



Universiteit Utrecht
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DOWN TO BIOGAS BUSINESS

*A case study on the private biogas sector in Uganda
and its challenges faced by micro-and small
enterprises*

Master Thesis

International Development Studies

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Contents

| | |
|--|----|
| Abstract | 4 |
| Acknowledgements | 5 |
| List of figures | 6 |
| List of tables | 8 |
| 1. Introduction | 9 |
| 1.1. Problem statement | 9 |
| 1.2. Research objectives | 10 |
| 1.3 Research questions | 10 |
| 2. Theoretical Framework | 12 |
| 2.1. Private sector and development | 12 |
| 2.2 Private sector and development critiques | 15 |
| 2.3. MSME's and development | 16 |
| 2.4. Critiques on MSME's and development | 17 |
| 2.5. Assisting MSME's | 18 |
| 2.6. Conceptual Framework | 21 |
| 3. Methodology | 23 |
| 3.1. Research Design | 23 |
| 3.2 Data Collection | 23 |
| 3.3 Data Analysis | 26 |
| 3.4 Limitations | 27 |
| 4. Geographical and Thematic context | 29 |
| 4.1 National Context in Uganda | 29 |
| 4.2. Energy Poverty in Uganda | 31 |
| 4.3 Biogas in Uganda | 33 |
| 4.4 Biogas in the world | 35 |
| 5. The biogas sector in Uganda | 37 |
| 5.1 Macro-level | 37 |
| 5.2. Meso-level | 39 |
| 5.3. Micro-level | 41 |
| 6. Bottlenecks in the sector | 43 |
| 6.1. Affordability | 43 |
| 6.2 Relationships between the farmer, UDBP and BCE | 46 |
| 6.3 Relationships between the UDBP and BCE's | 48 |
| 6.4. Relationships between BCE's and Biogas associations | 49 |
| 7. BCE's and their capacity | 53 |
| 7.1 BCE Characteristics | 53 |
| 7.2 BCE Challenges | 55 |
| 7.2.1 Technical capacity | 55 |
| 7.2.2 Financial capacity | 56 |
| 7.2.3. Mason turnover | 57 |
| 7.2.4. Subsidy withdrawal | 58 |

| | |
|--|----|
| 8. Discussion & Conclusion | 60 |
| 8.1 Summary of findings | 60 |
| 8.2 Practical implications | 62 |
| 8.3 Theoretical implications | 63 |
| 8.4 Implications for future research | 65 |
| 10. References | 67 |
| 11. Annexes | 72 |
| Annex 1: List of respondents in-depth interviews | 72 |
| Annex 2: Coding Matrix BCE challenges | 73 |
| Annex 3: Stakeholder Table | 74 |
| Annex 4: Survey End-Users | 76 |
| Annex 5: Interview Guide BCE's | 78 |
| Annex 6: Interview Guide other stakeholders | 79 |

Abstract

More and more, the private sector is believed to be an agent of development. Through strategies like corporate social responsibility, shared value creation and bottom of the pyramid approaches, the private sector is often believed to be able to address development issues, like unemployment and poverty, in a better way than governments have during the last decades. This optimism has trickled down into development strategies all over the world. This has also been the case in Uganda, where different donor-funded organisations have initiated the development of a private biogas sector in the country. Through this new sector, not only jobs would be created and economic development would be stimulated, but also the spreading of biogas (a renewable source of energy) would increase energy access and alleviate poverty among poorer segments of society. However, new companies within this sector are struggling to become viable and independent, which makes it hard for the sector to deliver its promises of contributing to development. This study poses the question why and how this sector is struggling to become independent and commercially viable. By using the Ugandan biogas sector as an exemplified case-study, it explores the difficulties a private sector encounters before it can contribute to development. In Uganda, challenges key actors in the sector, biogas construction enterprises, face in selling and constructing biogas were studied in detail with mainly qualitative methods. Results of this study showed difficulties related to the sectors infrastructure and relationships between different stakeholders. Furthermore, challenges regarding financial and technical capacity play a major role in the functioning of the sector. The findings of this study show the complexity of the private sector as an agent of development, supporting the argument that private sector development is not a panacea to stimulate economic growth and alleviate poverty.

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List of Abbreviations

| | |
|-----------------|---|
| ABPP | African Biogas Programme Partnership |
| BA | Biogas Association |
| BCE | Biogas Construction Enterprise |
| BSP | Biogas Support Programme |
| CAMARTEC | Centre of Agriculture, Mechanisation and Rural Technology |
| CSR | Corporate Social Responsibility |
| EBA | Eastern Biogas Association |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| GoU | Government of Uganda |
| HIVOS | Humanistisch Instituut voor Ontwikkelingssamenwerking |
| HPI | Heifer Projects International |
| IBA | Interregional Biogas Association |
| IP | Implementing Partner |
| MAAIF | Ministry of Agriculture, Animal Industries and Fisheries |
| MEMD | Ministry of Energy and Mineral Development |
| MNC | Multinational Corporations |
| NBSC | National Biogas Steering Committee |
| PSFU | Private Sector Foundation Uganda |
| SME | Small and Medium Enterprise |
| MSE | Micro and Small Enterprise |
| SNV | Stichting Nederlandse Vrijwilligers |
| UBA | Uganda Biogas Association |
| UDBP | Uganda Domestic Biogas Programme |
| UGX | Ugandan Shillings |
| WEBA | Western Biogas Association |

List of figures

| | |
|------------------|---|
| Figure 1 | Motivations and types of organizations of social innovation. |
| Figure 2 | Growth characteristics of MSE's that have been in existence for more than a year and started with less than 5 workers |
| Figure 3 | Conceptual model |
| Figure 4 | The problem tree |
| Figure 5 | Map of Uganda and neighbouring countries |
| Figure 6 | Percentage of Ugandan Gross National Income consisting of ODA. |
| Figure 7 | Domestic energy consumption Uganda, 2010 |
| Figure 8 | The rising cost of firewood in Uganda |
| Figure 9 | Total production of biogas plants per country. |
| Figure 10 | Biogas sector map. Key actors and their relations |
| Figure 11 | Factors of influence on the price of a biogas digester |
| Figure 12 | Percentage of plants constructed in 2013 with loans in 5 countries |
| Figure 13 | Current and desired relation between a Farmer and a BCE |
| Figure 14 | Number of employees of BCE's |
| Figure 15 | Percentages of registered BCE's. |

List of tables

| | |
|----------------|--|
| Table 1 | Assistance options and objectives to raise enterprise income among survivalist enterprises |
| Table 2 | BCE participation in the UBDP |
| Table 3 | BCE participation in the UBDP by target group |
| Table 4 | BCE membership of different biogas associations by domestic and institutional focus |
| Table 5 | Definitions of micro and small enterprises |

1. Introduction

Over 1.6 billion people in the world do not have access to electricity and most of these people live in Africa. They rely on traditional sources of energy such as firewood, charcoal and kerosene for cooking and lighting (World Bank, 2009). Although these sources of energy are often affordable and most accessible to the poorer segments of societies, they are considered to be inefficient, harmful to the user's health and a main cause of deforestation and CO₂ emissions. Although Africa has a lot of potential to use renewable sources of energy, heavy dependence on traditional sources persists.

In order to increase access to renewable sources of energy, a partnership between NGO's SNV and HIVOS resulted in the creation of a African Biogas Programme Partnership (ABPP), that supports national biogas programmes in five different African countries, namely Kenya, Burkina Faso, Ethiopia, Uganda and Tanzania. Through biogas technology, households that own a certain amount of cattle can convert the animal dung into biogas by using a biogas digester. The produced biogas can be used for cooking or lighting. In addition, the resulting bio-slurry that comes from the digester can be used as a high-quality fertilizer. Potential benefits of the use of biogas over biomass as a source of energy are numerous: it can save time collecting firewood or money buying it, the bio-slurry can increase agricultural yields and the use of biogas for cooking is not hazardous to one's health, in contrast to biomass. Despite these potential benefits, the initial costs of a biogas plant are high and until January 2014, external support and funding from NGO's has enabled a private biogas sector to develop by for example providing a subsidy. By stimulating the development of a private sector, not only biogas technology and its benefits would be spread, an independent and viable private biogas sector would also create jobs and stimulate economic growth.

1.1. Problem statement

This study focuses on the biogas sector in Uganda. In Uganda, the Uganda Domestic Biogas Programme has been of significant importance in the sector. It has supported the development of a private biogas sector in several ways: funding through subsidies, promotion of biogas technology and capacity building. The aim of the programme is to improve rural livelihoods by increasing the use of renewable energy through a commercially viable biogas sector. This sector should not only increase the use of biogas among rural households, but should also create jobs, increase incomes, promote gender equality and stimulate economic development.

From previous research, it is known that the sector encounters various difficulties that hinder it from being sustainable and commercially viable in the near future. For example, from January 2014, the UDBP will no longer provide support through subsidies, meaning that interested farmers have to pay the whole amount of the digester. Because the cost of such a digester is high and not many farmers can afford this, production of biogas digesters has dropped significantly since January 2014.

1.2. Objectives of this study

The aim of this study is to identify issues that constrain the private sector to contribute to development. It will focus on the biogas sector in Uganda as an in-depth case-study and an example. This study will provide an overview of the biogas sector in Uganda as it currently exists and will describe the sector and the actors involved. Then it will aim to identify problems or bottlenecks within the sector that hinder private sector development. It will particularly focus on its key actors, micro and small enterprises to explore their challenges and see how they can best be supported.

1.3. Research questions

As discussed in the above, the biogas sector in Uganda encounters difficulties in becoming commercially viable. For the biogas sector to contribute to the development of the country, it has to become a sustainable sector. It is therefore important that the constraints experienced by actors involved within the sector should be identified and furthermore, it should be examined how these constraints can be overcome by turning them into opportunities for the actors within the sector. This study will attempt to do this by answering the following research question and sub-questions:

What are the bottlenecks for the private biogas sector in Uganda to contribute to development and how can these bottlenecks be overcome in order to stimulate private sector development?

- ❖ *Who are the key stakeholders involved within the biogas sector and how are they related?*
- ❖ *What are the bottlenecks within the sector that hinder private sector development?*
- ❖ *How do key actors, MSE's within the sector perceive these bottlenecks?*

❖ *What can be done to overcome constraints and stimulate private sector development?*

Below, this thesis report will aim to answer these research questions. After discussing a theoretical framework, the used methodology and the geographic and thematic contexts of the research field, chapter 5 will give an overview of the sector and its actors, answering sub-question 1. Chapter 6 will discuss the bottlenecks in the sector that were found during this study and are considered to be hindering private sector development, answering sub-question 2. Chapter 7 will then focus on MSE's and their perceptions on the sector (sub-question 3) and chapter 8 will discuss the theoretical and practical implications of this study. Furthermore, chapter 8 will discuss recommendations on how constraints can be overcome to stimulate private sector development, answering sub-question 4.

2. Theoretical Framework

During the past decades, the role of the private sector in development has grown. Through privatization processes in developing countries in the 1990s, the private sector has shown an interest in taking over certain government responsibilities in, for example, public service delivery. With these processes, the private sector addresses the needs of the poor in developing countries (Desai & Potter, 2008, p. 500). Because the private biogas sector in Uganda strives to contribute to development in the country, it is important to understand the ways the private sector can have an effect, either positive or negative, on development. Therefore, this theoretical framework will focus on the private sector and its role in development. Section 2.1 will elaborate on this through the exploration of the theoretical concepts of ‘Shared value by Porter and Kramer (2011) and ‘Bottom of the Pyramid’ by Prahalad and Hart (2002). In order to give a nuanced view on these concepts, section 2.2 will then discuss some of the important critiques on these concepts.

