Closing the electricity deficit, at what costs?

THE IMPACT OF SMALL HYDROPOWER PROJECTS IN WEST UGANDA

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Abstract

Through the means of hydropower development Uganda has embarked on a mission to provide electricity to everybody by 2030. Much research has been done on the impact of large hydropower projects, however little is known about the impact of small hydropower projects. The aim of this research is to study the direct and indirect social and environmental impacts of small hydropower projects in west Uganda, and to study the displacement and resettlement effects. This leads to the following main research question:

What is the impact of small hydropower projects on the access and use of water and land, and on displacement and resettlement for the affected communities in west Uganda?

The research is carried out in west Uganda and the Rwimi small hydropower project is selected as case study. Using different research methods data is collected in four villages, three in the project area and one downstream. Desk research, focus group discussions and interviews with key informants and households in the affected villages have resulted in the following information.

The first discovery is the high number of hydropower projects in the country, 60 in total. Small hydropower projects account for 50% of the total number, which confirms that these projects have become a major focus in the effort to expand electricity throughout the country. When looking at the actors involved in Uganda's electricity sector, it becomes clear that the sector is centralised and under government control.

This study shows that the Rwimi project affects people's access and use of water and land. The degree of these impacts varies between the four villages. It also shows differences in impact between the project area and the downstream community, confirming that it is important to pay attention to the indirect effects of such projects.

It has become clear that access to electricity in the affected area is not always a given. Even though most benefits mentioned in the approval documents for the project rely on the assumption of electricity provision, only two of the 96 affected households have gained access to electricity.

When it comes to these small projects the general sense is that displacement and resettlement is less of an issue. The Rwimi project did not cause any physical displacement of people or demolition of houses. However, pieces of land had to be acquired causing 96 people to be economic resettled and compensated. The main issue in this process is the valuation of land, causing people to feel they received an unfair compensation.

The last point that must be addressed is the accumulative impact. Considering the high number of projects clustered in the western part of Uganda their impact can stack up. Where the impact may often be considered negligible at the individual level, the sum of the impacts can lead to big negative consequences. This accumulative impact needs to be understood and incorporated in the approval process.

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List of figures and tables

List of abbreviations

BIO	-	Belgian Investment Company for Developing Countries
DIDR	-	Development Induced Displacement and Resettlement
EPHL	-	Eco Power Holdings Limited
ERA	-	Electricity Regulatory Authority
ESIA	-	Environmental & Social Impact Assessment
ESMU	-	Environmental and Social Management Unit
GIS	-	Geographic Information System
GoU	-	Government of Uganda
GWh	-	Gigawatt hour
IPPs	-	Independent Power Producers
LIF	-	Livelihood Improvement Framework
MDGs	-	Millennium Development Goals
MW	-	Megawatts
NEMA	-	National Environmental Management Authority
NORFUND	-	Norwegian Investment Fund for Developing Countries
PAP	-	Project Affected People
PEAP	-	Poverty Eradication Action Plan
PPAs	-	Power Purchase Agreements
RAP	-	Resettlement Action Plan
REFiT	-	Renewable Energy Feed-in-Tariff
REP	-	Renewable Energy Policy
ROR	-	Run-Of-River
SDG	-	Sustainable Development Goals
SHP	-	Small Hydropower Projects
SMEs	-	Small & Medium Enterprises
UETCL	-	Uganda Electricity Transmission Company Limited
UGX	-	Ugandan Shilling
ULGA	-	Uganda Local Governments Association
UNLF	-	Uganda National Liberation Front

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1. Introduction

More than 1.1 billion people in developing countries lack access to electricity with a large share living in rural Africa. It is hypothesized that economic and human development are difficult without access to electricity. Therefore, the access to reliable modern energy has become one of seventeen Sustainable Development Goals (SDG) and the international community has embarked on a historical mission through the United Nations Initiative Sustainable Energy for All (SE4All) that strives to provide electricity to everybody by 2030 (Bensch, et al., 2017).

The interconnectedness between energy access and poverty reduction has been the top subject for multinational organizations, governments, and economists all over the world. Available data on Africa's income show that the share of Africans living on less than a dollar a day is on constant increase, the number of the poor in Africa has shot up five times more than the figure for Latin America, and twice that for South Asia (Bensch, et al., 2017). One proven method for reducing poverty is the access to sustainable electricity (Kanagawa & Nakata, 2008).

Expanding rural access to electricity is one of the top priorities of the Ugandan government. Currently, only 10.3% of the total rural population in Uganda has access to electricity and therefore the need for new sources of electricity is acute (The World Bank, 2017). To overcome this problem, the government of Uganda (GoU) has made a policy decision encouraging the private sector to develop and operate small hydropower projects (SHP) as a means of providing a wide electricity service in the country (Bower, 2014). Under this policy, government and the private sector are investing fully in these projects.

At the same time, Uganda is experiencing economic growth and rapid urbanization, which are driving a steady increase in energy demand. Electricity demand is increasing at a rate of 8.2% annually, which translates to 125,000 new customers every year (de la Rue du Can, Pudleiner, & Jones, 2017). This swift expansion has been fuelled by a dynamic economy that is growing at an average annual rate of 7%, placing Uganda among the fastest-growing economies in the world (de la Rue du Can, Pudleiner, & Jones, 2017).

Presently, SHP account for only a small percentage of electricity generation capacity in Uganda, but a lot of potential exists. Uganda features mountainous areas with many small rivers where hydropower plants can be developed. More than 50 potential small hydropower sites have been identified in Uganda through various studies (Bower, 2014). Because of its mountainous characteristics the western part of Uganda is especially suitable for SHP and has been getting a lot of attention in the past years. Several SHP have been completed in this area and more SHP are under construction or being planned and funded by diverse international and national actors (REA, Rural Electrification Agency, 2017).

Insights on the effect of rural electrification on local communities in different parts of the world have been provided by numerous studies, i.e. (Aglina, Agbejule, & Nyamuame, 2016; Kirubi, Jacobson, Kammen, & Millis, 2009; Nanka, 2008). And as hydropower is a hot topic in today's energy provision these projects have been used in several case studies, i.e. (Mboumboue & Njomo, 2016; Muhoro, 2010; Sharma & Thakur, 2017). Traditionally much attention has focused on large projects and the effects on people living in close proximity to these projects. According to research these large projects lead to certain social and environmental impacts and have a displacement effect (Bower, 2014).

Overall less scientific research has been done on SHP, but they are gaining attention as more governments and organisations commit to these projects. As part of the approval process for SHP, an impact assessment is usually mandated. Prior to building consent, an environmental and social impact assessment (ESIA) must be carried out by the hydropower developers (IFC, 2017b).

In these assessments, most projects identify the impacts and mitigation measures for the people who will be directly affected, but the impacts on people living downstream are usually addressed superficially or ignored (Sivongxay, Greiner, & Garnett, 2017). Hydropower installations affect the flow, quality and quantity of water released downstream, thus affecting the riverine and riparian ecosystems services (FIVAS, 2007). This means that impacts of SHP could extend downstream where people's livelihoods depend on the ecosystem services provided by the rivers.

New to the debate is the accumulative effect of SHP in a certain area. This accumulative effect is the result from the successive, incremental, and/or combined effects of a project when added to other existing, planned, and/or reasonably anticipated future ones. When added together this can cause significant environmental and social impacts, whereas they may often be considered negligible at the individual project level (IFC, 2017a).

Therefore, a lack of research still exists when looking at the impacts of SHP. Especially considering the indirect and accumulative effects of these projects. The objective of this research is to study the direct and indirect social and environmental impact, and the displacement and resettlement effects of SHP in west Uganda. To discover these impacts one specific project will be examined in detail. This can result in recommendations for future SHP development or indicate effects that have not been addressed considering the local context.

1.1 Research question

The objective of this research leads to the following main research question:

What is the impact of small hydropower projects on the access and use of water and land, and on displacement and resettlement for the affected communities in west Uganda?

To further help answer the main question several sub questions have been formulated:

- Which small hydropower projects are there in west Uganda?
    - How many SHP are located in the area?
    - Which actors are involved in hydropower in west Uganda?

- What is the change in access to water and land?
    - Change in access to water and land in project area?
    - Change in access to water and land downstream?

- What is the change in use of water and land?
    - Change in use of land and water in project area?
    - Change in use of land and water downstream?

- How did the displacement and resettlement process take place?
    - Level of information and engagement of local people in project development?
    - Displacement and degree of compensation?
    - Have certain conflicts taken place during the process?

Considering the research objective, the following hypotheses have been formulated:

1. Small hydropower projects affect the access to water and land in their direct proximity.

2. Small hydropower projects affect the access to water and land in downstream communities.

3. Small hydropower projects change the flow of the river, leading to changes in use of water and land in their direct proximity.

4. Small hydropower projects change the flow of the river, leading to changes in use of water and land in downstream communities.

5. Small hydropower project development causes people to be displaced or resettled.

First the national context of Uganda will be discussed to provide some background information on the research area. The following chapter reviews the current concepts and theories on hydropower development after which the methodology will be explained. The methods used to gather the data and a reflection on the use of these methods is included. Then the collected data on the different sub questions will be discussed resulting in the conclusion, which reflects on the findings in terms of general implications and policy recommendations.

2. National context

This research will take place in Uganda, officially the Republic of Uganda. It is a landlocked developing country in East Africa. It is bordered by five different countries, to the east by Kenya, to the north by South Sudan, to the west by the Democratic Republic of the Congo, to the south-west by Rwanda and to the south by Tanzania (CIA, 2017), see figure 1. Uganda is placed in the African Great Lakes region, and lies almost completely within the Nile basin. Around 18% of the total area of Uganda is open water and large areas are covered by swamps. In the south the country includes a substantial portion of Lake Victoria, shared with Kenya and Tanzania. Being one of the world's biggest lakes it has heavily influenced much of the south of the country. The most important cities are located in this area including the capital Kampala (CIA, 2017). The country can be divided into four regions: northern, eastern, central and western.

Fig 1: Map of Uganda (Nations Online, 2018).

2.1 Uganda background

Starting in 1894, the area was ruled as a protectorate by the British, who established administrative law across the territory (Watt, Flanary, & Theobald, 1999). In 1921 Uganda was given a legislative council and in 1958 the country was given internal self-government. On 9 October 1962 Uganda gained independence from Britain, with Milton Obote as prime-minister. The economic situation at independence was reasonably strong and the future perspectives were positive due to the existence of legislative and parliamentary institutions and sound electoral procedures (Watt, Flanary, & Theobald, 1999).

The prime-minister Obote pursued economic development policies up to 1966 which focused on agriculture. From 1962 up to 1971 the country's GDP grew by an average of 5.2% per year. However, soon after the independence of Uganda the country started to experience difficulties caused by ethnic tensions. Obote continued to lead the country under unitary presidential rule but had to work with a fragile coalition and a weak support base (Watt, Flanary, & Theobald, 1999). He abolished the local government system that was inherited at independence and undermined the authority of the chiefs, leading to Uganda's worst period in history.

Milton Obote was overthrown in 1971 as result of a coup led by Idi Amin, by then a senior army officer from the north of Uganda. It initiated the beginning of a period of political instability and economic decline (Watt, Flanary, & Theobald, 1999). According to Amin, an economic war was needed to 'Africanise' the private sector, and he ordered Asians who were not Ugandan citizens to leave the country. Skilled manpower was replaced by unskilled manpower to manage the economy in the name of 'nationalisation' (Watt, Flanary, & Theobald, 1999). However, as the Asians provided the backbone of Uganda's industry and business, Amin undermined the economic base of the country. As a result, poverty and widespread corruption increased causing the GDP to decline by 25% (Watt, Flanary, & Theobald, 1999).

The invasion of Uganda in 1979 by Tanzania, together with 26 anti-Amin forces that were united under the Uganda National Liberation Front (UNLF) marked the end of the power of Amin. He was forced to flee out of the country and the next ten years were characterized by further political instability, but also economic recovery. During the next period the country continues to recover and between 1990 and 2000 Uganda experiences economic growth and political stability (Watt, Flanary, & Theobald, 1999). In this period president Museveni proposed a Ten Point Program which should bring progress and development to Uganda. This manifesto included several solutions, based upon:

"the creation of a complete democratic infrastructure from village level upwards; the restoration of individual and community security via these local democratic structures, supported by an army and police under political control and maintained by uncorrupted political leaders and public servants; the removal of ethnic factionalism and the consolidation of national identity; the provision of basic social services; and, most importantly, the building of an independent and sustainable national economy" (Watt, Flanary, & Theobald, 1999, p. 41).

By this time an important objective in development thinking was poverty eradication as well as creating a better environment to enhance business and economy (The World Bank, 2016). Inspired by the Millennium Development Goals (MDGs) the Poverty Eradication Action Plan (PEAP) was introduced in Uganda in 1997. The percentage of the population living below the poverty line declined from 56% in 1992/93 to 44% in 1997/98 to 31% in 2005/06 and to 19% in 2013 (The World Bank, 2016).

The government of Uganda continues to be committed to achieving the Sustainable Development Goals, most of which line up with the national vision statement of the country: National Vision 2040. This vision focusses on a transformed Ugandan society from a peasant to a modern and prosperous country by 2040. The Ugandan government estimates that 76% of the SDGs targets are reflected in this vision and adapted to the national context. Uganda has shown tremendous improvement in some SDG indicators and focus areas, but much work remains to change the country from a predominantly low income to a competitive upper-middle income country (UNDP, 2018).

2.2 Political structure

In Uganda the president is both head of government and head of state. To aid him in his function the president appoints a vice-president and a prime minister (CIA, 2017). The parliament is formed by the National Assembly, consisting of 449 members. These include; 290 constituency representatives, 116 district woman representatives, 10 representatives of the Uganda Peoples Defence Forces, 5 representatives of the youth, 5 representatives of workers, 5 representatives of persons with disabilities and 18 ex-official members (CIA, 2017).

As of 2017, the country is divided into 121 districts (MOLG, 2017). Within these districts the rural areas are subdivided into sub-counties, parishes, and villages. The urban areas are subdivided into municipal and town councils. Parallel with the state administration, five traditional Bantu kingdoms still remain. They do not have much power but do enjoy some degree of autonomy, especially cultural autonomy. The kingdoms are Toro, Busoga, Bunyoro, Buganda, and Rwenzururu (MOLG, 2017).

2.3 Economy

Uganda has substantial natural resources, including fertile soils, regular rainfall, small deposits of copper, gold, and recently discovered oil. Agriculture is the most important sector of the economy, employing more than one-third of the country work force. Food crop production dominates the agriculture sector contributing over 55% of the agricultural GDP, while cash crops contribute 17%, livestock 15%, fisheries 10% and forestry 3% (FAO, 2017). Ugandan agriculture is mainly dependent on rainfed agriculture by small- and medium-scale farmers. On average these farmers own around 1.1ha of cultivatable land (FAO, 2017). The agricultural productivity is however relatively low which can be explained by the limited use of irrigation, as well as the absence of modern agricultural practices and inputs the (FAO, 2017).

The traditional exports crops that are produced in Uganda are cereals (maize, sorghum, millet, rice). In addition to these crops also cut flowers and cocoa are nowadays being exported (FAO, 2017). The different climate zones in the country result in different crops being produced. The relatively high rainfall areas are most suitable for banana and coffee production, while tea estates enjoy the benefits of the climate in the highland area. Other components of the primary sector in Uganda are livestock and fisheries. The latter can be explained by the large part of the country which is covered with water (FAO, 2017).

2.4 Demography

The population density in Uganda is relatively high in comparison to other African nations (CIA, 2017). Most of the population is concentrated in the central and southern parts of the country, particularly along the shores of Lake Victoria and Lake Albert (CIA, 2017). The population growth in Uganda is relatively evenly distributed per region and the total population has grown from 12,5 million in 1991 to 38,3 million in 2017 with a current population growth rate of 3.22% (The World Bank, 2017).

The country has one of the youngest and most rapidly growing populations in the world. The median age for males is 15,7 years and for females 15,9 years, and its total fertility rate is among the world's highest at 5.8 children per woman (CIA, 2017). These statistics show that Uganda can boast about a large population that can be classified as a work force, which can in turn help in its growth. However, with a huge percentage of the population that is young, it could prove to be a grave situation for the country as it must provide for these children and make sure that it can control its high birth rate. Unchecked, population increase can further strain the availability of arable land and natural resources and overwhelm the country's limited means for providing food, employment, education, health care, housing, and basic services (CIA, 2017).

2.5 Energy

Uganda is richly endowed with different energy resources, which are evenly distributed throughout the country (The World Bank, 2015). These include hydropower, biomass, solar, geothermal, peat and fossil fuels. The most important source of energy for most people in Uganda is biomass. About 90% of the total energy consumption is generated through biomass, firewood being the most dominant. Oil products account for 9.6% and electricity account for the remaining 1.4% (The World Bank, 2015).

Concerning electricity generation, Uganda currently has 850 Megawatts (MW) of installed capacity, of which approximately 645 MW is hydropower and 101.5 MW is thermal generating capacity. Access to electricity at national level in Uganda is low with around 21% in 2015. The country currently has one of the lowest per capita electricity consumption in the world, but as shown in the table below the access to electricity is increasing (The World Bank, 2015).

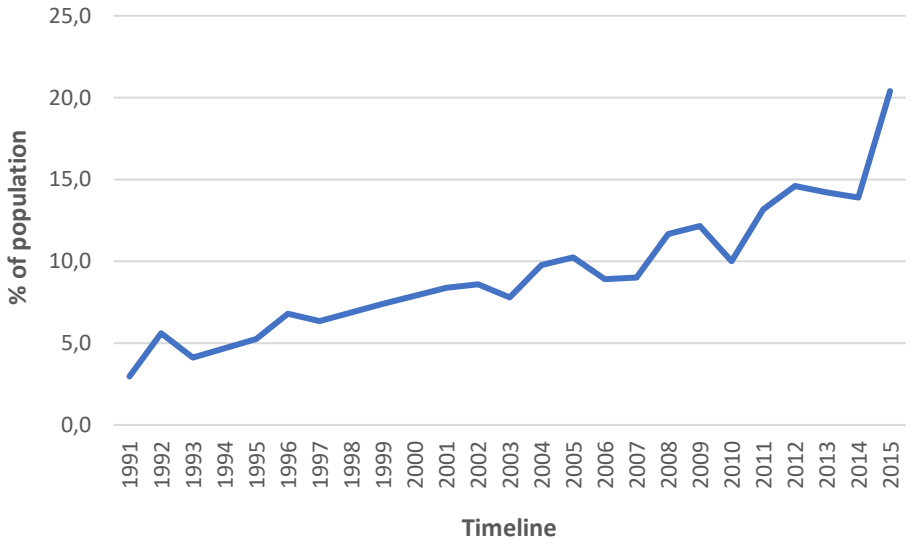

Fig 2: Access to electricity in % of population from 1991-2015 (The World Bank, 2017).

When the access to electricity is set out to urban and rural population there appears to be a serious division. The table below shows that the rural population lacks access to electricity and when compared to urban population it also lacks growth in access. Only 10,3% of the rural population has

access to electricity in 2015 and to manage this problem, rural electrification has become a key objective of the Ugandan government.

