda for an Energy for Rural Transformation Project in Support of the Second Phase of the Energy for Rural Transformaion Program*.
— (May 2015). *Project Appraisal Document on a Proposed Credit in the Amount of SDR 97.9 Million (US$135 Million Equivalent) and a Proposed Grant from the Global Environment Facility Trust Fund in the Amount of US$8.2 Million to the Republic of Uganda for an Energy for Rural Transformation Project in Support of the Third Phase of the Energy for Rural Transformaion Program*.
— (June 2017). *Implementation Completion and Results Report on a Credit in the Amount of XDR 57.6 Million (US$87 Million Equivalent) A Global Environment Facility Trust Fund Grant in the Amount of US$9 Million and a Global Partnership for Output Based Aid Grant in the Amount of US$5.5 Million to the Republic of Uganda for an Energy for Rural Transformation Project in Support of the Second Phase of the Energy for Rural Transformaion Program*.
World Bank Group (2022a). *Access to clean fuels and technologies for cooking (population)*. Accessed on October 14th, 2024. URL: https://data.worldbank.org/indicator/EG.CFT.ACCS.ZS.
— (2022b). *Access to electricity, rural (Uganda*. Accessed on July 26th, 2024. URL: https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS?locations=UG&skipRedirection=true.
— (2022c). *Access to electricity, urban (Uganda*. Accessed on July 26th, 2024. URL: https://data.worldbank.org/indicator/EG.ELC.ACCS.UR.ZS?locations=UG&skipRedirection=true.
— (2023). *Rural population (% of total population)*. URL: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=UG.
— (2024). *Energy for Rural Transformation III*. Accessed on July 27th, 2024. URL: https://projects.worldbank.org/en/projects-operations/project-detail/P133312.
World Energy Council (2024). *World Energy Trilemma Framework*. Accessed on August 3rd, 2024. URL: https://www.worldenergy.org/transition-toolkit/world-energy-trilemma-framework.
Worthington, E.B. (Dec. 1946). *A Development Plan for Uganda*. URL: https://www.calameo.com/read/0002090827691246be844.
Youssef, Adel Ben et al. (2016). *Energy Consumption and Health Outcomes in Africa*.