After discussing the more general role of the private sector in development, section 2.3 will go more in-depth on micro, small and medium enterprises (MSME’s) as a part of the private sector. In literature and practice, these MSME’s are believed to play an important role creating jobs and alleviating poverty in developing countries. This is also the case in the biogas sector in Uganda. However, many scholars are critical about the role of MSE’s in development and argue that their contribution has been overestimated. These criticisms will be discussed in section 2.4. Section 2.5 will then discuss ways in which MSME growth can be supported by external organisations or governments and will discuss theory by Norman Long (2001) on these planned development interventions and their complexities.

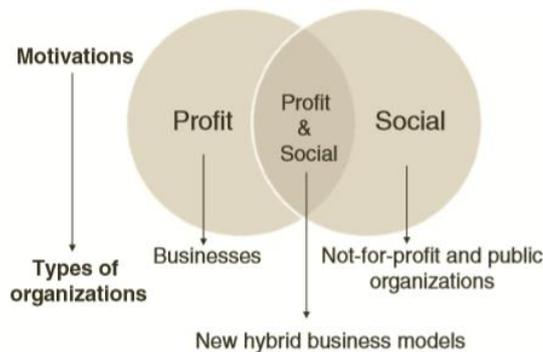
2.1. Private Sector and its role in development

For many years, the state has been considered the main agent of development. Through state interventions, regulations and public policy, the state had a prominent role in development processes from the 1940s till the mid-1970s. But economic turmoil in the late 1970s caused a growing dissatisfaction of this strong role of the state. Led by Margareth Thatcher and Ronald Reagan, neoliberalism limited the role of the state in development to regulating property rights, public defence and the maintenance of order and stability in society (Cypher & Dietz, 2009, p. 205). Instead of a strong state, the private sector and market forces were seen as the way to go in development. Neoliberalism has been subjected to heavy critiques. One of the main critics being nobel-prize winner Joseph Stiglitz, arguing the neoliberalism has increased

inequality and has only served to make the wealthy even wealthier (Stiglitz, 2008) (Stiglitz, 2012). Despite critical notes, the approach to development has shifted towards market-led development, not only for the purpose of economic development, but also for ‘political freedom and social justice’ (Rankin, 2001, p. 19). Still, it is more and more recognized that inequality has increased over the last decades and it is realized that the gap between the wealthy and the poor needs to be addressed.

However, Michael Porter and Mark Kramer (2011), claim to have found a way through which the private sector, the part of the market that is not controlled by the state, can decrease the gap of inequality and contribute to social goals. They elaborate on the concept of shared value creation in their article *The big idea: creating shared value* (Porter & Kramer, 2011). They argue that, succeeding business strategies of Corporate Social Responsibility (CSR) in which companies attempt to create social value next to their businesses, often to uphold their reputation, creating value for both their business and society should be an integral part of their business. This is what the authors call shared value: ‘...policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the communities in which it operates.’ (Porter & Kramer, 2011, p. 16). They further argue that, through shared value creation, the boundary between for-profit actors and non-profit actors will blur through the existence of new and hybrid organizations that create shared value by both making a profit and contributing to the community. This is shown in figure 1 below and demonstrates the way the private sector, in particular businesses, can become ‘hybrid’ by having profits as social value as motivations.

Figure 1. Motivations and types of organizations of social innovation.



Source: Michellini (2012, p. 13)

But Porter and Kramer are not the only ones with ideas on how the private sector can create societal value. At the start of the new century, an article by Prahalad and Hart, *The fortune at the bottom of the pyramid* (2002) appeared, followed by a book bearing the same title, written by Prahalad in 2004. Both the article and the book tried to demonstrate a way for the private sector to ‘seek their fortunes and bring prosperity to the aspiring poor’ (Prahalad & Hart, 2002, p. 1) and become more involved in development processes. In the light of oversaturated western markets, the authors state that for businesses, the opportunities of the future lie in the billions of ‘aspiring poor’, by seeing them as potential consumers as well as entrepreneurs.

...the poorest populations raise a prodigious new managerial challenge for the world’s wealthiest companies: selling to the poor and helping them improve their lives by producing and distributing products and services in culturally sensitive, environmentally sustainable, and economically profitable ways. (Prahalad & Hart, 2002, p. 2)

The authors argue that although they recognize the poor as active agents, multinational corporations (MNC’s) should take the lead in targeting ‘the bottom of the pyramid’ (BoP) over local entrepreneurs or organizations. This is mainly because MNC’s have better access to financial and managerial resources, infrastructure and knowledge. In short, Prahalad and Hart argue for businesses to make a profit while alleviating poverty. And although the main roles are for the MNC’s, the empowerment of local entrepreneurs is an important element in the business model Prahalad and Hart propose. Prahalad and Hart’s initial theory has evolved over time and several authors have contributed to the development of the theory. Laura Micheleni (2012) clearly summarizes this change and divides the BoP theory in two parts, namely BoP 1.0 and BoP 2.0. While the overarching theory remains the same, in the evolved BoP 2.0, the word ‘bottom’ was changed to ‘base’, in order to overcome negative associations with the word ‘bottom’, that implies a looking down on the poor (Arora & Romijn, 2012, p. 485). Furthermore, in BoP 2.0, the focus is more on the poor as equal business partners than consumers: ‘...the relationship extends beyond mere listening to a deep dialogue’ (Micheleni, 2012, p. 7), meaning that in BoP 2.0 the poor are considered to be entrepreneurs who should be taken seriously.

In Uganda, the private biogas sector can be considered to be creating shared value. A successful biogas sector and the private companies within, would be creating value for both

their businesses and society by making a profit and increasing access to energy for the poor, plus all the other benefits that comes with the use of biogas technology. The same can be said for the more specific BoP approaches. By targeting the poor as entrepreneurs and consumers, the private biogas sector would ‘seek their fortunes and bring prosperity to the aspiring poor’ (Prahalad & Hart, 2002, p.1): making a profit by selling a product, namely biogas, which potentially helps the poor out of poverty.

2.2 Private sector and development: critiques

As shown in the above, on the one hand, businesses have found to be promising actors in creating value and growth in low-income countries. But on the other hand, the role of the private sector in the development field has been highly criticized among scholars, for example on the theory of the BoP and shared value. Some argue that there exists a lack of empirical evidence whether or not businesses are making profits while alleviating poverty. There exists no substantial proof of the supposed and romanticized win-win situation (Arora & Romijn, 2012). In addition, an important criticism on the theory is that it fails to recognize existing power relations in the political and socio-economic spheres. According to the BoP theory, people are poor because of a lack of access to all sorts of products and services, but this overlooks the possibility of poor people being poor because of political, social or cultural structures and hierarchies (Arora & Romijn, 2012, p. 484).

From the post-structuralist stance, critics have argued that this involvement of the private sector in development is an ‘imposition of Western modernity on the Third World poor who are left with no choice but to resist this new juggernaut of privatized development’ (Arora & Romijn, 2012, p. 497). Dolan and Roll (2013) describe BoP approaches as a way to govern and incorporate low-income markets to serve in the world economy. This relates well to James Scott’s concept of ‘legibility’, on which he elaborates in his book *Seeing like a state: how certain schemes to improve the human condition have failed* (1998). Legibility according to Scott is a process of (state) interventions in order to make society as well as nature legible, readable and organisable. This is easier for governance purposes, but in the process, there is a lot of local knowledge and diversity lost. This local knowledge, or *mētis*, is according to Scott, key to success to improve people’s lives. Applying Scott’s concepts, incorporating and structuring the bottom of the pyramid into the world’s capitalist system could mean making this part of the economy legible and can only work for the poor if one would also incorporate

local practical knowledge and experience, *mētis*: ‘...any formula that excludes or suppresses the experience, knowledge, and adaptability of *mētis* risks incoherence and failure; learning to speak coherent sentences involves far more than merely learning the rules of grammar’ (Scott, 1998, p. 319).

2.3. Micro, Small and Medium enterprises and development

The previous sections discussed ways in which the private sector can potentially contribute to development. Because the subject of this study is the biogas sector in Uganda and in specific, biogas construction enterprises (BCE’s), this section will focus more in particular on micro, small and medium enterprises (MSME’s) and their potential contribution to (economic) development and poverty alleviation. It will start by defining MSME’s and will then elaborate on ways in which MSME’s are considered to be able to contribute to development purposes.

There exists no international definition of MSME’s. Most organisations however, define an enterprise as medium, small or micro enterprise depending on its number of employees. But even within counties, definitions are not clearly set. This is also the case in Uganda, where different agencies use different definitions. Because this study was conducted in Uganda, it will follow the definition of MSME’s as used by the Ugandan Ministry of Finance, Planning and Economic Development as well as the Uganda revenue Authority and the Uganda Investment Authority. This definition considers micro enterprises to employ 1-5 people, small enterprises to employ 5-50 people and medium enterprises to employ 50-250 people (Kushnir, 2010, p. 118).

The poor forming medium, micro and small enterprises have been considered to be the key to development during the last decades. They are considered to have large potentials in contributing to growth, employment and poverty alleviation. This can be done through direct income generation for a household, empowerment of the individual and by providing new opportunities for the poor and in particular, women (Liedholm & Mead, 1999, pp. 7-8). This belief is reflected by World Bank report *Review of Small Business Activities* (2001), emphasizing the need to support growth of small enterprises. ‘Why? Because small business is a powerful force for poverty reduction. It creates jobs- jobs through which people can acquire skills and raise their incomes. And because these jobs build the foundation for a middle class, something that increases opportunities and promotes more open and pluralistic societies’, thus the World Bank (2001, p.6). Large microcredit schemes, as intended by nobel

prize winner Mohamed Yunus and his Grameen Bank were set up all over the world to support the development of these small enterprises through small loans that are built on trust instead of assets, making credit more accessible to the poor (Grameen Bank, 2011), with an underlying assumption that all the poor are capable entrepreneurs.

Mazumdar (2003) elaborates further on why exactly the SME sector is considered to contribute to development and what characteristics of SME's are important in this. The author discusses three arguments why SME growth is considered beneficial for developing countries. First, in contrast to large enterprises, SME's are thought to be more labour intensive. Large enterprises do not provide enough employment for everyone. In the SME sector, however, because of a lack of capital, human labour is not yet replaced by technology. SME's thus make use of more human labour, hereby creating more jobs than large enterprises. Secondly, large firms often concentrate in specific urban areas. 'By contrast, widespread SME growth could create many growth poles in small towns and rural areas, which could serve as the basis for renewed sources of growth' (Mazumdar, 2003, p. 4). Therefore, SME's could stimulate growth rates in wider areas instead of just some economical hubs. Third, income in the SME sector is considered to be more equally divided. '...The typically large wage difference between SMEs and LE's [Large Enterprises] implies that a larger share of output produced by the former leads to more of the wage bill going to workers in the lower wage groups.' (Mazumdar, 2003, p.6) Consequently, it is thought that a larger SME sector will lead to a more equal income distribution in a country.

2.4 Critique on MSME's effects on development

In the above, section 2.3 discussed how MSME's and in particular MSE's can contribute to (economic) development and poverty alleviation. However, as is the case with the private sector in general, many authors are critical about the contribution MSE's can make to development. Different studies also show that the development of MSE's is not a panacea to development and poverty alleviation. This section will discuss some criticisms about the effect the MSME sector can have on development.