Electricity access	1992	2015
Access to electricity, urban (% of urban population)	33,6	51,4
Access to electricity, rural (% of rural population)	1,5	10,3

Table 1: Urban and rural division of access to electricity (Data World Bank, 2017).

In 1999, the power sector underwent extensive sector reforms that led to the un-bundling of generation transmission and distribution. Under the Electricity Act of 1999, the Electricity Regulatory Authority (ERA) was established as an independent sector regulator; opening the sector to private sector investment and participation (USAID, 2018). Today, distribution is regulated, and cost-reflective tariffs are utilized, with 54% of power generation coming from independent power producers (IPPs). Significant public investment has been injected into the energy sector, particularly in the area of electricity supply. Following liberalisation, the electricity sector is now attracting the largest private sector investments in the country. These investments create a major source of employment but also serve as a vital input into other sectors (The World Bank, 2015). In 2007 a new policy was introduced to reform the energy sector and focus more on renewable energy: The Renewable Energy Policy (REP).

Within this policy the government has developed a feed-in-tariff structure, to promote the development and use of renewable energy sources. Renewable Energy Feed-in-Tariff (REFIT) is a tool used for promoting the generation of electricity by the private sector, focused on renewable energy sources (ERA, 2016). This feed-in-tariff structure only applies to small-scale projects which generate up to a maximum capacity of 20 MW. In the context of REFIT renewable energy is defined as electricity, which can be generated from energy resources such as water power, wind power, solar energy, geothermal energy, biogas and landfill gas combustion, and biomass cogeneration (ERA, 2016).

3. Theoretical review

After the introduction of the main topic and the national context of the country, this chapter will elaborate on the relevant theoretical concepts that are needed to guide this research.

3.1 Small hydropower projects

In this research small hydropower projects (SHP) play a central role and thus must be examined. These type of hydropower projects use a different kind of system than the large hydropower dams, namely run-of-river (ROR) systems. This means running water is diverted from a flowing river and guided down a channel, or penstock, that leads to a generating house (Helston & Farris, 2017). There the force of the moving water spins a turbine and drives a generator. The water is fed back into the main river further downstream. The figure below represents a schematic example of a SHP as explained. The difference between ROR and large hydropower plants is that ROR systems do not dam the river to create a water reservoir. Most ROR facilities do use a small dam, or weir, to ensure enough water enters the penstock and have a small reservoir called pondage to store small amounts of water for same-day use. However, they cannot store large amounts of water for future use like large hydropower plants (Helston & Farris, 2017).

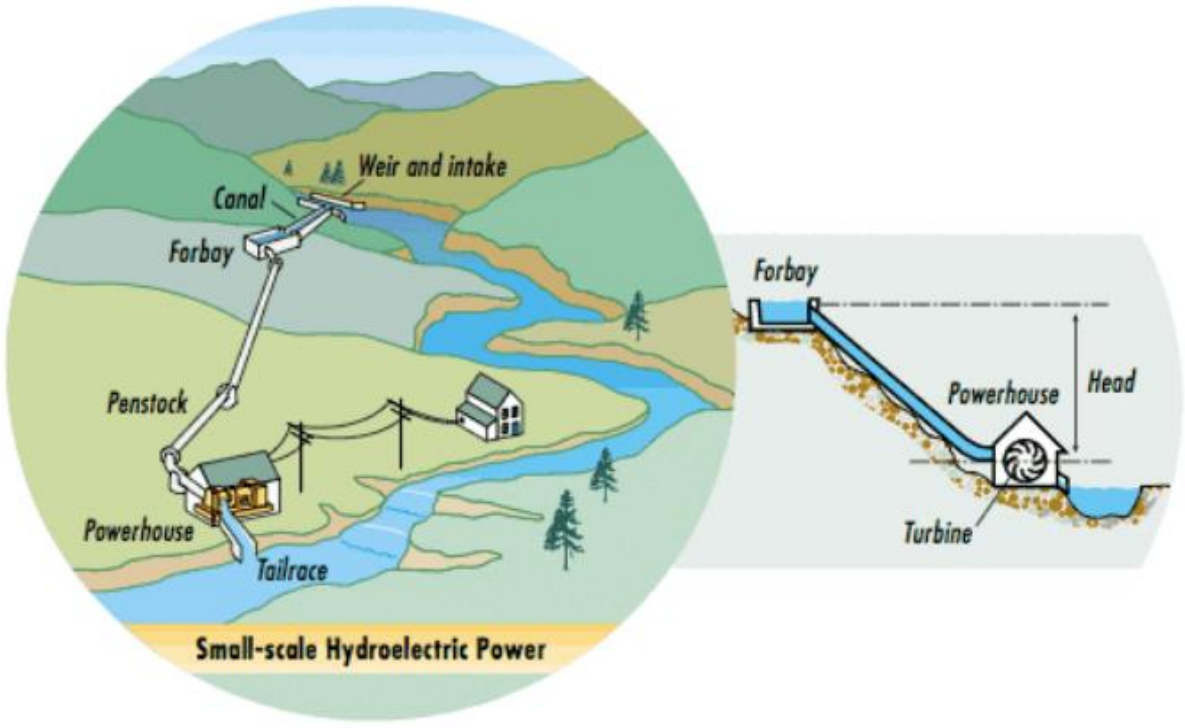

Fig 3: A schematic example of a SHP (Modal, Solomon, Tew, Gerhman, & Lehner, 2014).

The absence of a major reservoir in SHP has two main implications, one being more negative and the other positive. The first is that if or when the river's water levels are depleted because of drought or water extraction, the 'fuel' for the ROR system is reduced or becomes entirely unavailable. Without a dam for storing water, there is no stored power. This means the capacity factor of SHP varies between 40% and 80% (Helston & Farris, 2017). The second implication is that the lack of a major reservoir reduces the environmental footprint of SHP.

The use of the term ROR for power projects varies around the world. Some may consider a project ROR if power is produced with no water storage while others may consider limited storage acceptable. Furthermore, there is still no universal international definition for SHP, but it is generally defined by a generating capacity with upper limits varying from 10 to 50 MW. Among international agencies, there is a growing consensus that SHP are defined as having a capacity between 1 and 15 MW (Kelly-Richards, et al., 2017). Yet despite the gradual recognition of SHP as a separate subset of hydropower, definitions still vary among nation states, international agencies, and NGOs. In this research the classification of table 3 will be used where SHP have a capacity ranging between one and fifteen MW.

Classification	**Capacity**
Mini Hydropower Projects	< 1 MW
Small Hydropower Projects	1 – 15 MW
Large Hydropower Projects	> 15 MW

Table 2: Hydropower project classification (Helston & Farris, 2017).

As a well-established renewable energy source, hydropower is playing a great role in the shift towards a less carbon-intensive future and focuses on sustainable development. Hydropower development does not only improve energy supply and thus contribute to the energy SDGs (Zhang, et al., 2017), but it can also reduce poverty as will be elaborated in the next sub chapter. Although SHP are looked upon positively there are some drawbacks. SHP are considered an 'unfirm' source of power: a ROR system does not have the capacity to store energy and therefore cannot precisely match the output of electricity generation with consumer demand (Helston & Farris, 2017). This means that these systems generate more energy during times when river flows are high and less during the dry summer months. Another drawback is that SHP divert an amount of river water which reduces the river flow, affecting water velocity and depth, minimizing habitat quality for fish and aquatic organisms (Helston & Farris, 2017).

When developed with care to footprint size and location, SHP can generate sustainable energy while minimizing the environmental and social impacts. Like all hydro-electric power, these projects use the natural potential energy of water. This eliminates the need to burn coal or natural gas to generate the electricity used by individual consumers and industry (Helston & Farris, 2017). Moreover, SHP do not flood an area to create reservoirs, therefore eliminating the methane and carbon dioxide emissions caused by the decomposition of organic matter (Helston & Farris, 2017). In tropical countries where methane generation can be a problem this is a particular advantage.

Public discourse on SHP often mistakes the reduction of environmental and social impacts for elimination of them. It is important to understand that SHP inflicts a smaller impact on aquatic ecosystems and local communities, but like all forms of energy cannot completely prevent stresses on plant, animal, and human well-being (Helston & Farris, 2017). The impacts of SHP will be further elaborated in chapter 3.4 but first the relationship between energy and development needs to be discussed.

3.2 Hydropower as a development strategy

Electrification and development are often assumed to go hand in hand. The relationship between the two has been demonstrated by a comprehensive study that analysed 77 countries over a period of 25 years (Hirmer & Guthrie, 2017). Although the researchers highlighted that this relationship is dependent on the interaction of multiple factors, electrification is seen as a key mechanism to improve living standards, to increase income through 'income-generating activities' and to improve community services such as education and health services. Despite said benefits, a rising population, a shortfall in sustainable energy projects and partial uptake of modern energy sources has meant there has been slow progress in this sector (Hirmer & Guthrie, 2017).

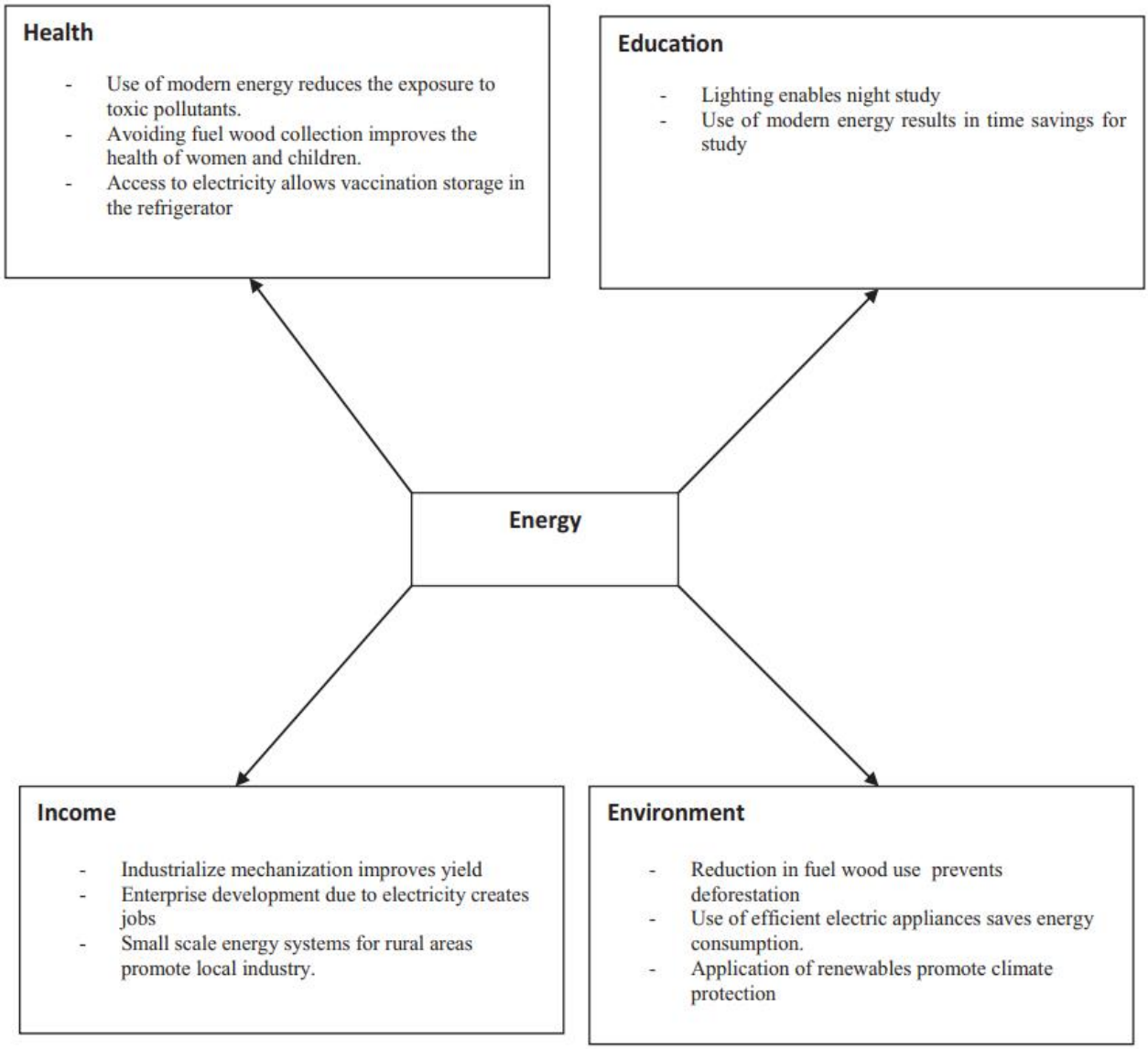

Fig 4: Linking energy with components of poverty (Kanagawa & Nakata, 2008).

Kanagawa and Nakata (2008) provide a conceptual framework of the relationship between energy access and poverty indicators. Energy access has influence on socio-economic development and therefore world donors have made efforts to improve areas such as education, health, income and environment. These indicators are directly connected to energy as shown in figure 3.

3.2.1 Health

According to WHO (2014), “Energy access is a critical enabler of access to medical technologies, and thus an important determinant of the effective delivery of essential health services “ (p. 2). Despite this, a study found that only 36% of hospitals in sub-Saharan Africa have reliable energy access (Adair-Rohani, et al., 2013). Whilst there are different energy requirements pertaining to the size of the health centre and the services offered by said facilities, electricity access in health centres can significantly improve a wide range of health services through. For example, extended night-time hours, faster emergency response and improved equipment (Hirmer & Guthrie, 2017).

Energy access can also provide households to change the way they cook food. Cooking on biomass, such as firewood, charcoal or animal dung, is one of the most serious public health problems in the world (WFP, 2017). Indoor air pollution and inhaling smoke during cooking is a key cause of respiratory diseases that kills more than 4 million people every year. Women and children being the most affected. Another health issue related to safe cooking is the collection of firewood. Particularly women and children often travel long distances to collect firewood putting them into risk of gender-based violence (WFP, 2017).

3.2.2 Education

Globally there are approximately 200 million children attending primary and secondary schools which are not connected to energy services (Sovacool & Ryan, 2016). Inclusive and quality education is a key driver for sustainable development, as described by Sovacool and Ryan (2016): “Education is widely recognised as one of the most essential components for poverty reduction” (p. 108). According to UNESCO's ‘Education for All’, in 2015 a total of 58 million children worldwide did not attend school and 100 million did not complete their primary education. And the majority of those not receiving adequate opportunities for education are girls (UNESCO, 2015). Reasons for the gender inequality include the time intensive daily chores conducted by girls, such as the collection of firewood, and inadequate hygiene facilities: “adolescent girls’ concerns over privacy, particularly during menstruation, influence their education decisions and can act as an obstacle to school attendance” (Hirmer & Guthrie, 2017, p. 925). Improving the infrastructure of schools, such as energy access, can be vital for improving rural livelihoods. It helps to shift the imbalance between rural and urban communities by making rural dwellers more competitive, such as in their ability to receive higher levels of education. For example, energy access makes lighting possible which can expand the period of time for school attendance and other educational activities for children (Kanagawa & Nakata, 2008). Due to electrification rural households can obtain sufficient luminescence to study at night, but are also able to use television, radio and mobile phones for educational purposes. Concluding, access to electricity and other modern energy can create child-friendly educational environments (Kanagawa & Nakata, 2008).

3.2.3 Income

The EU Energy Initiative Partnership Dialogue Facility states that the “residential use of electricity improves the quality of life of the rural community while productive use of renewable energy in rural areas leads to increased rural productivity, higher economic growth and a rise in rural employment” (Lecoque & Wiemann, 2015, p. 4). Additionally, agricultural practices are the dominant source of income in most developing countries. Therefore, improving agricultural practices is a critical element for the economies of developing countries as it is linked to increased rural productivity, food security, higher economic growth and a rise in rural employment (Lecoque & Wiemann, 2015). In addition to the agricultural sector, rural electrification initiatives can greatly benefit the local service sector by

providing electricity to hairdressers, beer halls, shops, kiosks and local repair and maintenance businesses for instance (Hirmer & Guthrie, 2017). Additionally, small and medium enterprises (SMEs) that undertake labour intensive activities such as milling, or fruit and vegetable processing can greatly benefit through increased productivity as well (Lecoque & Wiemann, 2015).

3.2.4 Environment

In addition to social and economic impacts, there are also environmental impacts related to electrification that can be distinguished. One of the most important choices in the electrification process of a country is which energy sources to use, without increasing total greenhouse gas emissions (Borges da Silveira Bezerra, et al., 2017). Therefore, renewable energy systems are increasingly regarded as the most favourable option for providing power and electricity. Research has shown that when access to electricity is available, family expenses with kerosene, diesel, oil, gas and batteries drop. This makes electricity a substitution for traditional fossil fuel (Borges da Silveira Bezerra, et al., 2017). Not only can it serve as a substitute for fossil fuel but also for wood that is being used for heating and cooking. Therefore, reducing deforestation, reducing landslides and reducing the loss of soil fertility which are forms of environmental degradation with global importance (Tanner, 2015).

3.3 Hydropower and development-induced displacement and resettlement

The past century was a period of rapid economic development in many areas of the world (Terminski, 2013). Although it has led to an improved quality of life in many regions, just as often the consequence was the deterioration of living conditions and various forms of marginalization of the poorest and already excluded communities (Terminski, 2013). Hydropower projects are historically a good example of this phenomenon. Their implementation serves the economic interests of the country and so improves the well-being of all its citizens. At the same time certain groups of people are forced to move from their homes and land as a result of these development projects (Cernea, 1996).

The construction of large dams is a typical example of projects implemented for the greater good. These projects can lead to an increase in the amount of available energy and therefore lowering its price. This can in turn then contribute to economic growth of the whole nation (Terminski, 2013). In addition, these projects can yield other benefits as stated in the chapter before. However, the increased energy supply and accompanied well-being of residents cannot be achieved through the displacement of project affected people (Terminski, 2013). Several policies of developing states regard involuntary resettlement as a necessary and unavoidable cost of development, and the people affected by it as victims of a just cause (Terminski, 2013). For those who are displaced, the end result is most often loss of livelihood and impoverishment (Cernea, 1996).

It is estimated that development-induced displacement and resettlement (DIDR) may directly affect over 15 million people each year making it the world's largest statistical category of internal displacement. Other categories being; conflict-induced displacement, environmentally-induced displacement and disaster-induced displacement (Terminski, 2013). According to Robinson forced displacement refers to "individuals or communities compelled, obliged, or induced to move when otherwise they would choose to stay put; the force involved may be direct, overt and focused, or indirect, covert, and diffuse" (Robinson, 2003, p. 5).

3.3.1 Displacement or resettlement

When analysing the contemporary picture of displacement caused by development two different terms are usually employed: displacement and resettlement. Sometimes used interchangeably both do however have a different meaning. Displacement is commonly used in the context of relocation related to a decrease in access to existing land and resources, without adequate support mechanisms for the affected people (Terminski, 2013). This phenomenon is mainly associated with the loss of economic and social facilities and loss of access to livelihood resources, with no benefits gained in return (Terminski, 2013). It is mostly applied to the situation where individuals and/or communities have been cut off from their socio-economic base and their standard of living deteriorate significantly.

Two specific forms of displacement can be distinguished; physical displacement and economic displacement. The first is used when land acquisition results in the loss of shelter and assets causing project affected people (PAP) to move to another location. Economic displacement is considered "the loss of income or means of livelihood resulting from land acquisition or obstructed access to resources caused by the construction or operation of the project or its associated facilities" (Terminski, 2013, p. 101).

Resettlement is more process-related than displacement (Terminski, 2013). The term is used in the context of relocation, based on previous plans and consultation meetings with the affected communities. This process is usually accompanied by beneficial support mechanisms in the new place of residence (Terminski, 2013). The costs of physical relocation and the depletion of former resources is compensated by the support provided in the new location.

3.3.2 Compensation principle

The practice of compensation for people displaced or affected by development projects differs around the world. The characteristic that is common in most developing countries is a narrow perception of compensation. The term adequate compensation is not seen in economic terms but as social and functional. Their goal is not to improve, or at least restore material and non-material conditions, but to enable people to rebuild their livelihood in another place (Terminski, 2013). In developed countries in contrary the main aim of compensation is full restoration of material and non-material conditions lost through displacement. The amount of compensation received by resettled people in the west often exceeds the economic value of their former properties. In the global south compensation is often not intended to fully compensate for economic losses but to facilitate continued functioning in the new place of residence (Terminski, 2013). A specific group of people is particularly vulnerable when it comes to compensation. Those who have no legal right to the land they live on receive very slight compensation or are not considered for compensation at all.

An extremely important issue is the form of compensation that is received by the affected communities. Some of the most common forms are cash, land for land and home for home. Compensation received as cash is not always the most optimal solution. This form of compensation can cause serious social problems such as landlessness and joblessness in the long run (Terminski, 2013). This is because compensation in cash often leads to improper use of money by individuals who never experienced owning these large amounts of cash. Instead, it is considered more appropriate to resettle people in areas similar to those previously inhabited, allowing them to follow their accustomed agriculture based economic model (Terminski, 2013).

Compensation should not be seen as a one-time fixed solution for people's loss caused by displacement and relocation. Very often displaced people are not able to cope with their new economic situation (Terminski, 2013). The difference between their improved economic situation and their actual needs is too great. Therefore, it is considered important to ensure long-term economic support mechanisms such as new jobs or educational prospects. As Terminski (2013) puts it, "social support mechanisms are the only means of preventing the potential multigenerational exclusion brought about by involuntary resettlement" (Terminski, 2013, p. 63).

3.3.3 Information and engagement

Although projects requiring resettlement do not generally offer people an opportunity to choose whether to move or not, project-affected people can still have considerable influence over a project (Vanclay, 2017). If their input is not sought, affected people are likely to engage in various forms of resistance or protest to ensure their voice is heard. Thus, the active participation of displaced people in the resettlement process is essential if there is to be any possibility of risk management and livelihood restoration. There is evidence to suggest that the more people are involved in decisions in relation to how, where, and when they move, the more likely they are able to adapt to the situation and recover from the stress associated with being resettled (Vanclay, 2017).

Some resettlement practitioners advocate that the whole resettlement process should be approached as a negotiation process, with the people to be resettled being treated as equal parties to a negotiation that is conducted fairly and in a spirit of good faith, informed participation, openness, mutual respect, with the intention to deliver mutual benefits (Vanclay, 2017). Participatory processes need to be sensitive to the local cultural context and underpinned by a gender analysis to ensure that women can participate, influence resettlement, and contribute to the decision-making process (Vanclay, 2017). However, negotiation can be problematic as in some countries, where expropriation is being implemented, there are fixed compensation schedules and no possibility of negotiation. This invariability results in people being resentful and distrustful.

3.3.4 Conflicts

The problem of resistance against development projects is an essential element of the discourse on DIDR (Oliver-Smith, 1991). In all parts of the world local resistance against the negative consequences of economic development is highly visible. These resistance movement can result in the modification of original development plans to reduce their negative impacts but have also resulted in complete cancellation of projects (Oliver-Smith, 1991).

Resistance against development projects takes place on three levels: grassroots movements, traditional non-governmental organizations, and virtual resistance through the internet (De Wet, 2002). In many cases the resistance is local in the form of protests against one single project. However, protest movements can also pursue different objectives (De Wet, 2002). The main goal of resistance movements is the complete cancellation of controversial development projects. Others only try to minimize resettlement or its potential negative consequences. Lastly, some resistance movements have focused primarily on economic demands. These include more compensation money or other forms of compensation demanded by the movement (De Wet, 2002).

3.4 Hydropower impacts

The development of a hydropower project may have direct or indirect impacts, negative and positive, on the local population and environment. These impacts can occur during different phases of the project, including the planning, construction, or operation phase. At the same time these impacts can occur in different zones, namely the area in close proximity to the project as well as downstream areas. It could be, for example, the construction phase which induces involuntary resettlement in the project area. The downstream area can be impacted when the dam is in operation, either through soil erosion, flooding of cultivated land, or a reduction of fishing activities and the loss of a source of protein, amongst others (Kouangpalath, Lebailly, & Ducourtieux, 2016).

In addition to involuntary displacement, hydropower projects can have significant adverse social, economic, environmental, and ecological impacts on downstream communities. Serious implications have come to the fore only after the completion of the dam and a number of the impacts have only developed over time (Sharma & Thakur, 2017). Downstream communities throughout the tropics and subtropics face some of the most drastic impacts of hydropower projects, particularly: "where the changed hydrological regime of rivers has adversely affected floodplains that supported local livelihoods through flood recession agriculture, fishing, herding and gathering floodplain forest products" (Kouangpalath, Lebailly, & Ducourtieux, 2016, p. 109). Negative social outcomes include livelihood impacts on activities such as farming, hunting, fishing, and ecotourism, and effects on other social values such as indigenous autonomy, biodiversity conservation, and landscape aesthetics.

It must be understood that riparian ecosystems are incredibly fragile and dependent on a complex web of relationships connecting the species that live in and around the river. Even minor changes in water flow, turbidity, sedimentation and temperature can have an enormous impact upon life in the river. Unfortunately, it is challenging to develop SHP that don't fiddle with all these finely-tuned ecosystem knobs (Modal, et al., 2014). Anderson et al. (2015) examined 10 case studies of different SHP that spanned a range of sizes and types. It concluded that in every case there were declines in biodiversity that ranged in severity from minor to catastrophic. Kelly-Richards et al. (2017) have also documented the environmental impacts from SHP in their study. These impacts and the percent of cases with the reported impact are listed in the table below.

Type of environmental impact	**Percent of cases with reported impact**
Reduction in water flow	100%
Fish fauna affected by the project	78%
Areas with no prior encroachments	67%
Cultural heritage sites affected	44%
Pipelines causing landscape impacts	11%
Changed water quality	11%
Aquatic organisms affected	7%
Reduced riverine habitat for birds and fish	7%
Protected sites impacted due to landscape value	7%
Changed water temperature	7%

Table 3: Most documented environmental impacts from SHP (Kelly-Richards, et al., 2017).

The impacts of SHP on land can be significant too. Altering the water flow can change the flood patterns and seasonal flow of a river for good or bad. Rivers may shift, and fertile soil may not be moved to downstream areas effecting the quality of agricultural land (IUCN, 2012). Construction of infrastructure like roads and transmission corridors during the development phase can lead to increased erosion into the river. Even more the roads themselves can fragment and split animal habitats (Modal, et al., 2014). Hydropower projects can also raise issues of ownership and access rights for both water and land and should be considered against current and future demands such as agriculture, drinking water supplies, fishing and ecosystem health (IUCN, 2012).

3.4.1 Access to water and land in riverine area

Unlike land grabbing, water grabbing has no commonly accepted definition in either academia or international development policy. Water grabbing can be abstractly defined as: “a circumstance where powerful actors are able to appropriate water resources at the expenses of traditional local users, often with negative impacts on the environment” (Dell'Angelo, D'Odorico, & Rulli, 2017, p. 122). It involves the capturing of the decision-making power around water, including the power to decide how and for what purposes water resources are used now and in the future.

Water grabbing is implicated in a whole host of activities that span the food, energy, mineral and climate domains. From large-scale agricultural and biofuel projects, to the extractive industries, to hydropower schemes, to the privatization of water services for drinking and sanitation, the dimensions of water grabbing are global in reach (Franco, et al., 2014). Hydropower represents one of the dimensions of the global water grab. Although the rate of dam construction for hydropower projects has varied over the years, the overall trend points steadily upward.

In general terms, water grabbing is leading to a significant double transformation of waterscapes and their associated water tenure relations towards new arrangements favouring powerful actors and the requirements of capital accumulation (Franco, et al., 2014). Poor and marginalized communities see a re-distribution of water flows in which they either lose direct access, or their ability to use water resources is severely compromised. All rationalised in the name of development. Water grabbing therefore carries with it significant implications for basic human rights including the right to water, to food, to health, to work, to self-determination, and in the case of indigenous peoples, special rights to territory and ancestral lands and resources (Franco, et al., 2014).

3.4.2 Accumulative effect

While there are good reasons to argue that the social and environmental impact of SHP is small compared to many alternatives, it is important to note that the impacts of these facilities can stack up. In cases where multiple SHP are built in a single area, the impact grows (Modal, et al., 2014). The successive, incremental, and/or combined effects resulting from SHP when added to other existing, planned, and/or reasonably anticipated future ones in a given area cause the accumulative effect (IFC, 2017a). Even in countries and regions where SHP projects are subject to ESIA review, projects are most often approved individually, without considering accumulative effects of hydrologic or associated infrastructure and land disturbance or regulating the distance between projects (Kelly-Richards, et al., 2017). Although impacts of SHP are highly variable, scholars suggest that the accumulative effect of multiple projects in one area are likely greater than the sum of the impacts from each individual project. As the density of SHP increases, there is a particular need to understand this accumulative effect.

3.5. Conceptual model

The conceptual model reflects the relationships between various elements of the theoretical framework of this research. It explains the most important influences of different factors on each other and shows a simplified outline of the research. The model presented below indicates that the research will take place in the context of energy and will look at one specific SHP. The impact of the project on access and use of water and land and the displacement and resettlement process will be examined. The impact inside the project area will be investigated leading to the direct effect and the impact downstream will be investigated leading to the indirect effect.

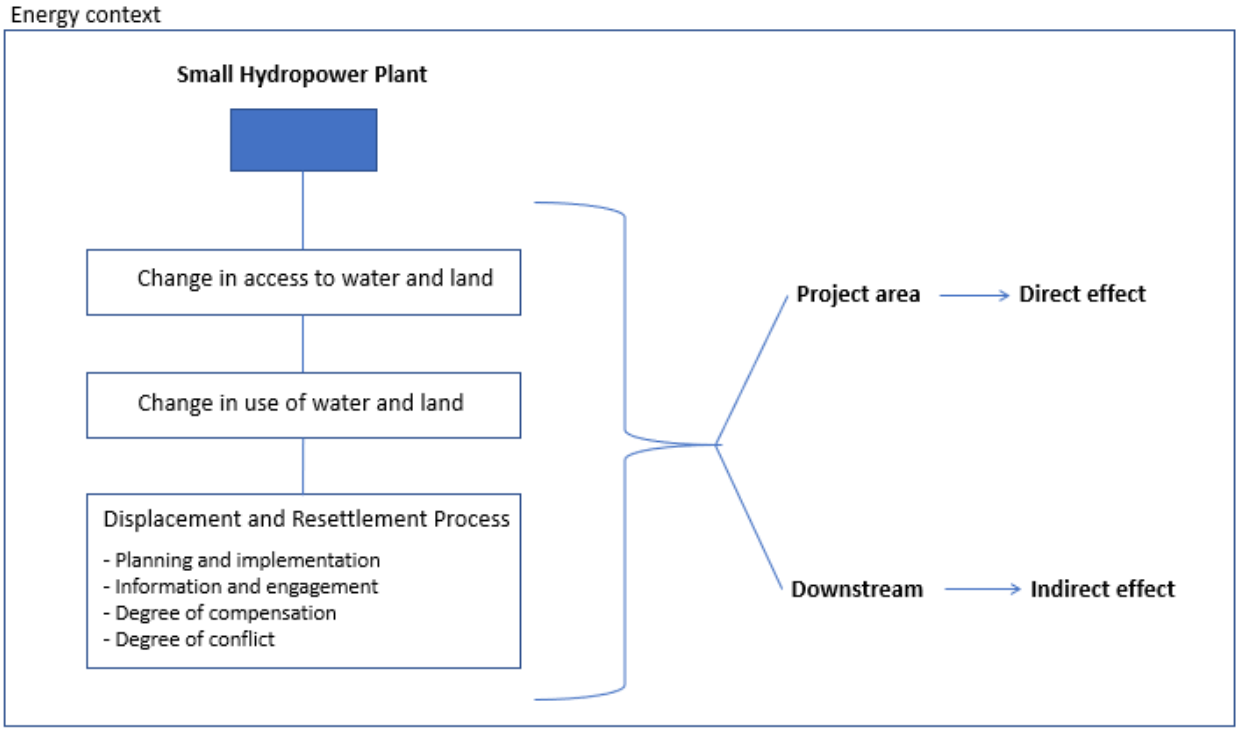

Fig 5: Conceptual model (source: author).

4. Methodology

This chapter identifies the information that is needed to answer the research question and presents which research instrument is most suitable to obtain the required data. In this research the use of mixed methods is applied to obtain the required data. Both quantitative and qualitative methods are applicable in this research as it allows the collection of both factual and subjective information (Hennink, Hutter, & Bailey, 2011). Both methods have their strengths and weaknesses, and by combining both methods their weaknesses are reduced. This allows for a comprehensive approach on collecting data. The different phases of this research can now be identified.

Phase 1:

The first step of this research is to identify the current activity of SHP in west Uganda. Questions like how many projects are operational, how many are being constructed and how many are being planned? But also, how is the electricity sector composed and which actors are involved in SHP development in Uganda? The first part of this research is focused on mapping the area and getting a general idea of the SHP situation on a meso level.

To gather this information several structured interviews are conducted with key informants that are involved in hydropower and rural electrification: Electricity Regulatory Authority, Rural Electrification Agency and GETFiT organisation. These informants are selected because they are involved in different areas within the energy sector in Uganda. Therefore, they can provide diverse information regarding the energy sector, rural electrification and sustainable energy projects.

Secondary data is used as a complementary method to get a clear image of the SHP activity. To present this information a geographic information system (GIS) map is included which is a system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data (Foote & Lynch, 2015).

Using the data collected in this phase in combination with relevant news articles, one project is selected to start the next phase. The project selected as case study in this research is the Rwimi SHP. Reasons for choosing this specific project are location in western Uganda, included in the GETFiT program, operational since October 2017, reports on conflict over water, willingness to cooperate, acquired ESIA and resettlement documents and four affected villages including one downstream.

Phase 2:

The second phase of the research examines the effect of Rwimi SHP on access to water and land, and the use of water and land. To research this concept both focus group discussions and interviews have been conducted. By using focus group discussions, a lot of data can be collected in a short period of time providing a broad range of views. This method also offers the ability to explore new topics whereby issues can be quickly identified (Hennink, Hutter, & Bailey, 2011). After these focus group discussions, semi structured household interviews have been conducted to gather personal experiences and to collect data based on standardized questions. These standardized questions allow for comparisons of the data between the different villages.

First a structured interview with the Rwimi SHP environment and social impact expert is conducted to gain information on their view of the social and environmental impact of the project. During this interview the impact on access and use of water and land by the affected communities and installed mitigation measures have been discussed.

Then focus group discussions and household interviews were conducted per village. The focus in selecting participant for the focus group discussions and interviews was on project affected people. The research area includes three villages located in the project area (Kihoko, Nyakabale and Nyaseke) and one village located downstream of the powerhouse (Upper Rugendabara). The different Local Chairman 1 (village leaders) were instructed to gather people for the focus group discussions who live in these affected areas, presented in figure 7.

Within these areas both people living close to the river and close to the village centre are included. Also people living close to project facilities and people living further from these facilities are included. The Local Chairman 1 have also been instructed to gather a diverse range of household compositions if possible, including female head households and elderly. The focus group discussions were always held near the trading centre of each village.

During the focus group discussions, a selection was made for household interviews based on the information provided by the participants. These interviews have been privately conducted at the participants house or on their land. From the village centres footpaths were followed towards and along the river and project facilities, providing the opportunity to interview a diverse range of households. Also, households who were not present at the focus group discussions. After consulting the affected communities, a follow-up interview has been conducted with the Rwimi project expert to discuss the collected data.

Phase 3:

In the third phase of the research the process of displacement and resettlement is examined. In order to research this concept interviews have been conducted with a key informant and locally affected people. Central in these interviews is the question how the process of displacement and resettlement has taken place.

A structured interview with the Rwimi SHP project site manager was used to gather information on the number of displaced or resettled people, the form of compensation and the degree of interaction with local people during the displacement and resettlement process. To obtain information on how local displaced or resettled people have experienced the process semi structured household interviews have been conducted in the research area. This type of interview is preferred, as it ensures that important topics are covered, and it allows for the interviewees to bring up their own ideas and thoughts.

For the selection of participants, a document from the resettlement plan is used which contains all the names of compensated households per village. The list is sorted alphabetically and depending on the number of compensated households per village, every second or third household is selected. However, during the field visits more households insisted on being interviewed and were added to the selection. Topics that have been discussed in the interviews are: the level of information and engagement of local people, the degree and form of compensation and the degree of conflicts during the process.

An important aspect during the research is informed consent from the participants. Before collecting data through focus group discussions or interviews the participants will be provided with information on the study so that they can make an informed, voluntary and rational decision to participate. The information provided to participants will be clearly formulated, without the use of difficult words and academic jargon. To eliminate potential risks to participants the data collection will be done anonymously and only shared within the research team.

As this research is not linked to a specific organisation or fund, conflict of interest is unlikely to occur. At this moment there are no financial or other personal considerations that may compromise, or have the appearance of compromising, my professional judgment in conducting this research.

Interviews conducted	Participant
ERA	Staff member
GETFiT	Staff member
REA	Staff member
Kabarole Research and Resource Centre	Researcher
Mountains of the Moon University	Professor African Development Studies
Eco Power Holdings Ltd,	Company member in charge at project site
Eco Power Holdings Ltd,	Environment and social impact expert
Kihoko village	Local Chairman 1 (village leader)
Nyaseke village	Local Chairman 1 (village leader)
Nyakabale village	Local Chairman 1 (village leader)
Upper Rugendabara village	Local Chairman 1 (village leader)
Focus group discussions conducted	**Amount**
Kihoko	2
Nyaseke	2
Nyakabale	1
Upper Rugendabara	1
Household interviews conducted	**Amount**
Kihoko	16
Nyaseke	18
Nyakabale	10
Upper Rugendabara	13

Table 4: Interviews and focus group discussions conducted during the field work (source: author).