Servon and Bates (1998) conducted a study to see if micro enterprise programmes targeting the poor are a useful development strategy. They predicate the study upon the popular belief that the poor, with hard work and a small loan will be able to lift themselves out of poverty by starting a small business. However, the authors state that their findings '... provide little support for the popular notion that hard work, frugal living, and a

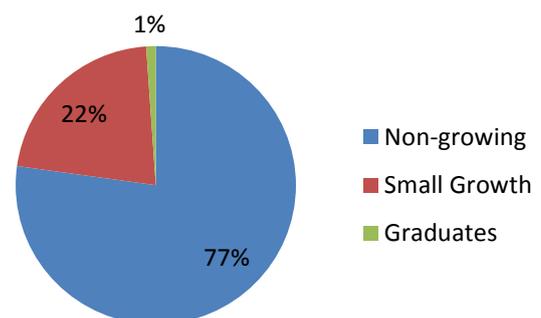
small amount of financial capital are sufficient ingredients for business success'. (Servon & Bates, 1998). The authors claim that factors such as education, type of business and significant capitalization play an important role in the viability of new small enterprises. Business success and viability is important, because only then can MSE's contribute to development through, for example, employment and income generation.

A study conducted by van Praag and Versloot (2007) indicated that entrepreneurs, defined as small and young companies, indeed contributes to employment generation. Nevertheless, jobs created by small enterprises are less secure than jobs created by larger firms, which can destabilize the labour market (Van Praag & Versloot, 2007, p. 377). Another study, conducted by Beck, Demirguc-Kunt, and Levine (2005) suggests that a large MSME sector does not stimulate development and poverty alleviation. Although the authors found that the size of the sector might have a positive effect on GDP growth per capita, they did not find statistical evidence that a larger SME sector can be poverty alleviating or has a positive effect on income inequality. (Beck, Demirguc-Kunt, & Levine, 2005)

2.5 Assisting MSE's

Critiques on micro and small enterprises and their role in development as described in the above indicates that the contribution of MSE's to development is not self-evident. First, it is hard for MSE's to become strong enterprises and second, their contribution to development is not proven. In particular to resolve the former issue, several assistance programmes have aimed to support these enterprises in becoming strong enterprises and contributing to development. Liedholm and Mead (1999) elaborate MSE's and the way MSE's can be supported through assistance programmes and projects or, in other words, planned interventions. Their suggestions on how to define and support MSE's are particularly useful for this study. After elaborating on this, using the work of Liedholm and Mead (1999), this section will briefly discuss the politics of these planned interventions, using the work of sociologist Norman Long (2001).

Figure 2. Growth characteristics of MSE's that have been in existence for more than a year and started with less than 5 workers



Adapted from: Liedholm and Mead (1999, p. 87)

Liedholm and Mead (1999) define four types of enterprises: newly established, non-growing, slow growing and graduated enterprises. Newly established enterprises are recently started businesses where the entrepreneur has to acquire a large set of skills in a short time to be successful. Many assistance programmes target these MSE's, assisting them in acquiring the required skills and start-up capital. Non growing enterprises, the largest group within MSE's, have survived the first crucial period but are surviving, not growing, ever since they started. Slow growing enterprises are, as the name implies, slowly growing since their start. Typically, they are more commercially oriented and with a bit of assistance, their growth might increase. Finally, Liedholm and Mead describe graduated enterprises that have successfully developed themselves into well-functioning enterprises within the top-end of small enterprises (Liedholm & Mead, 1999, pp. 84-101). This classification is useful for providing assistance to SME's, since every type of SME needs a different approach. Figure 2 above shows the latter three types and to what extent they make up the total of surviving SME's. Data used by Liedholm and Mead (1999) is based upon a large scale survey in six developing countries.

For starting MSE's, technical skills are most important. For this type of enterprises, entrepreneurs who already have experience in the particular business have bigger chances of survival. Therefore, assistance programmes targeting new entrepreneurs with previous experience might be more cost-effective. Support to these enterprises should be directed to on-the-job training and building on existing skills and knowledge. (Liedholm & Mead, 1999, p. 87).

For the largest group of MSE's, the non-growing or survivalist enterprises strategies to help them grow are directed to increase the company's turnover through reducing costs, increasing sales or switch to other products. Table 1 below, shows different possibilities to assist survivalist MSE's to achieve these goals and increase their turnover and income.

Table 1. Assistance options and objectives to raise enterprise income among survivalist enterprises

| <i>Objective</i> | <i>Financial assistance</i> | <i>Non-financial assistance</i> |
|------------------|--|--|
| Reduce costs | Lower interest rates on borrowed funds. More access to credit can make it possible to buy inputs in bulk, therefore at lower price | Better management or different production technology can mean lower costs per unit |

| | | |
|---|---|---|
| Raise volume of sales | More access to credit can make it possible to purchase more inputs and thereby increase sales | Better marketing systems can open up access to larger markets |
| Switch to more productive product lines | New products may require more fixed or working capital | Product adaptation can help to serve a more profitable market |

Source: Liedholm and Mead (1999, p. 91)

As for slow growing enterprises, Liedholm and Mead (1999) characterize them as enterprises that have started with 1-4 employees and have grown with 1-4 employees ever since.

Providing assistance to growing enterprises becomes more complex and specific. Hence, it is necessary that assistance programmes are adjusted to the enterprises specific needs in a specific market. Besides providing a strong and stable environment on macroeconomic and sector level, which is important to sustain and increase growth, support at individual enterprise level should focus on short term assistance directed to solving specific problems. (Liedholm & Mead, 1999, pp. 109-112)

Providing support to MSME's through assistance programmes can potentially lead to growth of these companies, along with social benefits like increasing employment generation and alleviation of poverty. In the Ugandan biogas sector, a donor-funded project has aimed to do just this. However, as is the case in Uganda, these planned interventions are often complex and need to be done well in order to reach desired outcomes. Therefore, it is important to understand the dynamics of these particular interventions. For that purpose, this study will apply theory by sociologist Norman Long.

Long (2001) takes a critical stance towards these planned interventions for the purpose of development and defines it as the following: '... an ongoing, socially constructed and negotiated process, not simply the execution of an already-specified plan of action with expected outcomes.' (Long, 2001, p. 31). About these expected outcomes, Long argues:

Outcomes may result from factors not directly linked to the implementation of a particular development programme. Moreover, issues of policy implementation should not be restricted to the case of top-down, planned interventions by governments, development agencies and institutions, since local groups actively formulate and

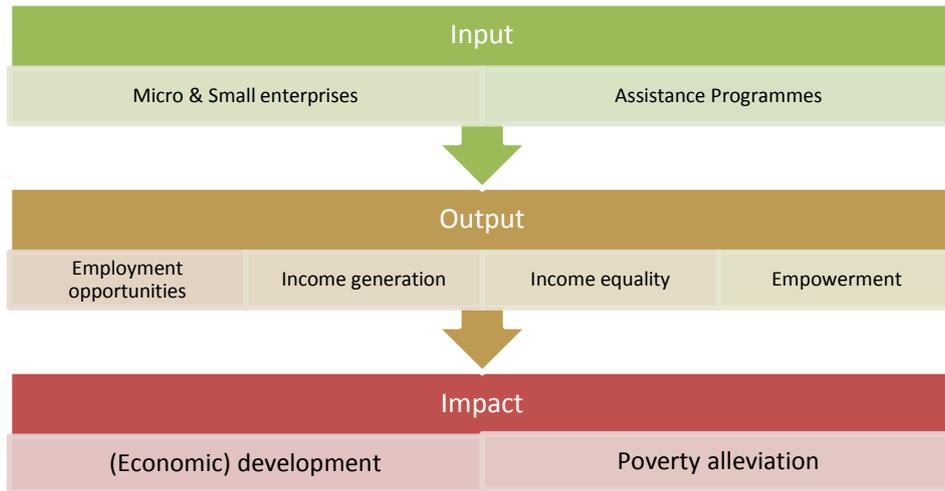
pursue their own ‘development projects’ that often clash with the interests of central authority (Long 1984, p. 177-9 and Van der Ploeg, 1987, as cited in Long, 2001, p. 31)

In other words, the outcomes of a planned intervention, such as the support of MSE’s through assistance programmes, are a result of an ongoing process on which many factors internal of the intervention as well as external, play a role. In addition, these interventions should not be implemented top-down over the heads of local groups since their interests might not be the same. Furthermore, Long argues against the boxing of interventions ‘in time and space’, meaning that development interventions are not restricted to specific geographical contexts and do not begin and stop at specific times. The process of negotiations between actors involved goes on, even after evaluation reports have been written. Therefore, Long proposes to consider development and development interventions from an actor-perspective. This means approaching the subject by recognizing interventions as social arenas, in which all actors involved are continuously negotiating their interests and are acting upon their individual agency. By applying this perspective, Long criticizes generalized planning models while it leaves room for agency and dynamics. (Long, 2001). This study will make use of Long’s actor-perspective when approaching the Ugandan biogas sector and the interventions that have been made in this sector.

2.6 Conceptual Framework

Through the conceptual framework shown below in figure 3, this theoretical framework is summarized and visualized. In short, it shows how the private sector, and in particular MSE’s, sometimes with the help of assistance programmes, are assumed to increase employment opportunities, income generation, income equality and empowerment, hereby contributing to economic development and poverty alleviation. However, criticisms on this role of the private sector as discussed in the above noted that this process is not self-evident and that MSE’s encounter many complications before being able to contribute to development and poverty alleviation. Therefore, this study will examine MSE’s and what constraints them from successfully contributing to this process of development by conducting a case-study, namely the Ugandan biogas sector.

Figure 3. Conceptual model



In short, through BoP and shared value approaches, the private sector shows potential to contribute to development, economic growth and poverty alleviation in different ways. Micro, small and medium enterprises in particular, are thought to be able to contribute to development in various ways. Nevertheless, critiques described above show that the private sector contribution to development through BoP, shared value and MSME approaches is not self-evident: including the poor into the economy is not a panacea. Following the argument of Arora and Romijn (2012), political, cultural and social structures must not be overlooked. Nuancing the potential role of the private sector is important to highlight its strengths and potentials, but also, its limitations.

Assistance programmes to support the private sector and in particular, MSE's, have the potential to help the private sector reaching social goals and creating shared value. How this can be done is discussed in section 2.4 above. However, this section also highlighted the complexity of these planned interventions and proposed a way to approach them using theory on the actor perspective following Norman Long (2001). This approach will be further discussed in chapter 8.

3. Methodology

This chapter will discuss the methods used in this study. It will first discuss the overall research design in section 3.1. Section 3.2 will then discuss the different methods that have been used to collect data in the field and section 3.3 will discuss the methods that were used to analyse the data after data collection. This chapter will conclude with the limitations that came with this research.

3.1. Research design

Throughout the study, a descriptive approach will be used with the aim to give a detailed description of the Ugandan biogas sector and the perceptions of SME's within the sector. Therefore, a case-study design will be used, described by Bryman (2008, p. 52) as: 'a detailed and intensive analysis of a single case'. The Ugandan biogas sector will be considered as an exemplifying case, because it is a case that 'exemplifies a broader category of which it is a member' (Bryman, 2008, p. 56). The Ugandan biogas sector is thus considered an example of the private sector aiming to contribute to development in a country. The case is not chosen because it is a unique or extreme situation, but simply because 'it provides a suitable context for certain research questions to be answered' (Bryman, 2008, p. 56). Case studies are often criticized because the findings of case-study research are too specific to generalize them to larger populations. Case study researchers, however, intensively study a single case not with the purpose of generalizing the findings but for the accordance of the data with theoretical arguments made (Bryman, 2008, p. 57). The theoretical implications are therefore also of importance for this study, besides the practical implications, both discussed in chapter 8.

3.2 Data collection

Within a case study research design, qualitative methods are a suitable way of collecting detailed descriptions on a single case (Bryman, 2008, p. 53) Therefore, the focus of this research lies with qualitative methods. Informal and semi-structured interviews and participant observations have been the main methods with which data has been collected for this study. Furthermore, a focus group discussion has been held to validate the findings of this research. Below, this section will discuss the methods that have been used for each of the research question

In order to answer the research questions as mentioned in the above (section 5), this research is divided into two main parts. The first part, answering sub-questions one and two, entails a short stakeholder analysis in which the key stakeholders in the biogas sector are mapped and described. The

data to answer these questions will be collected through semi-structured interviews with different stakeholders in the sector, informal interviews and observations. Through these methods, data has been collected to identify key actors, relations and the main bottlenecks within the sector, that constrain the sector from becoming independent and commercially viable, thereby answering subquestions one and two: *Who are the key stakeholders involved within the biogas sector and how are they related?* And: *What are the bottlenecks within the sector that hinder private sector development?*

Sub-question three, *How do key actors, MSE's within the sector perceive these bottlenecks?* is directed specifically towards a key stakeholder group within the sector: biogas construction enterprises (BCE's). In order to find out their perspectives, role, threats and opportunities, a population study will be conducted among all BCE's known so far in Uganda. For this study, it is important to explore the perspectives of stakeholders within the sector itself. Following James' Scott theory (as discussed in section 2.2) local knowledge and experience is crucial in development issues. Without it, '...any formula that excludes or suppresses the experience, knowledge, and adaptability of mētis risks incoherence and failure; learning to speak coherent sentences involves far more than merely learning the rules of grammar' (Scott, 1998, p. 319).

The sampling frame used to access the BCE's is provided by the UDBP in the form of a flyer, in which the programme targets consumer households and provides them with information of all the BCE's in the different regions in Uganda. However, BCE's that were encountered that were not associated with the UDBP and were therefore absent from the sampling frame were also interviewed. Characteristics of all these BCE's were collected and analysed with quantitative data analysis software. Semi-structured interviews with the BCE's were held to identify their perspective on the sector and perceived threats and opportunities for their businesses. Topics and questions were prepared (see annex 5 and 6), but the interviews were left open for the respondent to direct the conversation to a certain extent.

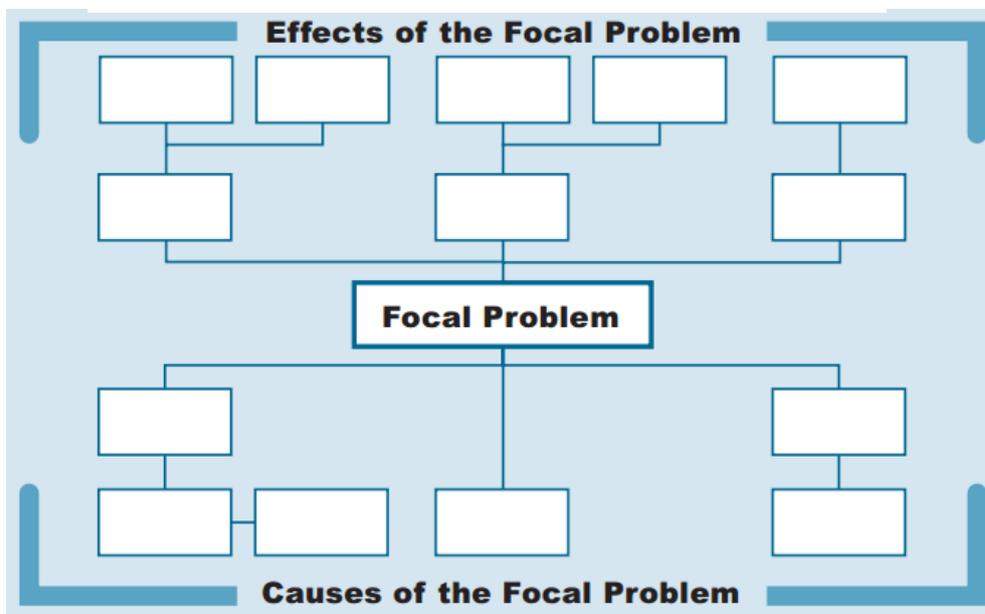
To find out more on the BCE's and their role within the sector from a different perspective, a short survey was conducted among end-users of biogas, collecting data about their use of biogas and their view on the BCE that has constructed their plant (See annex 4). In order to measure the latter, the questionnaire measured the levels of satisfaction of the households with particular services of the BCE's. Due to certain constraints, convenience sampling has been used to collect this data, which is considered a limitation of the study. This will be further discussed in section 3.4

Sub-question 4, *What can be done to overcome constraints and stimulate private sector development?*, will be answered based on the data that was described in the above and

will be further discussed in section 8.2 on practical implications and recommendations. Within the conducted formal and informal interviews, respondents were asked how, according to them, the sector can be supported and stimulated.

At the end of the fieldwork, a participatory meeting has been organized. This meeting, involving multiple stakeholders within the sector, was held in order to validate the findings of this research and to discuss possible solutions and opportunities following the findings. For this purpose, problem trees were used, identifying and understanding underlying problems and their solutions in the sector. The problem tree, adapted from DFID (2003) is meant to visualize a focal problem and break it down into understandable and manageable pieces. It is presented as a tree, in which the trunk of the tree presents the focal problem, the roots of the tree present the roots or causes of the problem and the branches of the tree present the effects of the problem (See figure 4). Using the problem tree as a starting point, possible solutions to this problem will be discussed. The results sketched problem trees in the workshop will be used to validate and correct previous findings and to identify solutions to the identified problems.

Figure 4. The problem tree



Source: DFID (2003)

3.3 Data Analysis

This section will describe how the collected data has been analysed to be able to draw conclusions from the data. Because most of the data is of qualitative nature, analysis has mostly been done in accordance with guidelines described in Miles, Huberman and Saldaña (2014). After data collection, all field notes, formal and informal interviews have been transcribed and coded using qualitative data analysis software NVIVO. During the first cycle of analysis, descriptive codes have been assigned to the data, ‘to summarize in a word or short phrase – most often a noun – the basic topic of a passage of qualitative data’ (Miles, Huberman, & Saldaña, 2014, p.74). Furthermore, attribute coding has proven itself useful in assigning attribute data to all respondents. For BCE’s this involved assigning data such as the name of the BCE, the start of the BCE and the number of its employees to each interview. After this first cycle, coding patterns and certain themes within the data were identified and subcodes were added. For example, for the interviews with BCE’s, patterns appeared in the data concerning ‘challenges’. During the second cycle of coding, the nature of these challenges were labeled in subcodes, like ‘competition’, ‘subsidy’, ‘awareness’ or ‘lack of financial capacity’. However, Bazeley (2009) states that there is a problem with the identification of broader themes in qualitative data and how these themes are often used in analysis:

There is a problem with relying for evidence on one or two quotes that might have been drawn from hundreds of pages of text. While one or two quotes might powerfully illustrate a theme, they do not convey how widely this theme might have applied, or for whom, or how it links to other themes. Frequencies are sometimes reported, but there is rarely an attempt to explain those who express this theme differently, or who do not express the theme at all. (Bazeley, 2009, p. 9)

To solve this problem, and to avoid ‘garden path analysis’, in which analysis is done but not leading anywhere, Bazeley suggest scholars dealing with qualitative data to follow certain steps. Step one involves describing the data and the identified theme, displaying frequencies but also describing those respondents who did not talk about the theme to give a good overview. The second step involves comparing the data or theme: compare groups, locations or timeframes within the data. Third, Bazeley advises to relate the data to larger or other

themes that were identified or to the work of others that have written about the theme before. Following these steps will, according to Bazely (2009), improve the coherence of the analysis. For this study, the three steps described by Bazeley (2009) have been used during analysis. However, the three steps – describe, compare and relate – have not always been described in this thesis report because this will make this report too extensive. However, using Bazeley's (2009) method of analyzing qualitative data is useful for realizing that qualitative data analysis is more than 'just' identifying themes and supporting it with one or two quotes.

3.4 Limitations

During the process of the research and analysis, several limitations were encountered. It is important that these limitations are taken into account because they could have had an effect on the results that will be further discussed in the next chapters.

First, during data collection, a sampling bias occurred when selecting respondents. Aiming to do a population study among BCE's in Uganda through an available sampling frame, this sampling frame proved to be inadequate. The sampling frame, provided by SNV only consisted of BCE's that were cooperating with the UDBP. For any other existing BCE's in the country, a sampling frame did not exist. However, BCE's outside the UDBP did exist. Selecting these respondents has been done through convenience or snowball sampling, a sample that 'that is simply available to the researcher by its virtue of its accessibility' (Bryman, 2008, p. 183). It is possible or even likely that by using this sampling method, not all BCE's that operate outside the UDBP were interviewed. Therefore the findings considering these BCE's might not be representative for general population of BCE's that work outside the UDBP. The same sampling bias might have occurred with the small survey that was conducted among end-users of biogas. In the absence of a sampling frame, convenience sampling might have resulted in an unrepresentative sample of biogas end-users. Adding the small size of the sample, no quantitative data from this survey has been used. However, qualitative data that was collected during the survey, informal interviews and observations have been very valuable to this research.

Secondly, it is possible that a social desirability bias has occurred. For the purpose of informed consent, each respondent has been informed that the research is carried out for SNV and that the result of the research will be used for both this thesis and SNV. It is likely that

some respondents replied to certain questions in a socially desirable way, in order not to jeopardize their relationship with SNV, the UDBP or an implementing partner. To minimize this bias, it was explained that the research was conducted not by SNV but for SNV. In addition, anonymity has been guaranteed to the BCE's. The names of the BCE were therefore changed into pseudonyms.

A limitation considering the collected data is that the data reflects the views of a limited number of stakeholders within the sector. Sixteen BCE's have been formally interviewed, plus eight more key respondents. The role of these key informants within the sector ranged from policy officers at SNV and the UDBP to government workers and UDBP supervisors. But, due to the small size of the sample and the fact that the sample contains all different stakeholders, the views reflected in the above might not accord with all stakeholders.

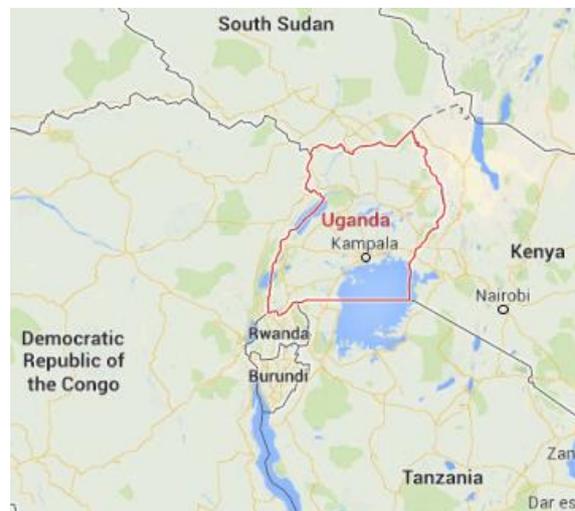
4. Thematic and geographical contexts

This section will elaborate on the research field and theme. First, a short introduction to Uganda, the country of research, will be given: a brief overview of the country's geographical aspects, history, politics and economy. Second, the energy sector in Uganda will be described before zooming in on the biogas sector in the country. The sector and the Uganda Domestic Biogas Programme will be discussed. Sources that will be used for this section will include policy documents from the Government of Uganda (2002) and project implementation documents from the UDBP and SNV (2009). A short section will also be dedicated on biogas programmes that were implemented in other developing countries, with the help of Gautama, Baralb & Heratc (2009) and Ilyas (2006).