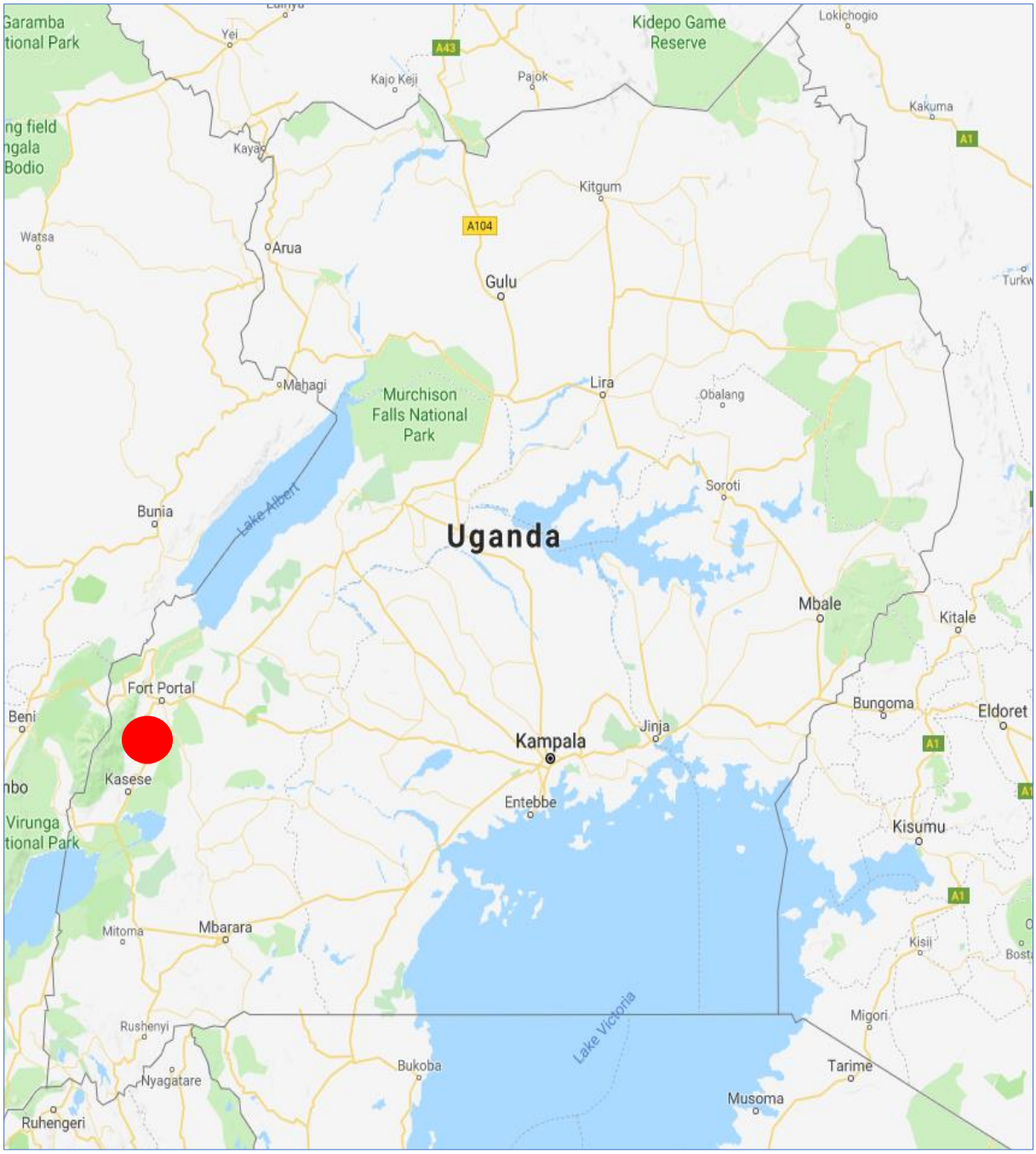

Fig 6: Location of the Rwimi project in Uganda, adapted from Google Maps (2018).

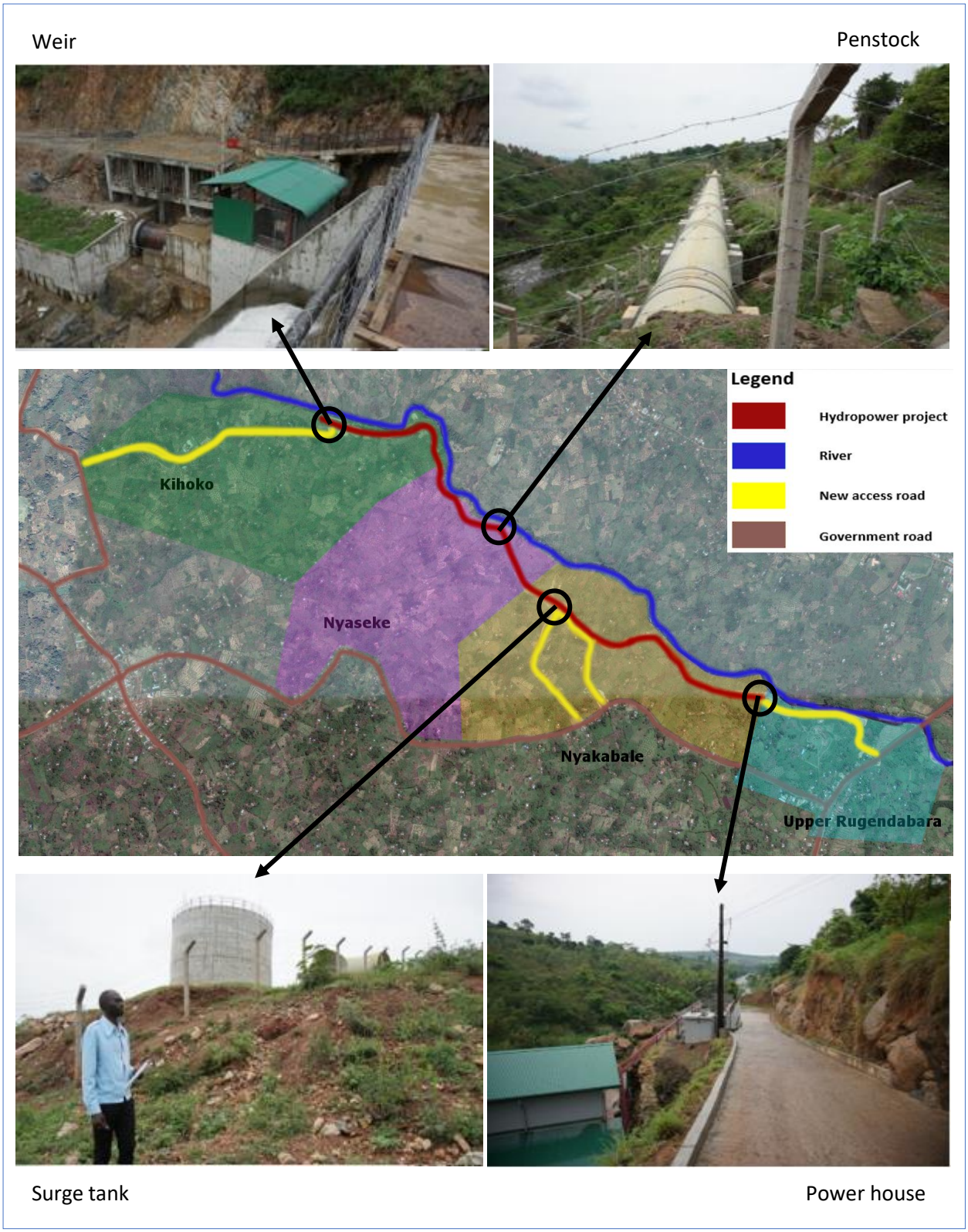

Fig 7: Research area, adapted from Google Maps (2018).

4.1 Limitations and risks

When collecting data in rural Uganda certain challenges can be faced. Several limitations experienced in the field and their consequences for this research shall be elaborated.

Time, weather and transport

The amount of time given for completing the field work was determined before departure. Within three months all the data must be collected, posing limits to the amount of data that can be collected. Also, the concept of time is different in Uganda compared to the Netherlands. In Uganda people tend to have a more relaxed attitude towards time, meaning a less rigorously scheduled lifestyle. This led to a different approach in managing tasks and arranging appointments.

Uganda experiences two rain seasons a year and one was during the field work period. This meant that within short periods of time a huge amount of rain can fall which influences infrastructure conditions, public transport and therefore accessibility of research location. In Uganda it became clear that the research location was not accessible by public transport so private transport had to be hired. Reaching the research location took more time than expected and these are reasons why only one project was selected for an in-depth case study.

Language

Even though English and Swahili are the main languages in Uganda, language still proved to be a limitation. There are more than fifty different dialects in Uganda and rural communities in west Uganda tend to speak no English. To collect data through focus group discussions and interviews it was crucial to have a translator who could understand the specific dialect and English. The selected project is located on the border between two districts where two different dialects are spoken. This meant using two translators was essential, increasing the risk of miscommunication and interpretation. Using graduates from the university with experience in research and providing them a training to inform them about the research reduced this risk. However, when using translators the risk of miscommunication and interpretation can never be fully eliminated.

Data bias

Because the selected SHP in this research has already been constructed data bias can be a risk. By obtaining information on the situation before SHP development this research relies on the memory of the participants to describe the past situation. Relying on the memory of participants can deliver data of low quality due to the time interval between the experience and the moment of this research. Choosing a project that finished construction recently reduces this time interval.

At the same time other forms of data bias can appear during the research. In case the process of displacement and resettlement is experienced negatively it can make participants romanticize their memory of prior situation. At the same time, it could also lead to exaggeration of the current situation. To minimize data bias both key informants and community members participated in the research.

The use of Local Chairman 1 as gatekeepers into the different villages can also lead to data bias as they may select specific participants they would like to be included in the research (Hennink, Hutter, & Bailey, 2011). In order to reduce this risk the village leader was informed to gather the project affected people at a specific location and during the focus group discussions a selection was made for individual follow up interviews.

4.2 Positionality

When gathering data in the field it is important to address the positionality of the researcher as it can influence the data collected. Being a white, western male doing research in Uganda will attract certain attention but can also make local people to be wary. Especially because some of the data has been collected in rural parts of Uganda, not regularly visited by tourists. It is proven important to approach local respondents and participants open-minded and respectfully as certain differences in culture and values were present. Looking for common grounds and shared interests eased the conversation, helped build rapport and gain local trust. Especially gaining the trust of the Local Chairman 1 of every village was essential as they acted as gatekeepers into the community.

To be flexible and adapt to unforeseen circumstances in the field has proven to be important. The short amount of time to complete the field work forces you to adapt and make decisions when things play out different than expected. Being direct and concrete in communication with Ugandan people is essential to get things arranged. When in the villages being patient, friendly, open and understanding are skills proven more useful. Keeping a low profile during the field work is advised to prevent any conflict between actors. At the same time having an objective, outside view is important to remain critical during data collection.

One major issue that influenced my positionality in Uganda is that people in the rural villages look up to you, consider you very important and think you have a certain amount of power to solve issues. They have expectations of you helping them solve their problems or provide them with money. To make sure they knew my intentions I instructed my translators to clearly explain my reason for being in the villages when meeting the Local Chairman, and before starting the focus groups and individual interviews.

Another issue I found in the rural villages influencing my positionality is that some of the children have never seen a white person before which can cause chaos and distraction. Also, alcohol consumption by men in the villages is a considerable problem in Uganda which proved to be difficult at times. Informing the Local Chairman of the villages certainly helped, however occasionally the focus groups or interviews got disturbed and we needed to take a break.

5. Small hydropower projects in Uganda

The first step of this research is to map the current and expected hydropower development in Uganda. To acquire the appropriate data interviews were conducted with participants from the GETFiT program, ERA and REA, complemented with secondary data available on their databases and the internet. As mentioned in chapter 3.1 there is no clear international classification concerning the size of hydropower projects, and during the gathering of the data this appeared to also be the case in Uganda. To map the hydropower projects, the classification mentioned in chapter 3.1 is slightly adjusted. As the GETFiT program classifies projects under 20 MW as small this will be applied in the classification, see table 5. Using this classification, the current and expected hydropower projects can be mapped to provide an overview of the activity in the country, see fig 6.

Classification	Capacity
Mini Hydropower Projects	< 1 MW
Small Hydropower Projects	1 – 20 MW
Large Hydropower Projects	> 20 MW

Table 5: Adapted hydropower project classification (Helston & Farris, 2017).

Classification	Operational	Construction phase	Expected	Amount	Capacity MW
Mini	1	-	18	19	6,05
Small	15	10	5	30	230,63
Large	2	3	6	11	2210,90
Total	18	13	29	60	2447,58

Table 6: Current and future hydropower projects by classification (source: author).

When analysing the map specific locations can be distinguished where either small of large hydropower projects are developed. Most large projects are built along the Nile or near the main lakes. The small projects can mainly be found in the western part of the country, and some in the eastern and northern part. This can be explained by the mountainous terrain and many rivers in these areas. Looking at the map and table 6, it becomes clear that hydropower development in Uganda has become a substantial effort. Considering 18 projects are currently operational, and a total of 42 projects are either under construction or expected making 60 projects in total. When taking the total amount of operational, under construction and expected projects, the number of small projects is 50% (30). This confirms that SHP have become a major focus and substantial part of Uganda's energy sector. Looking at the generating capacity of the different types of hydropower projects it becomes clear that most energy is generated by the large projects (90,3%). The small projects generate 9,4% and the mini projects generate 0,3% of the total expected generating capacity in Uganda.

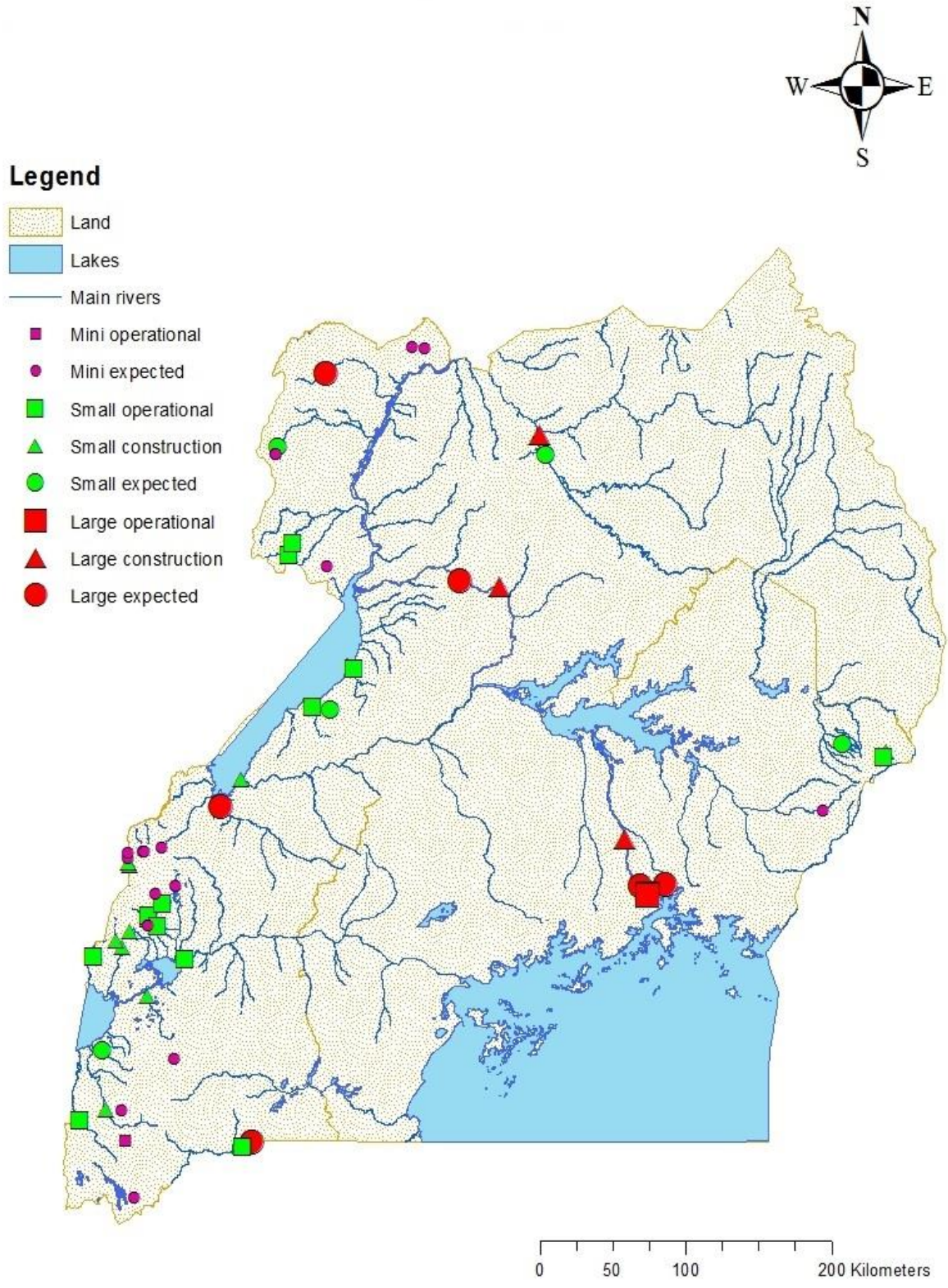

Fig 8: Hydropower projects in Uganda, according to size and phase (source: author).

Besides the different hydropower projects, also information on the different actors involved in hydropower in Uganda have been collected. The main institutions and the structure of Uganda's energy sector is shown in the figure below.