4.1. National Context Uganda

As a small and landlocked country in sub-Saharan Africa, Uganda is home to 36.35 million people. The country, still recovering from decades of political, social and economic instability under the reign of Idi Amin and General Obote, has been since 1986 on under the leadership of President Yoweri Museveni, after which stability in the country returned. Since 2006, multi-party elections take place in Uganda, which Museveni and his party the National Resistance Movement (NRM) have won so far. The fact that Museveni has been president for this amount of time has to do with Museveni abolishing the two five-year presidential term limits in 2005. During his years in power, opposition against Museveni has grown. Among other reasons, this has to do with corruption scandals in the country (World Bank, 2014b). According to Transparency International, Uganda scores 26 out of 100 points on perceived corruption, indicating that the country is highly corrupt (Transparency International, 2013). The prevalent corruption in the country has also affected international

Figure 5. Map of Uganda and neighbouring countries



Source: Google Maps

aid flows to Uganda. During the last decades, a large share of the Ugandan national income came from official development assistance. However, figure 5 below shows that the percentage of the national income consisting of ODA has decreased tremendously from almost 18% in 2006 to 10% in 2011 (World Bank, 2014b), because donors have been reallocating funds due to high corruption rates.

Figure 6. % of Ugandan Gross National Income consisting of ODA.



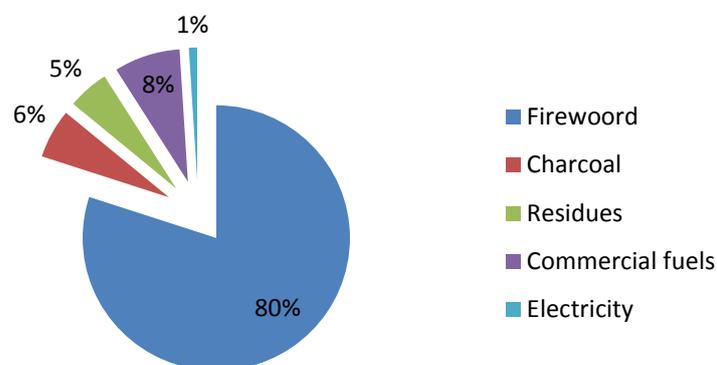
Source: World Bank data (2014a)

With a gross domestic product of USD 19.88 billion, Uganda is classified by the World Bank as a low-income country (World Bank, 2014a). During the 1990's, Uganda was one of the first African countries that agreed on trade liberalisation and neoliberal reforms which led to an average of 7% growth in GDP from the 1990's and the 2000's, which was greater than most other sub-Saharan African countries (World Bank, 2014a). However, the economic growth experienced in the last decades did not show in human development. Although Uganda is on its way in reaching the Millennium Development Goals (it has almost halved poverty since the 1990s) rising inequality has severely slowed down poverty reduction (UNDP, 2013, p. 78). With a human development index of 0.456, Uganda is ranked 161st in the list of 186 countries, classifying Uganda as a country with low human development (UNDP, 2013).

4.2 Energy Poverty in Uganda

Around 464 million people in Africa lack access to electricity and Uganda is no exception to this. Electricity counts only for 1% of the total energy consumption in the country and in 2010, only 8.5% of Ugandans had access to electricity (World Bank, 2014b). Instead, Uganda is very dependent on traditional biomass energy (firewood or charcoal), which is most widely used source of energy. As figure 6 shows, almost 80% of all energy consumption came from firewood alone, mainly from household consumption (Government of Uganda, 2011, p. 44).

Figure 7.
Domestic energy consumption Uganda, 2010



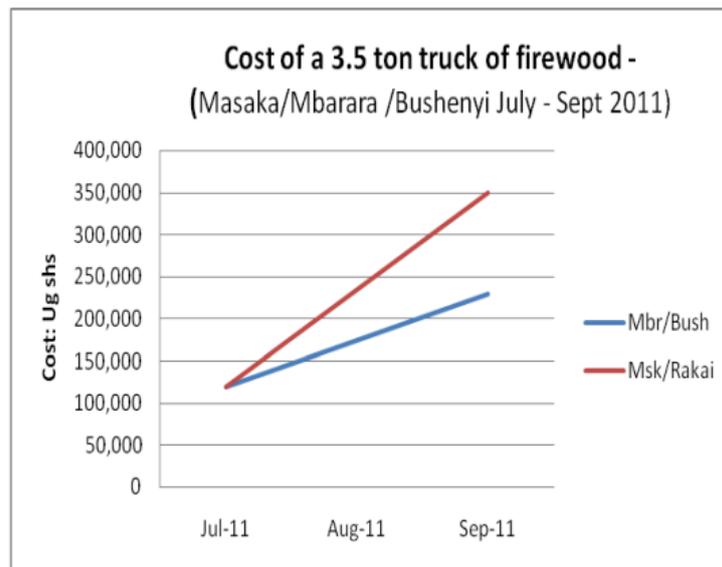
Source: Ministry of Energy and Mining (2011)

For a long period, Uganda lacked a clear strategy on energy in the country, but in 2002, the government issued *The Uganda energy policy*. It was issued with the ultimate goal ‘to meet the energy needs of Uganda’s population for social and economic development in an environmentally sustainable manner’ (Government of Uganda, 2002, p. 5). In the document, the need to provide the Ugandan population with access to energy resources is explained in order to achieve development and poverty alleviation. While Uganda has abundant (renewable) energy resources such as hydropower and solar power, energy poverty is a big issue in the country, due to inadequate infrastructure, insufficient investment and poor distribution. (Government of Uganda, 2002, pp. 3-5)

Uganda’s energy sector is divided into five subsectors, namely: power (electricity generation), petroleum, new and renewable sources of energy and atomic energy, which are all under the lead of the ministry of energy and mining. As mentioned, only a very limited proportion of the population has access to electricity: most people use biomass (firewood,

charcoal and organic residue) as a source of energy for cooking and heating, but it is also the most used source of energy in rural industries. This means, on the one hand, that large parts of the country use inefficient, relatively expensive and unhealthy sources of energy. Over the past years, the costs (see figure 7 below) and availability of firewood in certain districts have become a problematic issue for many. In addition, the use of biomass is one of the main reasons for deforestation and CO₂ emissions in Uganda. But on the other hand, trade in biomass energy contributes to a large extent to Uganda's economy by employing 20.000 people, and contributes USD 20 million to the incomes of the rural population. (Government of Uganda, 2002, pp. 19-20).

Figure 8. The rising costs of firewood.



The rise in cost of firewood in surveyed areas from July – September 2011

Source: Ministry of Energy and Mining (2011)

Although progress is slow and access to electricity still rare in Uganda, at least on paper, the government claims to be active in stimulating the use of renewable energy. These activities show in the annual reports the Ugandan ministry of energy and mining issues. For example, the annual report of 2011 shows a range of developments in hydropower, energy efficiency programmes, a list of rural districts that have been connected to power sources and a very promising list of rural districts that are or are to be connected in the future to the electricity networks. It also shows activities in supporting the promotion of efficient use of biomass and

the promotion of renewable energy sources such as solar energy and biogas technology. (Government of Uganda, 2011)

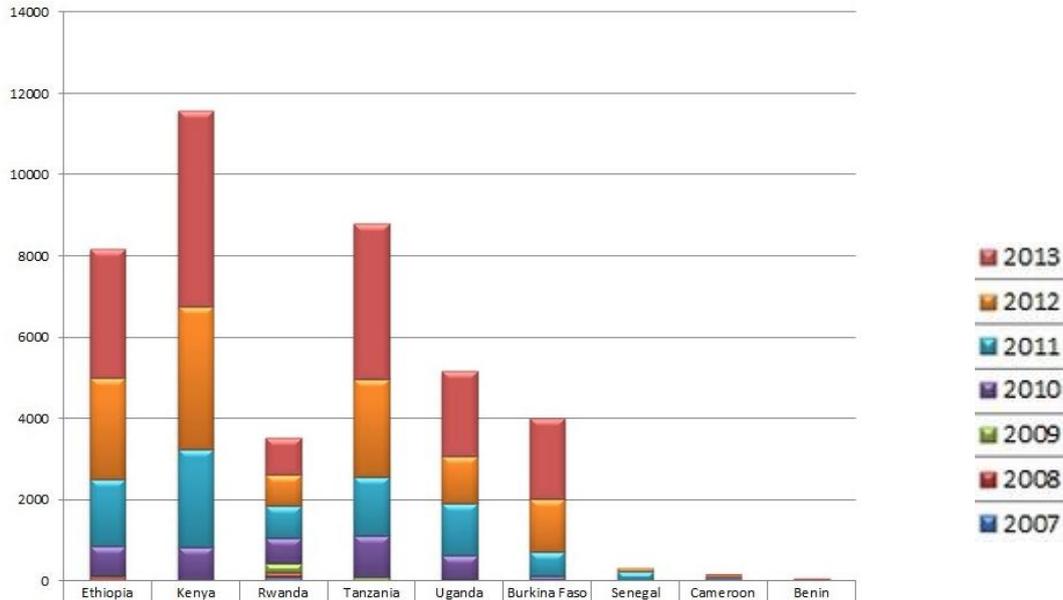
4.3 Biogas in Uganda

As described in the introduction, a biogas digester converts animal waste into biogas and fertilizer and the produced biogas can be used for cooking and lighting (SNV, 2013). The use of a biogas digester and biogas can potentially offer a lot of benefits: a reduction in firewood use and time spent collecting it or money spent buying it, a reduction of CO₂ emissions, a healthier living environment, more fertile agricultural lands, and a creation of jobs because of a growing biogas sector.

However, biogas has not always proven to be a success in Africa. In a study done by Kariko-Buhwezi, Mwesigye, Arineitwe and Colonna (2011) 212 biogas digesters and their users were researched. Most users were provided with a biogas digester by a donor organisation. About 55% of the 212 biogas installations sampled were not operational, mostly because of user error when the digester gets blocked or because of poor maintenance of the installation. Because of these reasons, most of the household energy needs could not be met by biogas. Furthermore, the authors argue, there is a need to provide training to the households concerning how to use the digester. It is also argued that households should invest in the digester themselves in order to create a sense of ownership. This would also motivate the owner to care for his digester in a sustainable way. (Kariko-Buhwezi, Mwesigye, Arineitwe, & Colonna, 2011). But other limitations to the use of biogas technology exist. A first and obvious one is the fact that the user of a biogas digester has to have access to sufficient bio-waste and water to be able to get sufficient gas out of the installation. Along with the investment in the installation, this excludes the poorest households who either not have the funds or the cattle. Akinbami *et al.* (2001) also point out possible social-cultural constraints experienced in Nigeria. The authors encountered households unwilling to adopt the technology simply because they were unfamiliar with the technology or because the households preferred cooking on firewood stoves because of the taste. Other constraints described are nomadic lifestyles of people or cattle, making it difficult to collect dung to feed the digester (Akinbami, Ilori, Oyebisi, Akinwumi, & Adeoti, 2001, pp. 109-110). A solution to some of these constraints could be the commercialization of biogas. In 2008, the organisations Hivos and SNV initiated the Africa Biogas Partnership Programme. The programme aims to support national biogas programmes in Africa in setting up private biogas sectors, in order to provide access to renewable energy to over a half million people by the

end of 2017 with a 100.000 biogas plants in five different African countries: Ethiopia, Kenya, Tanzania, Uganda, and Burkina Faso. Figure 8 below shows progress that has been made in the different countries from 2007 on.

Figure 9. Total production of biogas plants per country.



Source: Biogas4all (2014).

After the ABPP was created, national programmes in different African countries have been initiated, among which one in Uganda. Under the Uganda Domestic Biogas Programme (UDBP), over 4500 rural households have received a biogas digester in the last couple of years. The main goal of the programme is improving living conditions in rural and semi-rural areas through the establishment of a ‘sustainable and commercially viable biogas sector in Uganda’ (Kahubire, Byaruhanga, & Mohammed, 2010, p. ix).

In a feasibility study by ter Heegde and Sonder (2007) it was calculated that in Uganda, over 1.314.000 households would qualify for a biogas digester. This means that they own enough land and cattle and have sufficient access to water to be able to use biogas in the future. This shows the technical potential of biogas, but only the technical potential of biogas does not necessarily mean that the introduction of biogas will be a success in a country. The authors calculated feasibility of biogas with the country’s (human) development, the use of energy, health and sanitation and the environmental circumstances. According to the authors, Uganda could profit a lot from biogas on all these four aspects. (ter Heegde & Sonder, 2007).

In short, a private biogas sector would contribute to development in two ways: on one

hand through employment generation and economic development and on the other hand through the spread of biogas technology and its benefits. However, there are also many constraints in setting up a commercially viable biogas sector. Pariwara (2009) describes general constraining factors, such as the cost of the biogas plant, which is usually too high for small farmer households or the households are too hesitant to adopt biogas technology because a lack of public awareness (Pariwara, *Biogas technology in sub-Saharan Africa: status, prospects and constraints*, 2009, p. 192). Pariwara concludes with the following recommendation in order for the biogas sectors in Africa to be productive: ‘There is need for effective incentives in the form of national policies, legislation, taxes and financial subsidies and public outreach and education to weaken the socio-, economic-, and cultural-barriers to markedly increase the biogas production.’ (Pariwara, *Biogas technology in sub-Saharan Africa: status, prospects and constraints*, 2009, p. 198).

Through the UDBP, these constraints are addressed. In cooperation with the government, incentives, subsidies and training is provided to all sorts of stakeholders in order to promote the establishment of a commercial biogas sector, but still, constraints are not overcome easily.

4.4 Biogas in the world

All over the world, biogas programmes have tried to stimulate the adaption of the technology over the last decades. In Nepal, a private biogas sector has developed itself since the 1950’s but has really taken off from the early 90’s when the Biogas Support Programme (BSP), initiated by Dutch development organisation SNV, had been initiated as an independent non-profit organisation, which supported the sector. Up to 2013, 268.399 biogas digesters have been installed among rural areas in the country thanks to the efforts of multiple stakeholders involved (BSP Nepal, 2014). This means that the country has reached over 9% of the potential biogas plants. A crucial role in achieving this number of plants was played by the BSP who still support the sector (Gautama, Baralb, & Heratc, 2009). One important difference with the Ugandan biogas sector seems to be the availability of credit options. In 1974, the Department of Agriculture in Nepal initiated the construction of 250 plants for which an interest-free loan was provided to farmers and up to recently, loans and subsidies are provided by the Nepalese government. Furthermore, microcredit options gained popularity (Gautama, Baralb, & Heratc, 2009, p. 250). Of course, more differences between Nepal and Uganda exist that might explain different performances in the sector, but the unavailability of

credit options in Uganda seems to be in strong contrast with that of the availability of credit options in Nepal.

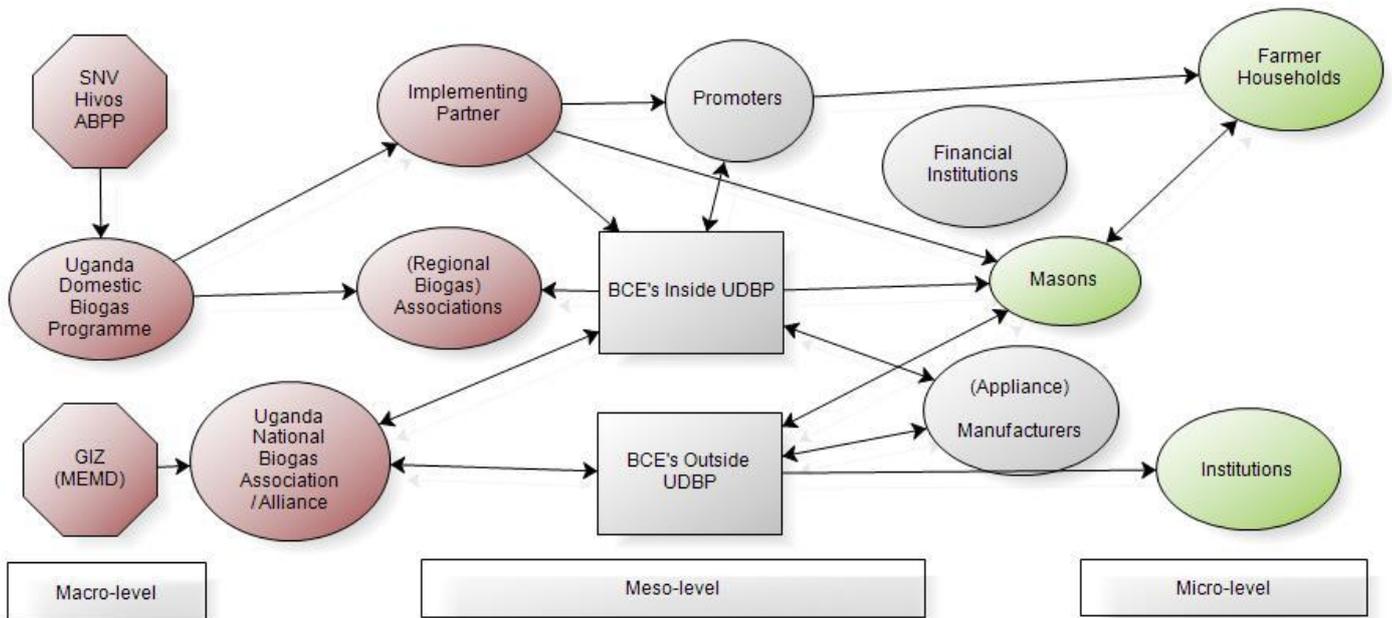
In Pakistan, the Biogas Support Programme, also initiated by SNV and supported by the Pakistani government, has been considered a success (Ilyas, 2006), reaching over 14.000 biogas plants by the end of 2013 (SNV Pakistan, 2014). Factors that contributed to this success in the country were, according to Ilyas (2006), the proper channelling of loans and subsidies through the Pakistani government and the BSP and effective promotion in the local languages. Furthermore, money made with the carbon trading business (through calculating how much CO₂ is saved just by biogas plants) is spent on providing new biogas users with a subsidy.

In most African countries, biogas has been introduced by NGO's, building digesters for schools and hospitals. Unfortunately, due to bad maintenance and quality, many of these digesters did not work for long and the technology did not take off (Mshandete & Parawira, 2009, p. 117). However, biogas is being explored by many Sub-Saharan African countries, since many of them have large potential of using the technology. In Tanzania, private stakeholders introduced the technology in the 1950's, and in 1975, the Tanzanian government contributed to the development the contemporary fixed-dome digester through the Centre of Argiculture, Mechanisation and Rural Technology (CAMARTEC), which was adapted from the Chinese model (Mshandete & Parawira, 2009, p. 119). The involvement of these private stakeholders in the past resulted in Tanzania in a number of 6.000 biogas digesters that were constructed before SNV implemented a national biogas programme in the country (SNV Tanzania, n.d.).

5. The Ugandan private biogas sector: Who are the actors within the sector and how are they related?

In order to find the bottlenecks within the Ugandan biogas sector and answer the research questions, it is necessary that the sector and its actors are known. This chapter will therefore describe the sector, its stakeholders and how they relate to each other, aiming to answer sub-question 1: who are the key actors in the sector and how are they related? Figure 9 below shows a schematic map of the sector, in which the most relevant actors are categorised by micro, meso or marco level.

Figure 10: Biogas sector map. Key actors and their relations



5.1 Macro-level

Categorised at macro level are actors within the sector that play a role on a larger national or international level

Uganda Domestic Biogas Programme (UDBP)

The Uganda Domestic Biogas Programme has been initiated by SNV and HIVOS (two Dutch development organisations) in 2008 in cooperation with the African Biogas Partnership Project (ABPP). The UDBP consists of a National Biogas Steering Committee (NBSC). This

committee is chaired by the Ugandan Ministry of Energy and Mining Development (MEMD) and part of it are the ministry of Agriculture, Animal industries and Fisheries (MAAIF), Private Sector Foundation Uganda (PSFU), a farmer representative, the NIA, SNV and HIVOS. The national implementing partner in Uganda is Heifer Projects International (HPI), which was chosen as the national partner to implement the project because of its extensive network in Uganda, its previous activities and experience with biogas. HPI has, in addition to its main office in Kampala, regional offices in the western and eastern regions. As in other African countries, biogas technology is not particularly new in Uganda, but never really took off until the UDBP started its activities in the county. So far, 5000 digesters have been built under the UDBP (SNV, 2013), where the potential is 216.000 plus an additional 100.000 that are near-potential. This means that 316.000 households meet the requirements that are necessary to have a biogas digester and can potentially benefit from it (Sengendo, et al., 2010, p. 28).

The main goal of the UDBP is to ‘to disseminate domestic biogas in rural and peri-urban areas with the ultimate goal of establishing a sustainable and commercially viable biogas sector in Uganda’ (Sengendo, et al., 2010, p. V). This is done through supporting actors in the private biogas sector, for example through capacity building, financial support and subsidy incentives. Most of all, the UDBP is very active in promoting biogas technology, raising awareness about biogas among the public and increasing the demand. This has been done through media campaigns, brochures, posters and through the training of sales-agents (or promoters). Furthermore, promotion is being outsourced to regional implementing partners (IP’s) located all over the country, strategically using their existing capacities and network to promote biogas (see below for more detailed descriptions of promoters and IP’s).

The UDBP project consists of two main phases. Phase I lasted from 2008 until 2013. It was characterised by heavy support and funding of the biogas sector. The most important funds provided by the UDBP consisted of a subsidy on domestic biogas plants for individual farmers. In 2008, this subsidy accounted for 650.000 Ugandan Shillings (UGX) worth of construction materials and appliances. By July 2013, this subsidy had been lowered to 487.000 UGX worth of materials and appliances. The subsidy was phased out entirely at the start of phase II by January 2014. Other funds provided consisted of the promotion fee for promoters, a small fee to support the biogas construction enterprises in constructing a plant and training to BCE’s and masons.