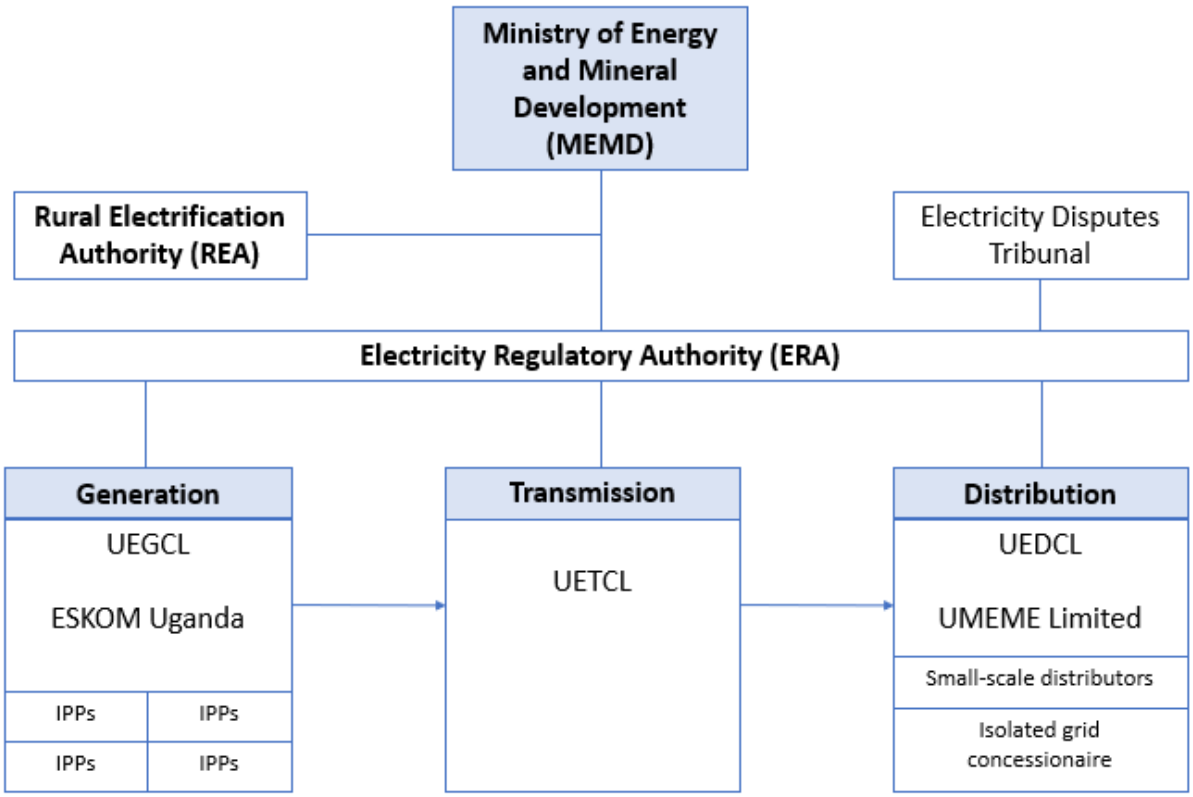

Fig 9: Structure of Uganda's energy sector, adapted from (Meyer, Eberhard, & Gratwick, 2018).

The lead agency in the energy sector is the **Ministry of Energy and Mineral Development** (MEMD) which is responsible for policy formulation, promotion, coordination, monitoring and evaluation. Part of the MEMD is the Energy Department, which is structured according to sectors. It comprises four divisions: Energy Efficiency, Innovative and Renewable Energies, Electricity and Provision with Oil Products. This institution is the focal point for energy policy matters and responsible for initiating legislation in the energy sector (Meyer, Eberhard, & Gratwick, 2018).

The **Rural Electrification Agency** (REA) is a semi-autonomous body established by the government, to operationalize the governments rural electrification function (REA, 2018). It realizes MEMD`s rural electrification plans as stipulated in the Indicative Rural Electrification Master Plan. This institution controls public funds for the subsidization of rural electrification projects (Meyer, Eberhard, & Gratwick, 2018).

The **Electricity Regulatory Authority** (ERA) is a government agency in charge of issuing licence for the generation, transmission, distribution or sales of electricity. ERA also has the main responsibility for setting a cost-reflective electricity tariff structure and investigate tariff charges. This institution defines

and monitors technical standards within the sector and enforces adherence to the national law (Meyer, Eberhard, & Gratwick, 2018).

The **Uganda Electricity Generation Company Limited** (UEGCL) is the holding company for state-owned generation projects. The primary purpose of this institution is to oversee the performance of ESKOM Uganda, and to negotiate and administer engineering, procurement, and construction contracts for government/public projects (Meyer, Eberhard, & Gratwick, 2018). **ESKOM Uganda** is a subsidiary of South Africa's ESKOM Holdings. This company was awarded a 20-year contract for the operation and maintenance of UEGCL's hydropower plants.

The **Uganda Electricity Transmission Company Limited** (UETCL) is a state-owned company whose primary purpose is to make bulk electricity purchases and transmit the electricity along high voltage wires to local and foreign distribution points. UETCL owns, plans and operates Uganda's transmission infrastructure meaning it is the dispatcher for nearly all the electricity generated in the country (Meyer, Eberhard, & Gratwick, 2018).

The **Uganda Electricity Distribution Company Limited** (UEDCL) is the countries holding company for state-owned distribution assets. It also administers and supervises the private distribution concession agreement, presently held by **UMEME Limited**. In 2005 this company became the major privately-owned electricity distributor in Uganda, after winning a 20-year contract to operate UEDCL's main distribution network (Meyer, Eberhard, & Gratwick, 2018). UMEME buys electricity from UETCL and, as of 2017 they were selling it on to 1,125,291 customers. Businesses and government departments account for about 70% of the utility's annual revenue (UMEME, 2017).

The electricity sector is centralised and under government control. However, besides the state-owned electricity generation projects there is an increase in the amount of privately-owned generation projects, so called independent power producers (IPPs), shown by the figure below. These IPPs construct and operate their own generation projects but are obliged to sell the generated electricity to the UETCL.

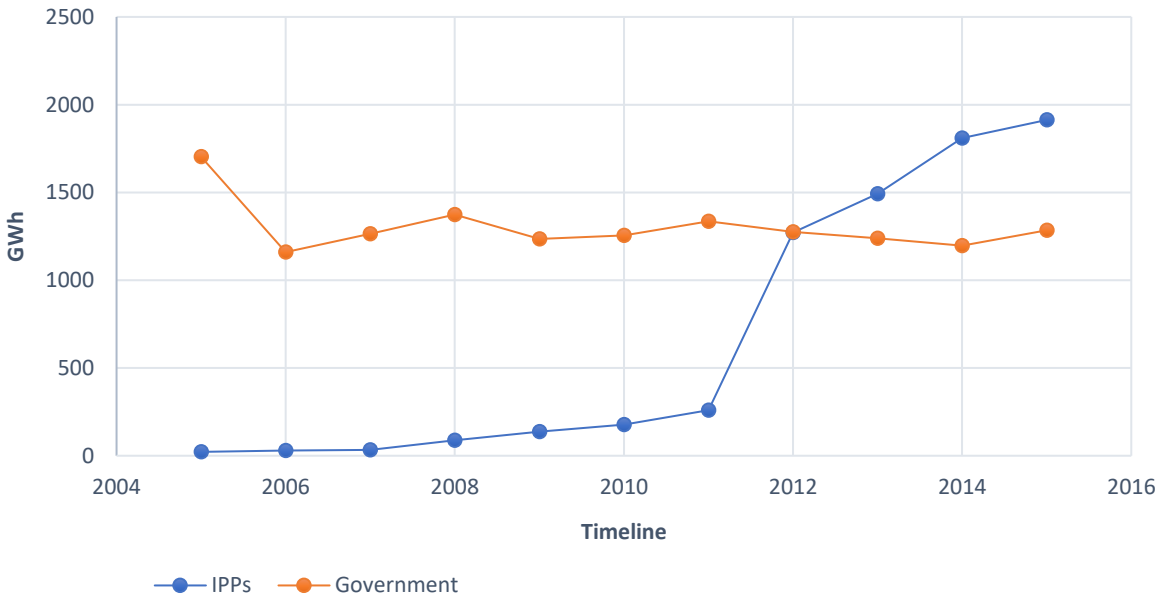

Fig 10: Electricity sold to UETCL by IPPs and government 2005-2015 (ERA, 2018).

Since 2011 there is a noticeable increase in the amount of GWh generated and sold to UETCL by IPPs. And it is expected to keep increasing in the future as Uganda puts effort in attracting foreign investments towards their energy sector (ERA, 2018).

One of the programs designed to leverage private investment into renewable energy generation projects in Uganda is the GETFiT program, which was officially launched on May 31st, 2013 (GETFiT, 2016). GETFiT is being supported by the government of Norway, the United Kingdom, the government of Germany and the EU through the EU Africa Infrastructure Fund. The main objective of the GETFiT program is to assist East African nations in pursuing a climate resilient low-carbon development path resulting in growth, poverty reduction and climate change mitigation. In Uganda GETFiT is fast-tracking a portfolio, currently of 17 small-scale renewable energy generation projects, promoted by private developers and with a total installed capacity of 157 MW (GETFiT, 2016). This will yield approximately 770 GWh of clean energy production per year, transforming Uganda's energy mix within a period of three to five years (GETFiT, 2016).

This program will result in:

- emission reductions of roughly 11 million tons of CO2 in the 20-year lifespan of Power Purchase Agreements (PPAs);
- an increase in Uganda's energy production by about 20%, and thus a contribution to tackling an anticipated supply shortage in the period up to 2020;
- facilitating (or significantly improving) access to energy for at least 200.000 additional households (approximately 1.2M people), also in rural areas due to strengthening of regional grids;
- leveraging of close to €400 million in public and private investments for renewable energy generation projects with a limited amount of results-based grant funding (GETFiT, 2016).

6. Rwimi SHP characteristics

The Rwimi small hydropower plant is a 6.6 MW project located in the middle reach of the Rwimi River with an expected annual energy output of 24.8 GWh (EPHL, 2013a). To generate the electricity the project uses the river that meanders through Kitswamba Sub County. The SHP is located along the border between Kasese District and Bunyangabu District, approximately 34km north of Kasese town and 47km south of Fort Portal town. The project achieved financial close and started construction in July 2015. During the construction phase the project was severely impacted by delays due to unusual high levels of water in the river. The project started commercial operation in October 2017 after 27 months of construction (EPHL, 2013a). The coordinates of the location are 0.386111 latitude and 30.185278 longitude.

Fig 11: Rwimi SHP main structures including weir, surge tank, penstock and power house (source: author).

The main structures that are built consist of a 42m long weir with a height of 14.5m. From the weir a 1200m long low-pressure pipeline runs to the surge tank diverting the river stream (EPHL, 2013a). The aim of the surge tank is to control the river water level. From the surge tank a 1200m long penstock runs to the powerhouse where the energy is generated, and the water is diverted back into the river. The powerhouse is connected to the national grid through a 750m long transmission line located along the Kasese Fort Portal main road (EPHL, 2013a).

The Rwimi SHP is built under supervision of and operated by Eco Power Holdings Limited (EPHL), which is focused on producing electricity through environment friendly and sustainable methods using natural resources. EPHL is a private limited liability company incorporated in Sri Lanka and registered in Uganda as a foreign company on 31st October 2011 (EPHL, 2018). The company holds water and environmental permits issued by the respective environment and water authorities in Uganda and has a track record of developing small hydropower projects in Uganda and internationally. Its intention is to sell all the generated power to the national grid under a Power Purchase Agreement to be executed with the Ugandan National Transmission Company (UETCL). The actual construction of the SHP is outsourced to KSJ Construction Ltd, a Ugandan construction company.

The total investment in the project is US$21,1 million, of which US$13 million by the Belgian Investment Company for Developing Countries (BIO), US$4,2 million by the Norwegian Investment Fund for Developing Countries (Norfund) and US$3,9 million in GETFiT commitments through KfW Entwicklungsbank (GETFiT, 2017). The UETCL will buy the energy generated by the Rwimi SHP and secure a more stable electricity supply for consumers and SMEs in Uganda.

During the approval phase the Rwimi project was classified under the category: major infrastructure development projects. In accordance with the Third Schedule of the National Environmental Act, Cap. 153, Part V, Section 20, the developer was obliged to undertake an ESIA and Resettlement Action Plan (RAP) before approval by the National Environmental Management Authority (NEMA) of Uganda (GETFiT, 2017).

Fig 12: Rwimi project sign in Kihoko village (source: author).

In terms of the magnitude of the environmental and social risks attached, the Rwimi project was considered high risk. This is based on the risk categorization by the International Finance Corporation (IFC), which considers the size, type, sector and the environmental and social context of the project.

The project was expected to have impacts on:

- Land-use; topography, soil (by way of increased erosion, sedimentation);
- Water resources and quality; hydrology, hydro-geology and surface & groundwater quality;
- Ambient air quality; Ambient noise quality and ground vibrations;
- Health and sanitation; community health, safety and security;
- Safety; including road safety due to project traffic;
- Socio-economic; land acquisition, compensation, resettlement, rehabilitation and livelihood;
- Ecology; forests, terrestrial wildlife, aquatic ecology and fisheries (GETFiT, 2017).

The villages that are affected by the SHP along the river have been identified. They consist of four villages; Kihoko, Nyaseke, Nyakabale and Upper Rugendabara. Besides the construction of the necessary hydropower facilities, the project also includes the construction of three access roads. One to access the dam site (Kihoko village), another to access the forebay, surge tank and the penstock (Nyakabale village) and the third to access the power house (Upper Rugendabara). Sections of the access roads have been demarcated along existing foot paths needing their grading and stabilising whereas other sections needed complete construction to acceptable standards (EPHL, 2013a).

Before discussing the different impacts of the project, a closer look at the affected villages must be taken. A distinguish can be made between villages located within the project area and downstream. Kihoko, Nyaseke and Nyakabale are locate within the project area, between the water intake and the power house. Upper Rugendabara is located downstream of the power house along the river Rwimi.

The villages have a total population of 2061 people in 470 households, with an average household size of 4.38, see the table below.

Village	Population	Number of households	Household size
Kihoko	532	100	5.32
Nyaseke	356	94	3.78
Nyakabale	823	200	4.11
Upper Rugendabara	350	76	4.61
Total	**2061**	**470**	**4.38**

Table 7: Population of affected villages (EPHL, 2013b).

The main occupation and livelihood sources of people living within the affected villages consist of farming, more specifically subsistence agriculture (79%) (EPHL, 2013a). This entail growing crops such as beans, cassava, matoke, sweet potatoes, yams and maize. Most people also grow fruit trees such as avocados, guavas, mangos and jack fruits. Other occupations mentioned are teacher, daily worker, permanent worker and pasturalist. During the field work it became clear that almost every piece of land is cultivated. As shown in the picture below, even steep slopes are not left untouched.

Fig 13: Cultivated steep slope in the research area (source: author).

6.1 Environmental & Social impact assessment

The environmental and social impacts of the Rwimi project have been appraised in the ESIA conducted by EPHL. The company has an in house Environmental and Social Management Unit (ESMU) that manages environmental and social issues focusing mainly on SHP (EPHL, 2018). The unit was strengthened with an environmental and social impact specialist from Uganda who has been managing hydropower impact assessments for the last two years.

The assessment of the project did not indicate any major permanent adverse environment or social impacts, though the project would result in temporary dislocation of communities and loss of livelihood (EPHL, 2013a). The major challenge faced by the project are access roads, the weir, surge tank and power house site. Most of the construction activities take place in sloping lands and therefore there is a high potential for soil erosion taking place during the construction phase of the project.

A significant negative impact of the project during construction and operation is the inconveniences experienced by the people in the area. The ESIA (EPHL, 2013a) mentions that the project leads to reduced quantity and quality of river water during construction and a reduced river flow between the weir and the powerhouse after the construction. This is considered significant because river Rwimi has been a potable water source for the people in and around the project area. This impact is likely to be felt by many people who use the river water for bathing, washing and drinking purposes.

Besides the use of the river the project also affects the community's mobility. During the construction phase the accessibility of the river and surrounding agriculture land is altered. Collecting water and leading cattle to the river and pasture land will become more difficult as infrastructure is developed, and protection fences are being built. When the construction of the different access roads is finished it is expected to provide the surrounding communities with an increased mobility. The roads enable people to move faster as they allow for the use of bicycles, motorbikes and cars (EPHL, 2013a).

At the same time land intake by the project is considered to affect the agricultural activities of the community members in the project area. In return for these inconveniences the community expressed that they have high expectations of acquiring access to electricity and it is assumed that the positive impacts of the project can override the negative impacts (EPHL, 2013a).

By providing clean energy the project has the potential to enhance the livelihoods of the households in the affected area. By contributing to the increased volume of grid electricity, the project has the potential to revive the poor and backward agricultural based economy of the project influence area (EPHL, 2013a). Lack of investment either by the private or the state sector, poor infrastructure facilities, inadequate natural resource management and utilization, lack of alternative sources of employment other than subsistence agriculture are the socio-economic constraints widely prevalent in most parts of Uganda (REA, 2017).

The social survey carried out as part of the ESIA (EPHL, 2013a), as well as the opinions expressed by the key informants and the local councillors, revealed that the communities around the project area have expectations that the proposed project will have strong positive contribution to development for the area. They perceive that the project can contribute to the poor agricultural based economy of the area either through direct influence of the project or through indirect means which will have other positive outcomes such as infrastructure development and development of access roads, health centres and other public facilities (EPHL, 2013a).

GETFiT acknowledges that there are still issues surrounding the ESIA conducted by developers. The level of the assessments provided by developers is often considered low and especially during the transition from construction to operationalisation phase new challenges arise. The conducted assessments do not focus on the entire project cycle and when the responsibility is handed over from the construction team to the operations team, knowledge on environment and social issues is lost (GETFiT, 2017).

Over time GETFiT has noticed an improvement of the conducted ESIA throughout the project cycle as they implied new rules. These enabled them to increase unannounced site visits on cost of the developer, construction stop, reduce funding and even revoking funding in some cases (GETFiT, 2017). In the case of Rwimi SHP the level of the ESIA was considered sufficient after some adjustments on their first draft version. After these adjustments they received approval from the National Environmental Management Authority.

6.2 Electricity

As mentioned in the previous chapter, the expectation of the affected households was that the project developer would be able to provide electricity to the local communities. However, such an outcome is only possible if the local political leadership will pursue this request through ERA. In case the political authority decides that the project area should have the benefit of receiving grid electricity, it is expected to be a boom to the local industry (EPHL, 2013a).

The project has been generating electricity since October 2017 and the affected villages have not yet been connected to the electricity grid. EPHL states that they never promised the local communities electricity, as it is not their dissension to make. EPHL explained the communities that they only generate the electricity. The distribution and transmission of the electricity is arranged through the government organisations UEDCL, UETCL and ERA. However, most benefits stated in the ESIA are based on the assumption of clean energy access in the affected project area.

During the interviews with affected households they expressed that they accepted the project expecting access to electricity. They believed that the project would improve local conditions and create new opportunities. They state that during the first information meetings held by EPHL, they indeed did not promise them electricity. However, in 2015 during the construction phase a member of the World Bank examined the possibility to provide electricity in the form of solar power. During the different phases of the project the communities received information on the provision of electricity and therefore kept high hopes of receiving electricity. At this point they understand that EPHL is not responsible for electricity provision, and their believe in improved conditions and new opportunities has lowered.

In total only two of the 96 project affected households have been able to get access to electricity. Since the electricity poles leading towards the weir site pass near their homes it was affordable for them to pay for wiring. The wiring costs paid are 640.000 and 1.2 million Ugandan Shilling and the electricity is paid through prepaid rechargeable cards. The electricity they receive is provided by Kilembe Investments, which is a different company involved in small hydropower development. The electricity is generated at sites in Kasese district, approximately 30 kilometres to the south.

These households use the electricity for lighting at night, radio and charging mobile phones. They say that using the electricity for cooking is too expensive and therefore keep using fire wood. The households without access to electricity all use fire wood for cooking and kerosene for lighting.

Fig 14: House with electricity access in Kihoko (source: author).

7. Water access

Concerning the access to water there are differences between the affected villages. In total there are currently six access points to the river. Three new access point have been created by EPHL, however three existing footpaths to the river have been destroyed.

First the effect on the access of water in the project area will be discussed, then the effect on the access of water for the downstream community.