Government of Uganda (GoU)

The government of Uganda is involved in the biogas sector mainly through the ministry of energy and mining development (MEMD). This ministry also provides the chairperson of the National Biogas Steering Committee, the committee that steers the UDBP. Also part of the committee is the ministry of agriculture, animal industries and fisheries (MAAIF). Even though these ministries are involved and their policy documents claim to stimulate the biogas sector (see, for example, Government of Uganda, 2011) most respondents described the government as an inactive or even absent stakeholder.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

GIZ, a German development agency, has recently been involved in the sector. It is funded by the German government. In 2014, MEMD and GIZ have initiated the formation of national renewable energy alliances. GIZ has identified a need for an association that supports the renewable energy sectors in a sustainable way. Though GIZ, a Ugandan National Renewable Energy Alliance (UNREA) is being initiated, and this alliance branches off into different alliances for the different kinds of renewable energy, one of which is the Uganda National Biogas Alliance. It is supposed to function as a platform for every actor within the biogas sector: from end-users to NGO's and the UDBP, BCE's, existing biogas associations, researchers, students, the government and so forth. Although it has not yet taken off, the alliance should become a platform which is inclusive and easily accessible to all through low membership fees (GIZ, 2014).

5.2 Meso-Level

Biogas Construction Enterprises (BCE's)

BCE's are considered key actors in the private biogas sector. A total of 16 BCE's were interviewed for the purpose of this study: three in the Eastern region, five in the Western region and seven in the central region of Uganda. Most of these companies are small- or medium enterprises (SME's), varying in size from 2-10 employees. BCE's do not only construct the biogas plants. Promotion, after-sale services and providing training for end-users on how to use biogas are also part of their activities, although it is sometimes unclear if these activities are always carried out. Thirteen out of sixteen BCE's interviewed participate in the UDBP, which means they get some small financial support from the UDBP when they have

constructed a plant. Three other BCE's interviewed operate outside the scope of the project, which means that they don't register the plants they build with the UDBP and do not receive any support from the UDBP. Some of these companies have dropped out of the project, while others have never worked with the project to begin with. Further analysis described in chapter 3 below will explore more in detail the differences between these BCE's working inside and outside the scope of the UDBP

Promoters

Promoters of biogas are mostly individuals, who promote the use of biogas in rural communities. They work either for the UDBP or for BCE's directly and in phase two of the project receive a promotion fee of 50.000 UGX for every plant they bring in. This fee is either transferred from the UDBP to the promoter or is transferred via the BCE that has constructed the plant. Although there are some very active promoters, BCE's pointed out that from the many registered promoters, just a few are actually productively promoting and bringing in plants.

Biogas Associations (BA's)

Currently, there are four biogas associations active in Uganda, namely the Uganda Biogas Association (UBA) and three regional associations: the Eastern Biogas Association (EBA), the Western Biogas Association (WEBA) and the Interregional Biogas Association (IBA). These regional biogas associations have been initiated by the UDBP, because of limited outreach and activities of the UBA. These associations are meant to be platforms for different stakeholders, which contribute to for example capacity building, knowledge exchange and promotion of biogas. However, these associations themselves struggle with their capacities and are not (yet) being considered active or valuable platforms by most respondents. This will be discussed in further detail in chapter 3.3.

Financial Institutions (FI's)

Until now, financial institutions (e.g., banks) have been almost absent in the biogas sector, but are considered a crucial actor. So far, there have been very few credit options for end-users of biogas to build a digester with the help of a loan. With the withdrawal of subsidies from the UDBP, most low-income farmers can simply not afford to pay for the construction of the plant and a loan could make the use of biogas more accessible to these farmers. However,

biogas is not considered a bankable product in Uganda and financial institutions are hesitant to give out these loans, not willing to take the risk of not getting any returns. Even though several BCE's and the UDBP have been involved in negotiations with FI's in order to initiate a biogas or renewable energy loan, this has not yet taken off. The absence of financial institutions will be further discussed in chapter 2.

Appliance Manufacturers

Appliance manufacturers supply the BCE's with the appliances and construction materials for the digester. Three BCE's are registered also as appliance manufacturers by the UDBP, supplying the sector with mainly stoves and dome pipes. The lamps that are used to attach to the digester are often imported from asia and construction materials such as sand, cement and bricks are often locally supplied.

5.3 Micro-level

Masons

Masons are employed by the BCE's and are the ones who do the construction work for the BCE's. Most of them work on a 0-hour based contract: whenever there is work, they get a call. This means that whenever there is no plant to construct, masons often have to go find other construction work with other companies to make a sufficient living. Sometimes, BCE's borrow each other's masons when they are short of manpower or when they have a big plant to construct. Most masons active in the biogas sector have received a mason training provided by the UDBP, while a few are trained by the BCE's themselves.

Implementing Partners (IP's)

Implementing Partners are often small, local NGO's and are part of the UDBP. They are considered to be able to reach out to local communities in a better and efficient way than the national implementing partner, Heifer International. This is because they are already well-known in their areas of operation and possess an extensive network that they can use to the benefit of the biogas sector. Four IP's have been interviewed for the purposes of this research. Their main role is to promote biogas and raise awareness about biogas in local communities. However, IP activities often overlap with BCE responsibilities: for example, they sometimes carry out after-sales services and user training. Furthermore, from preliminary observations it

seems like there exist some competition between IP's, in particular in the western region, where 5 IP's are active. This is a high number of IP's, compared to one in the eastern region and three in the central region. Some IP's encountered in the west compete for plants, to be able to reach the targets set by the UDBP and to get the management fee the IP's receives from the UDBP for every plant that was constructed.

End-users

End-users of biogas consist of two groups: domestic and institutional users. Among the domestic users are mainly farmer households. Most of these farmers have a low income, living on their small plots of land on which they grow crops (mostly plantain bananas) and keep small numbers of cattle. A small survey among these households shows that they mainly use biogas for cooking and the fertilizer. Even though most farmers also use the biogas lighting, the lamps easily break and are known to not provide sufficient light for the whole house for a night. The UDBP and participating BCE's mainly focus on the domestic end-users in their approach. Institutional users of biogas mainly comprise schools and universities and to some extent prisons and hospitals. Most of the institutional digesters use bio-latrines to feed the plants with human waste. The gas that is produced is mainly used for cooking. The institutions are not targeted by the UDBP and most of the participating BCE's. Therefore, BCE's that operate outside the UDBP target these institutions. This division will be further discussed in chapter 3 below.

6. Bottlenecks within the sector

This section will describe the bottlenecks that were found within the sector. A root problem in the sector relates to biogas technology and comprises the affordability of biogas technology. Not many people can afford a biogas digester, which lowers the demand. This problem will be described first in section 3.1. Secondly, with the purpose of realizing a commercially viable biogas sector in Uganda, the UDBP has created a programme infrastructure in order to support the sector. Parts of this infrastructure and actor relationships, as described in chapter 2, are found to be constraining to private sector development. Section 3.2 will discuss these problems in the sectors infrastructure. For example, promotion has been directed to the programme instead of the private sector and implementing partners often stand in the way between an entrepreneur and his customers. Non beneficiaries of the programme find it hard to compete with the given subsidies by the programme. In short, this section will describe what particular parts of the sector's current infrastructure are found to be constraining within the sector and what actors play a role in this, according to this study.

6.1 The Affordability of biogas

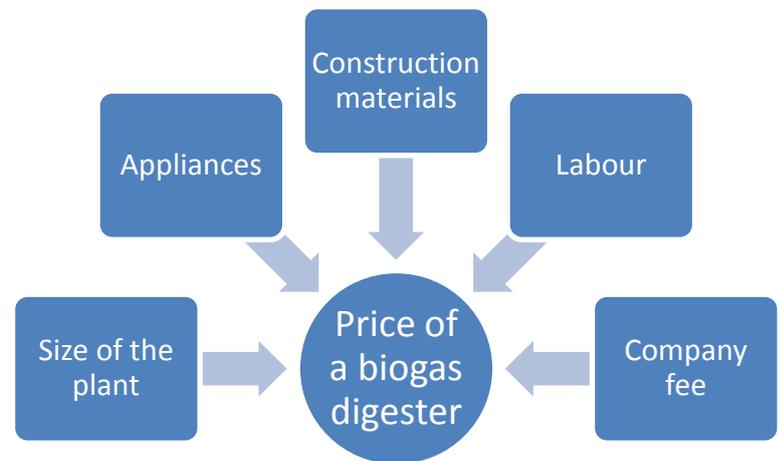
Biogas, with all its benefits, is a cheap way of producing energy and is very suitable for developing countries such as Uganda, where energy poverty rates are high and deforestation is an important issue. In particular, a lot of poor farming households would profit from the use of biogas technology, gaining cheap energy and high-quality fertilizer. However, during this research, it became clear that poor farming households, who potentially would profit the most from the use of biogas, are not able to afford it. This is a problem, because low-income farmers are the sector's target group and create the demand. This section will discuss the issue of affordability, why it is a problem and how it can be dealt with based on the findings of this study.

At the time of research, a domestic biogas digester of 6 cubic metre cost a total of around 2.4 million Ugandan Shillings (Mugerwa, 2014): a little over 900 US\$. After five years of subsidized plants, a household interested in biogas is now expected to pay the full price for a digester. With an average household income of a little over 3.5 million UGX (Uganda Bureau of Statistics, 2010), or US\$ 1.371, the cost of a digester is over 65% of the yearly average household income. As such, one can imagine that a biogas digester is an enormous expense

for most low-income households. A small survey in the central and

eastern region of Kampala supported the expectation that paying the full price for a biogas digester is not possible for many. The results showed that, among 22 biogas-using respondents, 21 farmers acquired their biogas plant because of the option of cost sharing through available subsidy of the UDBP. Only one farmer encountered was able to pay the whole amount of the plant through his own savings. Although the sampled households might not be representative for the general population of farmers with a biogas digester (see limitations section), it does indicate that many cannot afford the technology by themselves.

Figure 11. Factors of influence on the price of a biogas digester



BCE’s that were interviewed confirmed this: “The more work I have done on biogas I, feel that people can’t afford it...they may want to have the systems, however, the upfront costs, they don't have it.” (Biogaz, 2014). Even though most farmers have physical capital, it is financial capital that is often lacking: “They know being rich is having cash, they have animals, they have land, but they cannot afford to buy those materials and appliances to setup because it is cash.” (SEE, 2014). In addition, even though sometimes households would be able to pay the price of a digester, school fees and other expenses would be prioritized over biogas: “...of course during school times, when the term begins, it is also challenging again. Because someone has to choose between prioritizing biogas and school fees. Which one would you choose? Which would come first?”(Balance Energy, 2014).

Lowering the costs of the construction of a digester, in order to increase access to the technology is a challenge. In Uganda, the UDBP introduced the new CAMARTEC, or fixed dome digester as the main model for construction. This particular model has been found most suitable in Uganda by the SNV, which offers technical assistance to the UDBP. The CAMARTEC model was selected for different criteria such as its durability, methods of construction and operation and maintenance practices (Bos & Kombe, 2009). The cost of the digester varies because the costs of the construction materials vary per region, depending on

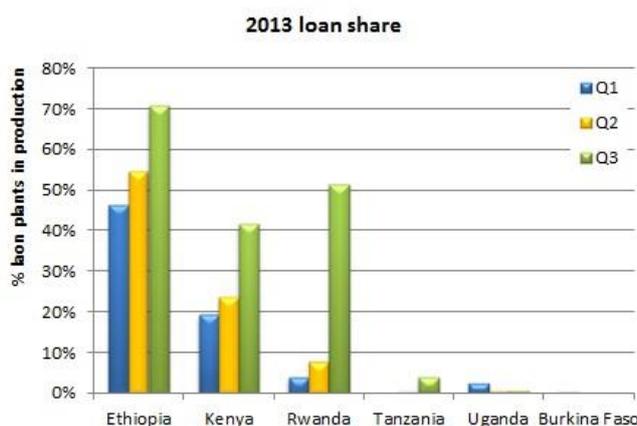
availability and quality. Figure 10 shows that the price of a digester is determined by the construction materials (bricks, sand and cement) appliances (lamps and stoves), labour, and a company fee. Reducing the price of a digester is almost impossible, since labour and company fees are kept low (too low, according to some BCE's). Furthermore, the costs of construction materials fluctuate heavily and are even increasing lately. George Mugerwa, programme coordinator of the UDBP explains why:

When we talk about construction materials, try to look at the countries which are surrounding us. There is a lot of construction and infrastructural development which is taking place in these countries. In Uganda, we have only 2 major companies that manufacture cement: Hima and Tororo, and you are seeing what is happening in southern Sudan, so the majority of the cement that is being manufactured has to go to Sudan. The little which remains here, is being sold at a higher cost which makes the cost of constructing the digester to be high. (Mugerwa, 2014).