7.1 Direct effect

All interviewed households in Kihoko, the village near the weir site, express that their access to the river is still good. The access to the river has always been easier in this area because the slopes to the river water are less steep. At the same time people in this village tend to live closer to the river. In Kihoko one existing footpath has been destroyed and one new access point has been built. The participants state that there is no difference in the level of access to the river water.

In Nyakabale (66,6%) and Nyaseke (70%) people expressed that their access to the river has decreased. Five of these people even consider their access to the river severely decreased. These are all people that own some cattle, consisting of cows and goats, usually not more than five animals. Like in Kihoko new access points have been created. However, the slopes in these areas are steeper resulting in the new access points consisting of steps. The steps are considered to be too steep and local people fear to take their cattle on these access points to the river. One of the participants said, “I’m afraid my cows might fall from the steps and die.” To access the river with their cattle they now walk downstream to Upper Rugendabara to reach passable access points.

Fig 15: New river access point with steep steps in Nyakabale (source: author).

Fig 16: Existing river access point in Upper Rugendabara (source: author).

Not only are the new access points considered dangerous but in both villages construction material like stones and boulders block the existing access points. During the construction phase the contractor KSJ left construction material behind which is still scattered along the river at the project sites. Heavy rainfall during rainy season caused these rocks and boulders to get swept down and destroy two existing access points.

Fig 17: Destroyed river access point by construction material in Nyaseke (source: author).

To provide the affected communities access to good quality water EPHL promised that water taps would be installed before construction would start, through a gravity water scheme. When the construction phase started no water taps had been installed in Nyakabale village, causing the local people to strike. After blocking the access road to the surge tank for one day, EPHL ordered the contractor KSJ to stop construction until the water taps had been installed.

The level of access to these taps differs for people in every village. Some tend to live nearby the taps and say their access to drinkable water has improved. However, others live further away from the installed water taps and state that they now walk up to 30 minutes to reach them. Another issue that has caused the access to drinking water to decrease is the fee for using the taps. For the maintenance of these taps every household must pay 1000 Uganda Shilling (€0.25) per month. If the fee is not paid, the household cannot use the water taps resulting in them using the spoilt river water for drinking purposes.

At this moment the biggest concern of people living in the project area is the safety of the river. Local people fear the river and are concerned about their safety since the hydropower project is operational. The water level in the river between weir and power house is affected because of the project. When the hydropower plant stops operating the water level in the river increases suddenly and quickly and the local people are not informed. They express their concerns that children that fetch water and play in the river can be surprised by the sudden increase. Others also expressed their concerns about their goats and cows being taken by the river. One elderly man has already been taken by the river and lost some valuable possessions like National ID and cash. He now doesn't have enough funds to buy a new National ID and therefore doesn't travel outside his village.

EPHL promised an alarm would be used to inform the people in the villages when they would stop operating the hydropower plant. Local people state that the alarm has never been installed and that they only received information on when the water would be released during the first week of the plant being operational. EPHL replied that they are in the process of installing an alarm and are aware of the communities' concerns. In the mean time they state that they inform the local chairman of villages. However, because the times of being operational are not consistent they admit that they struggle to provide clear information.

7.2 Indirect effect

Most interviewed households living in Upper Rugendabara (downstream) express that their access to the river is still good. Like in Kihoko the access to the river has always been easier in this area as the slopes to the river water are less steep. In this area no existing access points have been destroyed or new access points have been built, however some people express that their access to the river has increased.

These people tend to use the newly built access road to the power house. This road is built along the river shore, which enables people easy access. It also enables people to reach the river by vehicle, especially the possibility to access the river by truck is considered a benefit. They use the trucks to transport the soil from the river which is used and sold as construction material. They state that the new access road has been an improvement for the accessibility of the river in Upper Rugendabara.

People living in Upper Rugendabara do not have any new concerns about the safety of the river. As they are located downstream they don't experience the river water level increasing suddenly and quickly like the people living in the project area. Where in the project area this is a major concern, downstream this issue is never mentioned.

As in the project area, water taps have been installed in Upper Rugendabara. The level of access to the water taps in the downstream community is considered good. The walking distances to the taps are manageable and the terrain is easily passable. The only issue they express concerning the water taps is the maintenance fee that must be paid monthly.

8. Water use

As mentioned in the ESIA, the river Rwimi serves most of the villagers to obtain water for consumptive purposes such as drinking, washing, cooking, bathing and feeding of cattle (EPHL, 2013b). The project was expected to lead to reduced quantity and quality of river water during construction and a reduced river flow between the weir and the powerhouse after the construction, affecting these purposes.

First the effect on the use of water in the project area will be discussed, then the effect on the use of water for the downstream community.

8.1 Direct effect

The interviewed people in all three villages in the project area (Kihoko, Nyaseke and Nyakabale) state that during the construction phase the quality of the river water was severely affected by construction material, soil and cement. At the same time, they expressed that the quality of the river is still spoilt since the project is operational. The local people mention that the colour of the river has changed, the water is now darker than it was before the construction. The ESIA provided by EPHL claims that no construction debris was allowed to be mixed with river water to prevent reduced water quality (EPHL, 2013a). EPHL explains that the effort among the site managers to ensure decent waste management was not sufficient, but that the quality of the water will restore to the same level when the debris settles down. This process just needs more time.

Fig 18: Water tap in Nyakabale village (source: author).

All interviewed people in the project area now prefer to use the water taps for drinking. The main reasons being either the river water being spoilt or the water taps being closer to their homes. They state to only use the river for drinking purpose when the water taps are not working. When asked how often the water taps have not been working, the answer is three or four days since they have been constructed in all three villages. Most people consider the water taps to be reliable, only in Nyakabale village the majority of interviewed people (61,1%) consider the water taps to be unreliable.

In all three villages the local people find the water taps to be busy and at certain times they have to que up. Especially in Nyaseke they find the water taps to be busy as one of the taps is located next to a school building. At the same time local people expressed that they were promised more water taps than they received. Kihoko village received three instead of six, Nyaseke received two instead of four and Nyakabale received three instead of six. After consulting EPHL about this issue they state that the

gravity water scheme in place has been a burden on their capital and that as soon as they can afford it they will install the promised number of water taps.

Even though the overall use of the river water has reduced, it is still used for washing and bathing purpose by all affected households. The development of the hydropower project and the reduced water quality did not influence these purposes. Some households still use the river for cooking purpose (36,9%), others use the water taps (63,1%). This depends on the distance between the house and available water source. Those living closer to the river use the river water for cooking purpose and those living closer to the water taps use those. When the river water is used for cooking the water is boiled to ensure the quality is sufficient.

Fig 19: Washing clothes in river Rwimi (source: author).

Concerning the reduced river flow after construction, GETFiT raised an issue which is assessing and determining the minimum flow requirements of hydropower projects (GETFiT, 2017). Balancing various societal interests on water use is an issue that requires clear expectations and a clear decision-making framework for developers. GETFiT states that this issue is one of the key focus point for this year.

By design SHP result in a reduction of the natural river flow between the intake and the power house. Typically, this section of the river is three to four kilometres long. The release of a minimum flow is a normal mitigation measure to reduce impacts on people and ecosystems along the affected river section (GETFiT, 2017). The volume of the minimum flow also directly impacts on the economic viability of a hydropower project, as water that could otherwise be used for power generation remains in the natural river channel. Minimum flows have therefore been a challenging issue in all hydropower projects, with developers struggling to derive a clearly justified minimum flow level and develop appropriate designs to release and monitor it (GETFiT, 2017).

The inadequate guidance from government agencies and lack of clarity on which methodologies should be applied to arrive at minimum flow releases have complicated the assessment of minimum flows for developers. GETFiT states that this may have resulted in the inefficient allocation of water among competing societal interests (power production, ecosystems, other human water uses) and unequal requirements on developers.

The minimum flow requirements would normally include consideration of issues such as loss of power production, human water use interests along the affected river section (domestic water use, water supply schemes, irrigation), fish and other ecological concerns as well the presence of alternative water sources (GETFiT, 2017). It is therefore important that minimum flow requirements are identified on a project-specific basis, so that the characteristics of the project setting are accommodated for. The allocation of water between users, local population and hydropower developers, can result in an unfair process as developers and stakeholders can engage from a more powerful position (GETFiT, 2017).

At the water intake of the Rwimi SHP a special pipeline is installed to make sure a certain amount of water continues flowing into the river. EPHL calculated that the average water requirement by the affected communities and ecosystem is 14 m^3/day (GETFiT, 2017). This amount of water passes through the pipeline to make sure the level and quantity of the water in the river stays at the required level. As the research was done during the rainy season, the local people didn't express their concern on the changed water level. However, since the operational phase local people experience lower water levels during dry season and have been trying to make their concerns heard. Chairman of the local council expressed his concerns to EPHL and explains that the company doesn't listen to the pleas of the local people. EPHL on the other side explained that they do not operate during the day to not affect the water level. They state that the hydropower facility only runs from 7pm until 5am. During the field visits, ranging between 8am and 6pm during the period of five weeks, the hydropower plant was seen operational on most occasions. Only on the day when the powerhouse needed some repairs the plant was not operational. EPHL reacted by stating that they are demanded to supply a certain amount of energy and that this is the reason that they must operate.

8.2 Indirect effect

As in the project area, all the interviewed people in the downstream village Upper Rugendabara state that during the construction phase the quality of the river water was severely affected by construction material, soil and cement. The quality of the river is still spoilt since the project is operational and they also mention that the colour of the river has changed.

In the ESIA the effect on the quality of the river water for this community is mentioned and therefore water taps have also been installed in this village. All interviewed people in the downstream area prefer to use the water taps for drinking, giving the same reasons as the people in the project area. As in the project area the people of Upper Rugendabara find the water taps to be busy and were promised more taps, they received four instead of six.

The river is still used for washing and bathing purposes by all the interviewed households. However, unlike the participants in the project area, all the interviewed households also use the water taps for cooking purpose. Because this area is less mountainous with fewer steep slopes the water taps are easy accessible, even for people living closer to the river than the water taps. They have less difficulties fetching water at the water taps for both drinking and cooking purposes.

As the people in Upper Rugendabara live downstream from the power house they are not directly affected by the reduced river flow. The water that is diverted at the weir is released back into the river at the power house, so the amount of water flowing through the river near their village has not changed. Although the amount of water is still the same, the changed river water flow in the project area does have an effect for the use of the river in the downstream community.

Traditionally the people here have been collecting soil from the river to use and sell as construction material. They use the soil to make bricks which can be used to build houses, or which can be sold on the market. However, the interviewed people state that the hydropower project has affected this business. The changed flow of the river has reduced the amount of sediment transported downstream, decreasing the amount of soil that can converted into bricks and be sold at the markets or used for construction. The people state that they have already noticed a decline in the amount of useable soil and expect this amount to further decline in the future.

9. Land access

The effect of the Rwimi project on access to water has been discussed, but at the same time SHP can influence people's access to land. Overall, the access to land is still considered to be good in all four villages. During the construction phase of the project access to land was considered more difficult. Construction sites, demarcating fences and more traffic on the roads caused inconveniences for the local people. Especially the households holding cattle experienced difficulties guiding their cattle during construction phase. However, since the project is operational these issues are no longer a problem.

9.1 Direct effect

The construction of the two access roads in the project area has caused land plots to be split into two. Since the project is operational the affected people expressed that this does not influence their ability to access their land. Crossing the access roads from one piece of land to the other is not considered difficult as the new roads are not frequently used by vehicles. At the same time the people state that the new roads have increased their mobility. More homes can now be reached by bicycle, motorbike or car.

Fig 20: New access road in Kihoko (source: author).

The current quality of the access roads differs. The one leading to the weir in Kihoko is of good quality, shown on the picture above. However, the road in Nyakabale leading to the surge tank is of poor quality and a big concern for the community. The new road in Nyakabale branches of the main government road towards the surge tank. Due to changes in the landscape rainwater now flows along the new road causing damages, see figure 20. The road is considered unusable for transportation vehicles, both by the community and workers from EPHL.

Fig 21: Condition of new access road in Nyakabale (source: author).

A major concern expressed by all people in the project area is the current quality of the main government road. This road connects the four villages to each other and to the Fort Portal-Kasese highway. It is the most important infrastructure, used by people to travel to markets, community centres, schools, hospitals and other villages. During the construction phase this road was used by more vehicles than normal, as well as heavy machinery which has caused damages. The quality of the road has significantly decreased including more potholes, sunken parts and loose rocks. Local people find it more difficult and sometimes even dangerous to use the road. Both EPHL and the contractor KSJ state that this is a problem to be fixed by the government. Local people state that they don't want to wait for the government to fix the road but want EPHL to take responsibility as they caused this issue.

During the field work period one case was found where the project directly affected the access to land. This caused two families to be disconnected from both the village and their land. In this case the pipeline connecting the surge tank with the power house passed besides their homes. To travel from their house to their land or the village, or the other way around, they must pass the pipeline along a steep hill, shown on the picture below. After construction, certain parts of the pipeline have been covered by soil and vegetation to make sure it stays in place.

Fig 22: Pipeline affecting access to land (source: author).

Especially the elderly members of these families say it costs a lot of energy to climb the hill and in case of emergency their house is not accessible by motorbike or car. They also fear to become isolated when they get older or when they get sick. The families have addressed this issue and suggest a small bridge or structure should be constructed to increase their accessibility to land. EPHL state that they have promised to deposit more dirt at this specific spot to make the steep flatter.

9.2 Indirect effect

Like in the project area, the construction of the access road in Upper Rugendabara has caused land plots to be split into two. The affected people expressed that this does not influence their ability to access their land, as crossing the road is not considered difficult. The new access road in this area has also increased the mobility of the people, more homes can now be reached by motorised vehicles.

The current quality of the access road in the downstream area is considered good and does not cause any issues. However, the people in Upper Rugendabara share the concern about the poor quality of the government road. The interviewed household express that they also use the government road to travel to markets, community centres, schools, hospitals and other villages. Since the construction phase they find it more difficult and sometimes even dangerous to use the road.

10. Land use

The Rwimi SHP did not lead to people changing the way they use their land. All affected people still use their land for subsistence agriculture and some households have cattle. Since the villages don't have access to electricity, no new businesses have been created and the local way of life remains the same. As result of the compensation payed for their land some affected people have built new houses on their land or bought an extra plot of land. However, as most of the land near the villages is already occupied the newly bought land is far away.

10.1 Direct effect

The biggest concern of people in the project area considering the use of their land is the construction material used and left behind by the contractor. During the construction phase KSJ used big stones and boulders. As mentioned, during the rainy season these stones and boulders get swept away by the heavy rain. However not only are river access points destroyed, these rocks and boulders also end up on cultivatable land. This causes crops to be destroyed and limits the amount of cultivable land. Some of the severely affected people have been compensated for this issue by EPHL through extra money, however the stones and boulders have never been removed from their land.

Fig 23: Rocks and boulders on agriculture land in Nyakabale (source: author).

Another issue is that some households in the project area rented land to the contractor during the construction phase. These plots of land were used to store construction material. These households were promised that their piece of land would be covered by 'black', fertile soil after they finished using the land. However, after finishing construction the contractor left without restoring the land to their previous condition. For this issue no compensation has been paid, as EPHL states that this problem should be solved by KSJ. The affected people claim that EPHL should take responsibility, as they oversee the project and did not supervise the contractor correctly. This issue is causing anger among the affected people because they are now left with pieces of land that are not usable for agriculture, their main livelihood source.

Fig 24: Rented plot used by KSJ to store construction material in Nyaseke (source: author).

In Kihoko village the land now occupied by the new access road to the weir site used to be covered by timber trees and fruit trees. These trees provided the people in the area of their main source of fire wood used for cooking, and their main source of fruit. These fruits are the most profitable crops when sold at the market. Since these trees have been destroyed local people are now forced to use small parts of their agricultural land to plant trees. This reduces the amount of cultivable land used for other crops, and at the same time people lose some of their income from fruits. The ESIA (EPHL, 2013a) mentions that during the construction phase it is necessary to properly mark the trees in the affected areas and limit the number of trees destroyed. It also mentions that a tree planning programme should be set up to support the affected people in planting new trees in their homestead (EPHL, 2013a). When this programme is mentioned during the household interviews, none of the participants have heard about the programme and state that they bought and planted new trees without assistance from EPHL or another actor.

In Nyakabale village the surge tank is causing problems for the use of surrounding land. The surge tank is built on top of a small hill and water has been starting to seep from the surge tank into the hill. From the hill the water resurfaces onto the new access road that diverts the water towards agricultural land of people living along the road.

Fig 25: Surge tank in Nyakabale (source: author).

Especially during raining season their crops suffer from too much water and get destroyed. The water doesn't only affect agricultural land but in some cases also latrines and houses that are not resistant to the amount of water. This issue is known by EPHL and they state that the water is not seeping from the surge tank. They explain that the raining seasons are becoming more unpredictable and heavy and therefore this issue with water can be expected.

To help the people affected by this issue EPHL is planning on digging a trench along the road and back into the river through pipes. Within the village people already try to assist each other by digging trenches along the access road. In this way they try to reduce the amount of water that flows down the hill and protect their neighbours.

Fig 26: Rain water diverted onto agricultural land in Nyakabale (source: author).

Fig 27: Trenches built to reduce rainwater flow along the road (source: author).

10.2 Indirect effect

In the downstream area the people don't experience the same issues concerning the construction material used and left behind by the contractor. In this area only one access road is built and no other hydropower related facilities. The combination of less construction material used in the area and the area having less mountainous characteristics results in no cultivable land being affected by rocks or boulders.

Like in the project area, the people in Upper Rugendabara still use their land for subsistence agriculture and some households have cattle. Since the village doesn't have access to electricity, no new businesses have been created and the local way of life remains the same. Some households have built new houses after receiving compensation money for their piece of land where the road is constructed. However, no real change or issues concerning the use of land is discovered.

At this point the results on access and use of water and land have been discussed. The next topic that needs attention is the process of displacement and resettlement.

11. Resettlement action plan

The primary goal of the resettlement action plan (RAP) is to ensure that people are treated fairly when they must be displaced, and that they share in the benefits of the project that involves their resettlement (IFC, 2002). The objectives of the RAP, is to ensure that the disruption of the livelihood of people in the project's area is minimized, ensure that the displaced people receive resettlement assistance to improve their living standards, provide explicit guidance to project staff and set up a mechanism for monitoring the performance of the resettlement program (IFC, 2002).

Eco Power Holdings Limited has prepared a RAP in compliance with the Land Act of 1998, the Land Acquisition Act of 1965 and the Electricity Act of 1999. Land will be acquired for the construction and operations of the power plant; this will include the access roads, the area to be occupied by the weir and the area impounded by the weir, area to be acquired for the low-pressure pipes, the fore-bay and the spill way, the high-pressure pipes, the power house and office structures and the transmission line (GETFiT, 2016).

The Land Act addresses four issues namely, holding, control, management and dispute processing (Coldham, 2000). As regards tenure, the Constitution of Uganda vests all land to be held under customary, freehold, mailo or leasehold tenure systems (Coldham, 2000). The Land Act defines the incidence of each tenure regime, provides mechanisms of the acquisition of certificates of customary ownership, the conversion of customary tenure to freehold, collective management of land held under customary law, the protection of the rights of women, children and persons with disability and lastly the creation of a Land Fund to assist various people wishing to obtain secure land rights (Coldham, 2000).

The Land Acquisition Act handles the procedures and methods of forced acquisition of land for public purposes, both for temporary or permanent use (EPHL, 2013b). It states that either the Government or a private developer is obligated to pay compensation to anyone who suffers damage caused by any sort of action (EPHL, 2013b).

The Electricity Act requires everyone who intends to construct, own or operate an electricity facility to obtain the appropriate license by ERA. The ERA is required to review the various proposals of projects including the impacts of the project on electricity supply, socioeconomic, the environment, natural resources, wildlife and cultural heritage before making a decision to grant the license (EPHL, 2013b).

The total land take for the project is 8.75ha (21.646 acres) directly affecting 96 households in the four villages. An inventory of land that would be affected by the project was completed after a land survey and land ownership details had been established to purchase the land from the respective owners (EPHL, 2013b).

Site	Land acquisition in hectares
Weir	0.74
Pipe line	4.61
Surge tank	0.14
Spill way	0.14
Power house, office and staff facilities	1.52
Weir access road	0.67
Surge tank access road	0.62
Power house access road	0.14
Transmission line	0.17
Total	**8.75**

Table 8: Land requirements Rwimi SHP (EPHL, 2013b).

The assessment of the project did not indicate any physical displacement of any household and/or loss of livelihood and services, and involuntary resettlement of people or demolition of homes did not occur. Although the project has not resulted in any physical displacement of households, the project does impact sections of cultivable land resulting in economic resettlement of 96 households (EPHL, 2013b).

The table below shows the total number of economic resettled people per village. In the project area 79 people are affected (Kihoko, Nyaseke and Nyakabale) and in the downstream area 17 people are affected (Upper Rugendabara). The people living in the project area are affected by the different hydropower facilities and access roads. The people living downstream are only affected by one new access road built in the area.

Village	Number of economic resettled people
Kihoko	26
Nyaseke	12
Nyakabale	41
Upper Rugendabara	17
Total	**96**

Table 9: Number of economic resettled people per village (EPHL, 2013b).

The required land of 8.75ha is spread over 96 plots and the average land intake is around 0.217 acres. The table below shows the degree of land intake in detail. It appears that 81,25% of the affected population must give up 0.3 acres or less and the most frequent degree of land intake is less than 0.05 acres with 24 households.

Land intake in acres	Frequency
< 0.05	24
0.05 – 0.1	16
0.1 – 0.2	22
0.2 – 0.3	14
0.3 – 0.4	05
0.4 – 0.5	02
0.5 – 0.6	04
0.6 – 0.7	02
0.7 – 0.8	02
0.8 – 0.9	02
0.9 – 1.0	03
21.646	**96**

Table 10: Degree of land intake (EPHL, 2013b).

11.1 Information and engagement

In general, the consultative process applied during preparation of the RAP meets the legislative requirement of the GoU and the Performance Standard of the IFC (The World Bank, 2014). The IFC Performance Standards mandates the developer to prepare a public consultation and disclosure strategy and implementation of adequate procedure for engagement with affected communities. The following provisions of the fifth Performance Standard (PS5), Land Acquisition and Involuntary Resettlement are identified as being of particular relevance:

- The Project is to "consult with and facilitate the informed participation of affected persons in decision-making processes related to resettlement. Consultation will continue during the implementation, monitoring, and evaluation" (The World Bank, 2014, p. 18).

- The Project is expected to "establish a grievance mechanism consistent with Performance Standards to receive and address specific concerns about compensation and relocation that are raised by displaced persons including a recourse mechanism designed to resolve disputes in an impartial manner" (The World Bank, 2014, p. 18).

- The Project is expected to "carry out a census with appropriate socio-economic baseline data to identify the persons who will be displaced by the project, to determine who will be eligible for compensation and assistance, and to discourage inflow of people who are ineligible for these benefits. In the absence of host government procedures, the client will establish a cut-off date for eligibility. Information regarding the cut-off date will be well documented and disseminated throughout the project area" (The World Bank, 2014, p. 18).

During the interview EPHL states that several community consultation meetings were held to provide information about the project. The meetings were held with a view to address and include the views and recommendations made by the community, the community leaders, local council representatives

and the project affected persons. Goal of these meetings was to create understanding on the basis of land valuation, payment mechanisms and community development actions which will be implemented after the RAP approval (EPHL, 2013b). Where necessary in consultation with the community members, follow up meetings were undertaken to minimize community disturbances.

Consulting the local affected people, they said that before construction many meetings were held in the villages. When the specific number of meetings was asked most people had already forgotten. Others said that they remember around three meetings and always an individual follow up meeting was mentioned when specific concerns were expressed. The meetings were always led by EPHL members and all the information provided to them came from company members. The level of information provided by EPHL does not differ between the four villages. The affected people in the project area and in the downstream area all received the same information.

As stated by EPHL, all the affected people interviewed expressed that they had the opportunity to speak up during the consultation meetings. They mention that their concerns were recorded and documented during the meetings. However, since these meetings they have never received any feedback from EPHL as how their concerns have been handled. The people feel that even though their concerns have been documented, they have never been addressed or taken seriously. The concerns expressed during the consultation meetings consider the amount of compensation money, time of payment, when to expect the new school and medical facility and the provision of electricity. The level of engagement provided by EPHL during the meetings does not differ between the four villages. The affected people in the project area and in the downstream area all had the opportunity to speak up and make their concerns heard.

To address concerns arising after the implementation of the RAP, a Grievance Committee was established consisting of Local Council III of Kitswamba Sub-county, Local Chairman of the four villages, two representatives from the community, a representative of the project affected people (PAP) and an EPHL member. The decisions taken by the Grievance Committee are considered to be final (EPHL, 2013b). The Grievance Committee continues to meet every month on the 15th and all the mentioned actors are required to be present. During these meetings the still existing and new concerns of community members are discussed. The Local Chairman of every village is responsible to address the concerns of their village members. So, the only way for local affected people to address their concerns now is through their Local Chairman.

During the interviews in all four villages, people expressed their concern that when they address their issues to the Local Chairman they never receive feedback. When this problem is discussed with the Local Chairman their response differs. The Local Chairman of Nyakabale and Nyaseke village state that the meetings of the Grievance Committee usually only take several minutes and that the meetings stop before issues can be addressed. The Local Chairman of Upper Rugendabara and EPHL on the other hand state that the meetings usually take two hours and that there is plenty of time to address local concerns. The Local Chairman of Kihoko village said that he has given up to address community problems as they never receive feedback and that issues are not addressed. He also states that EPHL and the Local Council III of Kitswamba Sub-county try to keep the local issues quiet during the meetings and that the Local Chairman have no other option than to follow, as they have less power.

11.2 Compensation

An important part of the RAP is to make sure that affected people are compensated when they get physically or economically displaced due to small hydropower development.

To determine the people who are eligible for compensation the project considers the existing National Laws and Regulations and the criteria contained in the World Bank Operational Manual. Meaning those who have formal legal right to land and lawful possession over the land are eligible for compensation (EPHL, 2013b). Under the National land tenure system in Uganda land bought from customary owners without official land titles is still considered under the customary tenure system. This type of land tenure is the most common across Uganda and in the four affected villages. All the affected households had customary land without legal titles, except two households in Kihoko who had formal legal land rights. After the compensation phase EPHL provided all the people without legal titles with official land certificates.

Land regime	Ownership	Before SHP	After SHP
Customary tenure	Owned	94	0
Customary tenure	Legal certificate	02	96

Table 11: Ownership of land before and after Rwimi SHP (source: author).

The key principles considering compensation by the project in the RAP are:

- "Resettlement and compensation of PAP will be carried out in compliance with Ugandan legislation. In addition, all economically resettled people will be offered an option between either a full resettlement package, including the provision of replacement residential land and a house, or cash compensation" (EPHL, 2013b, p. 38).

- "Experience has shown that cash compensation, although very sought after by many household heads, could be detrimental in the medium term, if not wisely used, to other household members, particularly the females and children. The project will make every effort to ensure that cash compensation will be made effective, and the RAP is designed accordingly" (EPHL, 2013b, p. 38).

- "Most affected people derive their livelihood from agriculture. Where farmers are economically displaced, they will be helped to restore the livelihoods and will provide transitional assistance if necessary as long as livelihoods are not restored to their previous level. Specific livelihood restoration activities will target women" (EPHL, 2013b, p. 38).

Village	PAP	Compensation	Disturbance allowance	Total cost
Kihoko	26	43.800.700	13.136.210	56.936.910
Nyaseke	12	48.225.000	14.467.500	62,692,500
Nyakabale	41	58.120.600	17.369.010	75.489.610
Upper Rugendabara	17	36.961.200	11.168.460	48.129.660
Total	**96**	**187.107.500**	**56.141.180**	**243.248.680**

Table 12: Rwimi SHP compensation per village in Ugandan Shilling (EPHL, 2013b).

It is understood that land acquisition was finalized and cash compensation to the 96 households was paid by the end of 2012 (EPHL, 2013b). All the affected people have been compensated through cash and nobody received the full resettlement package as mentioned in the RAP. The RAP mentions that EPHL (2013b) is required to monitor the spending patterns of the PAP that acquired cash compensation over time and to assist in responsible money management. EPHL set up bank accounts for all the interviewed households in which the compensation money was deposited. The table below shows how much compensation money the interviewed households received.

Village	**PAP**	**Compensation money recieved**			
		< 500.000	**500.000 - 2.000.000**	**2.000.000 - 5.000.000**	**> 5.000.000**
Kihoko	16	3	6	5	2
Nyaseke	10	1	1	2	6
Nyakabale	18	4	8	4	2
Upper Rugendabara	13	1	3	8	1
Total	**57**	**9**	**18**	**19**	**11**

Table 13: Compensation of interviewed households per village in Ugandan Shilling (source: author).

In Kihoko most people received a compensation ranging between 500.000 and 5 million. In this area the amount of compensation is a broad range as the pieces of land acquired by EPHL differ in size. Large pieces of land had to be acquired surrounding the weir and small pieces of land surrounding the new access road.

In Nyaseke most people received a compensation of more than 5 million. In this area the amount of compensation money received by the affected people is the highest, and the number of affected people is the lowest. In Nyaseke only the land along the penstock had to be acquired as no new access road is built in this area. Therefore, larger pieces of land had to be acquired from only a small number of households.

In Nyakabale the project affected the highest amount of people, and the amount of compensation money received is the lowest. In this area the new access road is the longest, causing EPHL to acquire small pieces of land from a high number of households. The households that received more than 5 million were the owners of the land where the surge tank is constructed.

In Upper Rugendabara most people received a compensation between 2 million and 5 million. Considering only a new access road and no other hydropower facilities have been built in this area the amount of compensation seems relatively high. However, the people in this area tend to own larger plots of land resulting in more compensation money received per household.

After compensation, the local people said their spending behaviour was monitored through two meetings. How the affected people spent their money differs by the amount of compensation paid by EPHL. In general, when households received less than 500.000 Ugandan Shilling the money was spent on daily expenditures. This amount of money is insufficient in order to pay school fees, buy a vehicle,

buy new land or to build a new house. The households that received more than 500.000 Ugandan Shilling use it foremost to pay for school fees for their children. Depending on how much money is left it is used to buy a vehicle, buy new land or to build a new house. Generally, the households that received over 3 million Ugandan Shilling bought a new plot of land and the households that received over 7 million Ugandan Shilling started constructing a new house. In households where a family member was sick the money is first used to buy medication before it is spent on something else.

During the resettlement phase the affected people in all villages expressed their concerns about compensation payment to the Grievance Committee. They insisted on the payment being settled quickly, however delays in payment resulted in the local community briefly blocking one of the access roads. The local people explained that the amount of compensation received was listed on a form that they had to sign during the resettlement process. However, they did not receive clear information on how their land was valued. Affected people still don't understand why they got a certain amount of money.

All interviewed household expressed that they expected the amount of compensation money to be higher. Some even expressed that if they did not agree with the given compensation their land would just be taken, so they felt forced to agree. Another concern of local people during the compensation was that trees and crops were compensated at the same value per piece. For example, the compensation for a full-grown mango tree was the same as for a newly planted mango tree which is found to be unfair.

Besides cash compensation for their land, affected people also received compensation in the form of seeds, goats and chicken. The RAP (EPHL, 2013b) mentions that the project would support the people with seeds of their choice for at least four consecutive agricultural seasons. The people explained that they received seeds for the last three seasons but that they didn't received seeds for this season. EPHL explained that the livelihood of the affected people has restored to their previous level and that this is the reason why they stopped providing seeds. Local people have however not been informed and are still waiting to receive the promised seeds.

All the affected households have been compensated with one goat and two chickens. While the people in Nyakabale and Upper Rugendabara state that all the chicken died within three months and that they were sick when received, people in Nyaseke and Kihoko did not encounter this problem and were grateful for receiving the goat and chickens.

To support the households whose livelihood have been significantly affected by the project a Livelihood Improvement Framework (LIF) was introduced. Households from whom more than 0.5 acres of land is acquired were eligible to enter this framework. Households from whom 0.25 to 0.5 acres of land is acquired are considered if the household is headed by a single woman, includes disabled members, includes orphaned members or is not benefitting from other support initiatives (EPHL, 2013b). Out of the 96 affected people twenty were selected for the LIF.

The goal of the LIF is to provide livelihood security assistance over a longer period of time until the income levels of these twenty affected households is restored. Members of these households are considered for work at the project site on priority basis and they will be provided with technical assistance to undertake alternative livelihoods (EPHL, 2013b).

Some interviewed households (3) said they are included in the Livelihood Improvement Framework. These are two households headed by a single woman and one household consisting of an elderly couple. They explain that working at the project site was never an option for them as they have other responsibilities. These include working on their land, looking after their kids and cooking. When asked if they received technical assistance to undertake alternative livelihoods they respond that they only received two workshops on improving their agriculture production. Currently they don't experience any extra support or help from EPHL in comparison to other affecter people.

11.3 Conflicts

Several conflicts between the affected people and EPHL have appeared during the different phases of Rwimi SHP, resulting in strikes and blocking off access roads. Two of these conflicts have already been mentioned in the previous chapters. One concerning the installation of water taps before starting construction phase, and one concerning delays in the payment of compensation money.

Currently there is still one conflict present that is clearly visible in Nyaseke. This conflict concerns unauthorized use of land by EPHL. During the construction phase EPHL rented land to be used as a temporary road for construction vehicles. After this phase EPHL would restore the used land to its previous condition and return the land to the owners. At this moment EPHL has stopped paying rent for the last seven months but continues to use the temporary road. The owners have started to block the road with trees and branches and insist the land to be restored to its previous condition. About two times a week EPHL workers remove the blockage early in the morning and the same day the owners block the road with new material. The owners state that they will now start blocking the road with rocks and are considering organising a protest for this issue to be solved.

Fig 28: Temporary road blocked by land owners (source: author).

EPHL say that they have told their workers to stop using this piece of land, however the workers explain that when they have to travel between different project sites this is the fastest route. When travelling between the sites they walk over the pipeline which is EPHL property. This is the only part of the pipeline that is not covered by dirt, about 150 meters long. They know they are not allowed to pass

this piece of land, but it saves them around one hour of travelling time. EPHL state that they are now preparing meetings between land owners and their workers to solve this issue, and to explain when the land will be restored to its previous condition.

Fig 29: Temporary road blocked by land owners (source: author).

At the same time people in the four villages are upset with several 'empty' promises made by EPHL. All the interviewed households state that EPHL promised to build an extra school and a medical facility. These claims are also mentioned in the RAP (EPHL, 2013b). Since there are no health centres in any of the four villages, people either travel elsewhere or seek local treatment. The nearest health care facility is around 4,5 kilometres away. Especially women and elderly members explain to be upset with this empty promise. Women had high hopes of a maternity ward to help pregnant mothers and the elderly want to be treated quicker in case of emergency.

EPHL has bought a plot of land in Upper Rugendabara for the construction of a new medical facility. The plot is protected by fences with barbed wire and currently used as storage of construction material. It seems that no construction has been started. The explanation from EPHL why they haven't started constructing the school and medical facility is that they don't have enough capital. Providing the gravity water scheme and installing the water taps in the villages caused them to postpone the building of the school and medical facility.

Fig 30: Plot for the medical facility in Upper Rugendabara (source: author).

Other empty promises included the removal of rocks and boulders on agricultural plots, depositing black, fertile soil on destroyed agricultural plots, the number of installed water taps, seeds for four consecutive seasons, providing extra support to vulnerable people through the LIF, an alarm or information when the water flow increases and a proper way to get feedback on raised concerns, which are mentioned in the previous chapters.

11.4 Project benefits

The acquired documents about the Rwimi SHP state that the project would bring immediate benefits to the project area and long-term benefits to the local community as well as to the national economy (EPHL, 2013b). The immediate benefits would consist of employment creation, resulting in increased income for community members. Only a few project affected people managed to get a job at EPHL. Currently twenty members work at EPHL doing low skilled jobs. They attended two weeks of training after which they received a certificate. They work ten hours a day, seven days a week, resulting in a consistent amount of income. The workers now earn 10.000 Ugandan Shilling every day (€2,20), which is an increase of their income. In general, the workers are pleased with their new job, their only remark is that food during the day is not provided by the employer.

The main benefit from the project expressed by the interviewed households are the installed water taps. Although the promised number of taps have not yet been installed, the access to safe drinking water is something the communities are grateful for. This access improves the general health and reduces preventable health risks such as cholera, typhoid and diarrhoea.

Another benefit is the improved mobility in the area by turning foot paths into the new access roads. The roads can be used by motorised vehicles resulting in people spending less time travelling. EPHL has helped in setting up a community organisation focused on improving agriculture productivity. Workshops are being organised to transfer knowledge towards and within the affected communities.

The last benefit mentioned is that people now own official land certificates. As mentioned, most affected people had customary land without legal titles before the project started. After the compensation phase EPHL provided the people with official land certificates, which can resolve future disputes regarding ownership of land more easily.

12. Conclusion

Now the collected data and results have been discussed, the last part of this research is to answer the main question:

What is the impact of small hydropower projects on the access and use of water and land, and on displacement and resettlement for the affected communities in west Uganda?

The answer to this question is formulated by answering the sub questions and hypotheses formulated at the beginning of this research. After answering the main question, the findings of this research will be put in a bigger perspective in terms of general implications and recommendations. The last part of the conclusion is a reflection on the research and suggestions for further research on this topic.

12.1 Answer

The first part of the research is focused on the situation of hydropower development in Uganda. The findings showed the number of projects and how they are spread within the country. The first discovery is the high number of hydropower projects, 60 in total. Considering 42 out of the 60 projects are either under construction or expected, it has become clear that hydropower development in Uganda is a substantial part of the effort to expand electricity throughout the country. When a distinguish is made in the size of these projects, SHP accounts for 50%. This confirms that SHP have become a major focus within Uganda's energy sector.

When looking at the actors involved in Uganda's electricity sector, it shows that the sector is centralised and under government control. The main organisations are state owned and involved in the transmission, distribution and generation of electricity within the country. However, there is an increase in the amount of privately-owned generation projects who construct and operate their own generation projects. The amount of these projects is expected to keep increasing in the future as Uganda puts effort in attracting foreign investments towards their energy sector.

Concerning the access to electricity, only two households have been able to get access. They use the electricity for lighting and charging of electronic devices. The rest of the affected households still don't have access to electricity and remain using fire wood and paraffin as their main energy source.

Within the project area there are differences between the affected villages concerning the access to water. In Kihoko the access to the river is still good, in Nyakabale (66,6%) and Nyaseke (70%) people expressed that their access to the river has decreased. The new access points are considered dangerous and at the same time construction material block the existing access points. The people in these villages who own cattle even consider their access to the river severely decreased.

The biggest concern of people living in the project area is the safety of the river. Local people fear the river and are concerned about their safety since the hydropower project is operational. When the hydropower plant stops operating the water level in the river increases suddenly and quickly and the local people are not informed.

People living in the downstream community express that their access to the river is still good. No existing access points to the river have been destroyed or new access points have been constructed. Some people even express that their access to the river has increased, as the new access road can be used to reach the river by vehicle. The safety of the river is not a problem in this area as the village is located downstream of the power house.

A new way of access to water has been created in both the project area and the downstream community. In every village several water taps have been installed, however people generally find them to be busy and a monthly fee must be paid to use the taps.

The access to land in both the project area and downstream community is still considered to be good. During the construction phase of the project access to land was considered more difficult due to construction sites, demarcating fences and increase of traffic within the area. However, since the project is operational these issues are no longer a problem. Only in the project area the access to land of two families is directly affected by the project, disconnecting them from both the village and their land.

The new access roads built in both areas have increased peoples' mobility within the area, however the bad quality of the main government road after the construction phase has decreased people's mobility between the villages and to the main highway.

Within the project area the overall use of the river water has reduced, caused by the poor river water quality and the safety issue of the river. All the interviewed people now use the water taps for drinking purposes, however the river is still used for washing and bathing by all the affected households. For cooking purposes some households still use the river (36,9%), others use the water taps (63,1%).

As in the project area, all the people in the downstream community use the water taps for drinking purposes, and the river is still used for washing and bathing. For cooking purposes all the interviewed households in the downstream community use the water taps, as they are easily accessible in this area.

The Rwimi project has caused a changed flow of the river water in the project area. As this research was done during the rainy season, the local people didn't express their concern on the changed water flow. However, during dry season people do experience lower water levels and have been trying to make their concerns heard.

The people living downstream of the power house don't directly experience a change in water flow since the project is operational. However, the changed flow of the river does have an impact on the downstream community. It has reduced the amount of sediment transported downstream, decreasing the amount of soil that can converted into bricks and be sold at the markets or used for construction.

The Rwimi project did not lead to people changing the way they use their land. Subsistence agriculture remains the primary activity in the project area and the downstream community. Since the villages don't have access to electricity, the local way of life remains the same.

The only effect of the project on the use of land is that it has become more difficult for the people in the project area to grow crops on their land. Construction material left behind and changes in the landscape, resulting in a changed rainwater flow, have caused pieces of land being less cultivatable.

The Rwimi project did not result in any physical displacement of households, and involuntary resettlement of people or the demolition of homes did not occur. By design SHP do not flood an area, as is the case with large hydropower projects. However, the project does impact sections of land resulting in economic resettlement of 96 households in total. In the project area 79 people have been affected (Kihoko 26, Nyaseke 12 and Nyakabale 41) and in the downstream area 17 people have been affected, resulting in 4,7% of the total population in the area being economic resettled. The people

living in the project area are affected by the different hydropower facilities and access roads. The people living downstream are only affected by one new access road built in the area.

The level of information and engagement before starting the Rwimi project is considered good. Before the construction phase started several community consultation meetings were held to provide information about the project. When specific concerns were expressed by the affected households, an individual follow up meeting was always conducted. The meetings were led by EPHL members and all the information provided to them came from company members. The level of information provided by EPHL does not differ between the four villages. The affected people in the project area and in the downstream area all received the same information.

During the consultation meetings the affected households had the opportunity to speak up and make their concerns heard. The level of engagement during the consultation meetings does not differ between the four villages. The affected people in the project area and in the downstream community all say they had the opportunity to speak up and make their concerns heard. However, even though their concerns have been documented, the people feel their concerns have never been addressed or taken seriously, as they never received any feedback.

All 96 economic resettled households have received a compensation through money deposits, supplemented with seeds, goats and chicken and all households received official land certificates. Money has been deposited in bank accounts and the spending behaviour has been monitored by the hydropower developer. Depending on the amount of compensation, the money is spent on daily expenditures, medication, school fees, new land or new houses. The major concern of the affected households during this phase is the valuation of their land. The process was not clear, and people feel the compensation given was not fair.

During the different phases of the project three conflicts have appeared resulting in brief strikes and blocking off roads. One conflict is still present and remains unsolved up to this moment. Concluding, the Rwimi project does cause people to be economic resettled, however no physical displacement or destruction of property is discovered.

12.2 Recommendations

The findings of this research can now be put in a bigger perspective in terms of general implications and recommendations.

Accumulative impact

The first part of the research showed the number of projects and how they are spread within Uganda. The first discovery is the high number of hydropower projects. Especially considering that every project is an intervention into a certain area. It is important to realize that every intervention leads to a certain impact on the project area, the downstream area and the population living in these areas. Even though the general sense is that the impact of small projects is low, the fact that there are impacts must be recognised.

As discussed in the theoretical review the number of projects and their impact can stack up, causing an accumulative impact. Seeing that the majority of projects are operational, being built or planned in certain specific regions can enhance the accumulative impact. As found with the project investigated in this research, the ESIA reviews are approved individually without considering the accumulative impact. Even though the impact of different projects is variable and influenced by project size, operating company and project location, the sum of the impacts needs to be understood and incorporated in the approval phase.

Electricity provision

The context of this research is electricity provision to rural areas in Uganda, or developing countries in general. Improving the access to sustainable electricity is considered a key instrument to enhance development, as mentioned in chapter 3.2.

Most benefits mentioned in the approval documents for hydropower projects rely on the assumption of electricity provision. The main argument is that access to electricity can create new opportunities for the rural population and give them the tools to escape their backward economic position. At the same time the affected population accept the project as they have high expectations on receiving access to electricity.

As seen with the project central in this research, access to electricity in the affected area is not always a given. From the interviewed households only two families are currently connected to the electricity grid. It is important to have appropriate mechanisms in place to assure the affected area with access to electricity. In the case of Uganda, the project operators should try to mediate between the affected communities and the national government to gain access to the national grid, as they are responsible for the transmission and distribution of electricity. If this is not possible substitutes like solar energy should be considered.

Safe and reliable drinking water

Another element to improve living standards is the access to safe and reliable water. In rural areas in Uganda people still use rivers for water consumption. As discovered in Rwimi, hydropower projects have an impact on the quality of the river water and therefore the use of this water. When the river is contaminated with construction material, soil and cement it is no longer considered safe to drink by the affected communities. Therefore, providing access to safe and reliable water for the affected communities before starting the construction phase of a hydropower project is advised.

Fair water allocation

As hydropower development can result in an unfair allocation of water between users, a minimum flow requirement should be identified on a project-specific basis. This can ensure that the local population is not hindered in their daily use of the river, especially in dry season when the water level drops. Even if access to alternative safe and reliable water is provided, easy access to the river is still important. For example, in cases where livestock is an important livelihood source, access to the river is still of importance.

Hydropower operator responsibility

The hydropower operator should maintain a high level of supervision during and after the construction phase to reduce negative side effects caused by the contractor. As discovered in the Rwimi project the material left behind by the contractor has caused several issues for the affected communities.

Easy access to land

During the construction phase it is expected that the level of access to land decreases, caused by demarcating fences, construction material and vehicles for example. After the construction phase the level of access to land is generally back to normal, although changes in the landscape can cause difficulties to arise in specific areas. Special attention from the hydropower operator is advised to assure people are not dislocated from their land or village.

Resettlement process

Traditionally large hydropower projects are central in the displacement and resettlement discourse. When it comes to small projects the general sense is that displacement and resettlement is less of an issue. Observations in the research area have proven that almost every piece of land is cultivated, all the way down the steep slopes to the river edge. At the same time these observations provided a sense of the size of these small projects. A number of facilities have to be constructed along different parts of the river, therefore always leading to acquisition of land. Even when physical displacement is not an issue, economic resettlement is expected to be present.

At the Rwimi project site the number of economic displaced people was 4.7% of the total population in the area. This number might seem negligible, but displacement remains a sensitive topic that must be handled appropriately and not be ignored in favour of the greater good.

The level of information and engagement before starting the Rwimi project is considered good. Managing people's concerns and providing feedback to the communities is however lacking. Even though a system, grievance committee, is in place to address local concerns and issues, the system doesn't seem to work. Proper management of the system can increase the effectiveness of dealing with local issues and concerns.

The economic resettled people have all been compensated through money deposits where the main issue remains valuation of land. When the affected people are properly informed on the valuation process during land acquisition it can increase their sense of receiving a fair compensation. This can also improve the general attitude among the affected people towards the project.

12.3 Reflection and further research

Decisions made throughout the research have determined what data is collected, the methods of data collection, the analysis of the data and ultimately the conclusions drawn. There are good reasons for the decisions made, influenced by the limitations experienced in the field. However, looking back gathering extra quantitative data could have been useful. This could potentially make it clearer to present differences between the villages or the project area and the downstream community. Furthermore, adding extra quantitative data can help to support the qualitative data gathered.

There are many possibilities for further research on this topic. A similar research can be performed on the Rwimi SHP when the project is operational for a longer period of time, or during the dry season. Some of the impacts discovered in this research might be less present. At the same time new impacts might be discovered not currently present.

As discovered in this research, many new hydropower projects are under construction or planned for the future. As more mini hydropower projects are constructed in Uganda a similar research can be performed on these projects. The impacts of small and mini projects can then be compared looking for similarities and differences.

It can also be interesting to see if the impacts of the hydropower projects extend further downstream. In this research only the first community living downstream is questioned. By incorporating different communities living further downstream in the study this can be examined. Further research can also focus on the accumulative impact by studying a number of hydropower projects located along the same river, or located in one specific area.

Lastly, the context of this research is electricity provision and within this context a range of further research can be conducted. The range of possibilities is so vast that going into detail is unnecessary. However, closing the electricity deficit remains an important subject in developing countries. But at what cost?

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Appendices

1. Interview and focus group discussion guides

Guide: Mapping the activity

- How many hydropower projects are operational in Uganda?
- How many hydropower projects are being constructed in Uganda?
- How many hydropower projects are being planned in Uganda?
- Which organisations are active in SHP in Uganda?
- Which foreign organisations or governments are active in SHP in Uganda?
- Have there been any conflicts in the country concerning SHP development?

Guide: Access and use of water and land

General information

Location: project area / downstream

Name of village: ……

Household head: male / female

Age: ……

Household size: ……

Years of living in this area: ……

- What is your primary source of income?

- For which activities do you use your land?
  - Before hydropower development
  - After hydropower development

- How is the condition of your land?
  - Before hydropower development
  - After hydropower development

- For which purposes do you use the river?
  - Before hydropower development
  - After hydropower development

- How is the condition of the river water?
  - Before hydropower development
  - After hydropower development

- Have you noticed any change in access to your land since small hydropower development?

- Have you noticed any change in use of your land since small hydropower development?

- Have you noticed any change in your access to the river since small hydropower development?

- Have you noticed any change in your use of the river since small hydropower development?

- Does your house have access to electricity?

- Which type of energy do you use the most, and for which purposes?

Guide: SHP key informant

- By whom was the resettlement programme created?
- Which companies were involved during the process?
- How many people have been displaced or resettled?
- When have local people been informed about the resettlement process?
  -Prior SHP development
  -During SHP development
- Who provided local people with information of the resettlement process?
  -Village leader
  -Neighbours
  -Project member
  -Media
  -Other?
- How were local people able to participate during the resettlement process?
- Have local needs and demands been considered during the process?
- How have resettled people been compensated?
  -Money
  -Land
  -House
  -Training
  -Other?
- What challenges have occurred during the resettlement process?
- What challenges have occurred during the SHP development process

Guide: Local participants that have been resettled

- When were you informed about the resettlement process?
  -Before hydropower development
  -During hydropower development

- Who provided you with information of the resettlement process?
  -Village leader
  -Neighbours
  -Hydropower Project member
  -Media
  -Other?

- What information did these sources give you?

- Did you participate in decision-making regarding the resettlement process?

- Were your wishes/needs/demands taken into account?

- Have you received any form of compensation?

- How were you compensated?
  -Money
  -Land
  -House
  -Training
  -Other?

- If applicable, for what purpose(s) has the financial compensation been used?
  -Land
  -Housing
  -Savings
  -School fee
  -Vehicle
  -Daily expenditures
  -Other?

- Do you feel that you got a fair compensation?

- Have you experienced any conflicts during the resettlement process?

2. Hydropower projects in Uganda

Number	Name	Village	District	Capacity	Status
1	Achwa 2	Pader	Gulu	42	Construction phase
2	Achwa 3	Aswa	Gulu	10	Expected
3	Adekokwok	Adekokwok	Lira	8	Operational
4	Agai	Agai	Arua	0.35	Expected
5	Agbinika	Yumbe	Yumbe	20	Expected
6	Amua	Amua	Moyo	0.18	Expected
7	Ayago	Ayago	Nwoya	600	Expected
8	Bugoye	Bugoye	Kasese	13	Operational
9	Bujagali	Jinja	Buikwe	250	Expected
10	Ela	Ela	Kabarole	1.5	Expected
11	Hoimo	Hoimo	Hoima	3.3	Expected
12	Igassa	Kibwa	Kabarole	0.3	Expected
13	Isimba	Isimba	Kamuli	183.2	Construction phase
14	Kabalega	Buseruka	Hoima	9	Operational
15	Kabasanja	Kabasanja	Kabarole	0.4	Expected
16	Kakira Cogen	Kakira	Jinja	52	Expect
17	Kanungu	Kanungu	Kanungu	6.6	Operational
18	Karuma	Karuma	Kiryandongo	600	Construction phase
19	Katooke	Katooke I	Kasese	0.3	Expected
20	Kiira	Jinja	Jinja	200	Operational
21	Kikagati	Kikagati	Isingiro	16	Operational
22	Kisiizi	Kisiizi	Rukungiri	0.3	Operational
23	Kisonko	Kasanze	Bundibugyo	0.7	Expected
24	Kitumba	Kitumba	Kabale	0.2	Expected
25	Kyambura	Kyambura	Rubirizi	7.6	Construction phase
26	Leya	Leya	Moyo	0.12	Expected
27	Lubilia	Kawembe	Kasese	5.4	Operational
28	Manafwa	Manafwa	Manafwa	0.15	Expected
29	Miria Adua	Miria Adua	Arua	0.10	Expected
30	Mpanga	Mpanga	Kamwenge	18	Operational
31	Mubuku 1	Kitoko	Kasese	5	Operational
32	Mubuku 3	Mubuku	Kasese	10	Operational
33	Muvumbe	Maziba	Kabale	6.5	Operational
34	Muzizi	Ndaiga	Hoima	44.7	Expected
35	Nalubaale	Njeru	Buikwe	180	Operational
36	Nchwera	Nchwera	Bushenyi	1.97	Expected
37	Nchwera 2	Nchwera	Bushenyi	0.5	Expected
38	Ndugutu	Ndugutu	Bundibugyo	4.8	Construction phase
39	Nengo Bridge	Nengo	Rukungiri	6.7	Construction phase
40	Ngiti	Ngiti	Bundibugyo	0.15	Expected

41	Nkusi	Kyangwali	Hoima	9.6	Construction phase
42	Nshungyezi	Nshungyezi	Isingiro	39	Expected
43	Nsongya	Kalisende	Kabarole	0.7	Expected
44	Nyagak	Paidha	Zombo	3.5	Operational
45	Nyagak 2	Paidha	Zombo	5	Operational
46	Nyagak 3	Paidha	Zombo	5.56	Construction phase
47	Nyakibaale	Nyakibaale	Rukungiri	0.10	Expected
48	Nyamagasani 1	Nyamagasani	Kasese	15	Construction phase
49	Nyamagasani 2	Nyamagasani	Kasese	5	Construction phase
50	Nyamwamba	Kilembe	Kasese	14	Construction phase
51	Nyarwada	Nyarwada	Nebbi	0.4	Expected
52	Ririma	Ririma	Kapchorwa	1.5	Expected
53	Rushobe	Murambi	Bushenyi	0.2	Expected
54	Rwigo	Rwigo	Bundibugyo	0.5	Expected
55	Rwimi	Rwimi	Bunyangabu	6.6	Operational
56	Sindila	Sindila	Bundibugyo	5	Construction phase
57	Siti 1	Siti	Bukwo	5	Operational
58	Siti 2	Chesowari	Bukwo	16.5	Construction phase
59	Tokwa	Bumate Central I	Bundibugyo	0.4	Expected
60	Waki	Butiaba	Masindi	5	Operational

3. IFC performance standards

Performance Standard (1) underscores the importance of managing environmental and social performance throughout the life of a project. Specific objectives are:

1. To identify and evaluate environmental and social risks and impacts of the project.

2. To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.

3. To promote improved environmental and social performance of clients through the effective use of management systems.

4. To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.

5. To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Performance Standard (2) recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. Specific objectives are:

1. To promote the fair treatment, non- discrimination, and equal opportunity of workers.

2. To establish, maintain, and improve the worker-management relationship

3. To promote compliance with national employment and labour laws

4. To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.

5. To promote safe and healthy working conditions, and the health of workers.

6. To avoid the use of forced labour.

Performance Standard (3) recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Specific objectives are:

1. To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.

2. To promote more sustainable use of resources, including energy and water.

3. To reduce project-related GHG emissions.

Performance Standard (4) recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Specific objectives are:

1. To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.

2. To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner, that avoids or minimizes risks to the Affected Communities.

Performance Standard (5) recognizes that project related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Specific objectives are:

1. To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.

2. To avoid forced eviction.

3. To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by

a. providing compensation for loss of assets at replacement cost

b. Ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.

4. To improve, or restore, the livelihoods and standards of living of displaced persons.

5. To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

Performance Standard (6) recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. Specific Objectives are:

1. To protect and conserve biodiversity.

2. To maintain the benefits from ecosystem services.

3. To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities

Performance Standard (7) on indigenous people which deals with avoidance of adverse impacts, information disclosure, consultation and informed participation, impacts on traditional or customary lands under use, relocation of indigenous people from traditional or customary lands and cultural resources

Performance Standard (8) on Cultural Heritage deals with graves and other objects of cultural significance.