The opportunity in increasing access to biogas technology to a larger public might lie in credit options. Small loans for farmers to be able to afford the high initial costs might overcome this difficulty. However, banks and other finance institutions need

Figure 12. Percentage of plants constructed in 2013 with loans in 5 countries

guarantees so that they won't lose their capital and the loan will be paid off. For this, farmers need a stable income, which many don't have. Although farmers save money on expenses such as fuel wood or kerosene, a domestic biogas digester does not directly generate income (Mugerwa, 2014). Therefore, many finance institutions do not consider biogas to be a bankable product. So far, it has been hard to get finance institutions involved in the sector, although a lot of effort is being put in by the UDBP and individual BCE's. Farmers that did receive loans could prove they had a stable income or were willing to provide a pledge. The loans were then given out as agricultural loans, home improvement loans or energy loans by microfinance institutions (MFI's), banks or savings



Source: Biogas4All (2014)

and credit cooperations (SACCO's). Figure 11 above shows the percentage of plants built with a loan in five countries where the UDBP is active. Notable is the low number of plants built with a loan in Uganda. At the moment of research FINCA, Finance Trust and Post bank were in the process of negotiating loans with the UDBP (Mugerwa, 2014), while some respondents mentioned also negotiating with Pride Microfinance and Opportunity Bank.

It has to be noted though, that the problem is not only the supply of affordable credit options, but also the demand. Four respondents specifically mentioned that not all farmers are willing to take up a loan:

People fear loans. Mostly in the eastern here. Because they always see other people who have faulted. So they think the bank comes and removes them from their land. And that's where I think they're strict they don't want to do all that. The banks think they are not capable of paying. So they don't give the money to begin with. (W&E Agricultural Engineers, 2014)

A BCE in the eastern region of Uganda (East Uganda Engineers) tried to solve the problem of affordability by letting customers pay in two or three phases, overcoming the problem of farmers having to pay a large amount of money at once. But as with many BCE's, E&A does not have enough working capital to do this for all its customers or to let the farmer pay for the construction over a longer period of time (East Uganda Engineers, 2014), nor do they have the skills and permits to act as a finance institutions.

Another way of dealing with the issue has been found in Masaka, in the central region of Uganda. An NGO called Masaka Diocesan Development Organization (Caritas MADDO) stimulates sustainable agriculture and dairy farming and promotes biogas to farmer groups. Since many farmers don't have financial capital but instead, physical capital, like cows, MADDO lets farmers pay back loans for biogas plants with the milk they produce. This way of financing biogas has also been found by Kappers (2013, p. 57) with UDBP implementing partner TAALI.

6.2. Relationships between the Farmer, UDBP and BCE

The UDBP has been actively promoting biogas over the past five years. Through folders, flyers, tv- and radio shows, the programme has been trying to sensitize the public about

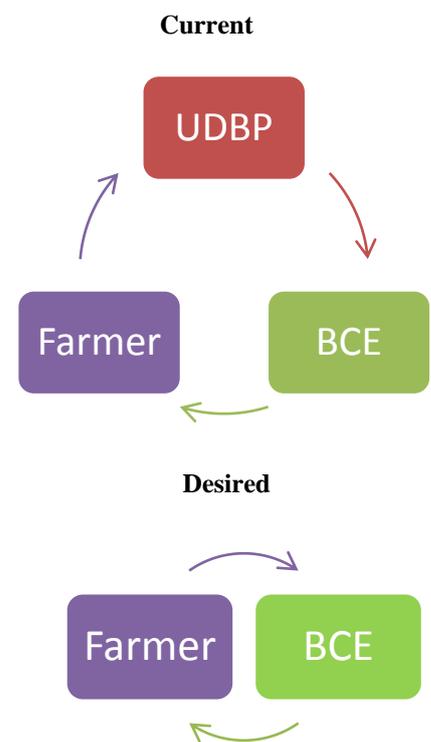
biogas and its benefits in order to create a demand. While conducting a field survey among biogas end-users, respondents were asked what BCE had constructed their biogas plant. Out of 22 respondents, 20 did not know that their plant had been constructed by a private company and answered ‘UDBP’, ‘Heifer’ or ‘SNV’. The UDBP supervisor who had come along to conduct the survey was able to provide the answer. However, the farmers themselves were under the impression that the UDBP had built the digester. This makes sense: on top of many digesters, the text ‘UDBP’ is engraved, along with the telephone number of the mason that built the plant or the number of a UDBP supervisor.

This results in situations in which, when the digester is dysfunctional or a lamp breaks, the farmer turns to either the mason or the UDBP instead of to the company that has constructed the plant. Also, cases were encountered whereby the implementing partner in an area that has promoted the plant to the farmer was the main contact person of the farmer. The implementing partner took up some after-sales services of the BCE’s, did minor repairs and even sold lamps to the farmers. UDBP then calls the BCE that has constructed the plant to check on the farmer and his digester. The desired situation (shown in figure 12), in a self-sustainable, independent private sector, would be that the relationship between the farmer and BCE would exist so that the farmer would directly turn to the BCE.

To support private sector development, ‘The establishment, development, and maintenance of relationships between exchange partners is crucial to achieving success’ (Morgan & Hunt, 1994, as cited by Parsons, 2006). In other words, creating and keeping a good relationship between exchange partners, a seller and buyer of biogas, a BCE and a farmer, is of major importance for a healthy private sector. The fact that many farmers do not even know from whom they

bought a biogas digester indicates an unhealthy or even absent relationship. Therefore, it is of importance that this relationship is strengthened. So far, the UDBP has promoted the programme itself along with biogas technology, but in order to create a well-performing private sector is important that the private sector is promoted (i.e., individual BCE’s), or, even

Figure 13. Current and desired relation between a Farmer and a BCE



Source: Workshop, 16-04-2014

better, supported to promote itself. Note that the sample included domestic users that were UDBP beneficiaries and thus this analysis is based on that particular data.

6.3. Relationships between the UDBP and (non-beneficiary)

BCE's

As the name states, the Uganda Domestic Biogas Programme focuses exclusively on the domestic biogas sector in the country. However, when aiming to create a commercially viable sector it is important not to forget the sector outside the domestic user. Institutional biogas, biogas plants in, for example, schools, hospitals and prisons, involve large digesters that are attached to special bio latrines. However biogas technicians and masons have only been trained in building small domestic digesters. Since the UDBP only focuses on domestic biogas, institutions have been underserved.

During the fieldwork of this research, it became clear that not all existing BCE's cooperate with the UDBP. Three out of 16 BCE's operated independently from the UDBP, either because they dropped out of the programme or, in some cases, they have never worked with the UDBP to start with. Table 2 below shows that all three companies focused mainly on institutional end-users as their target group, while only one company that operated within the UDBP focused mainly on institutions. The other 12 companies that worked with the UDBP focused exclusively on domestic users.

Table 2. BCE participation in the UDBP by target group

| | <i>Outside UDBP</i> | <i>Inside UDBP</i> |
|---------------------|---------------------|--------------------|
| Institutional focus | 3 | 1 |
| Domestic focus | 0 | 12 |

The reason for BCE's outside the UDBP to target institutions is rooted in the existence of a subsidy for programme beneficiaries, This subsidy included payment for some appliances and constructing materials for households that purchased a digester before January 2014 under the programme. This reduced the costs for the household significantly. Should a BCE operate outside the scope of the UDBP, the household would have to pay all the costs of the digester, including the appliances and construction materials. This results in a price difference between BCE's targeting households. BCE's that do not work under the UDBP might be disadvantaged in this case. One respondent captured this as follows:

When I looked at the overhead costs, my time, the training, training materials, I realized I needed to charge more than Heifer charged at the time. So very many households didn't buy my system and I was kind of stuck.(...) I'm now focusing more on the institutions, because the institutions, you know, they embed everything into the costs and they are like, ok, this is what needs to be paid. (Biogaz, 2014)

Another BCE perceived institutional biogas to simply be more profitable, since not much more time is spend constructing the plant, but more profit is made:

‘Like in a school has 500 students. And the digester which can serve 500 students. When you look at how much time you take to construct a unit of 500 students and how much time you take construct a unit of 5 to 10 people. The time is almost the same. So you are spending almost the same time for a much bigger digester where a client is going to pay you more money because the labour alone to construct a unit of 500 students could be close to 3 million shillings. Yet the other one is 500.000 so this is six times more labour. This is more profitable.’(CEWU, 2014)

In short, the existence of a subsidy for programme beneficiaries might have caused BCE’s outside the programme to shift to institutional biogas, for which there has been no subsidy. So far, this might have caused unequal competition within the sector. But after January 2014, the subsidy from the UDBP ended, which might end the cost difference between BCE’s inside and outside the UDBP. However, it is questionable if the BCE’s outside the UDBP will go back to domestic biogas. It would be more likely that BCE’s inside the programme will venture into institutional biogas, since without a subsidy, not a lot of farmers can afford a biogas plant. However, many BCE’s are struggling with their technical capacity and do not have the skills to cater for institutional biogas plants. This will be discussed in the next chapter.

6.4. Relations between BCE’s and Biogas associations

At the time of research, four biogas associations existed. By the time the UDBP started its programme, the Uganda Biogas Association already existed, but was considered weak by the UDBP. Therefore, during the programme, three regional biogas associations were initiated: the Eastern Biogas Association, the Western Biogas Association and the Interregional biogas

association. “Our plan is that when these associations mature, they should form a national association.” (Mugerwa,2014). These associations ideally involve all actors that are present in the sector: manufacturers, BCE’s, the UDBP, promoters, knowledge institutes etc. However for the purpose of this study this section will mainly focus on BCE involvement in biogas associations.

Table 3 below shows BCE membership of these associations. Notable is again the difference between BCE’s that cooperate with the UDBP and BCE’s that operate independently.

Table 3. BCE membership of different biogas associations by UDBP and non-UDBP

| <i>Association</i> | <i>UDBP BCE's</i> | <i>Non-UDBP BCE's</i> |
|----------------------------------|-------------------|-----------------------|
| Uganda Biogas Association | 4 | 2 |
| Interregional Biogas Association | 4 | 0 |
| Eastern Biogas Association | 3 | 0 |
| Western Biogas Association | 4 | 0 |
| No member | 0 | 1 |

During the interviews, BCE’s were asked whether they were a member of a biogas association and if they were satisfied with their membership. All BCE’s that operated within the UDBP were members of a biogas association and two of those were members of both a regional association and the Uganda Biogas Association. Two out of three BCE’s that operated independently from the UDBP were members of the Uganda Biogas association, the other one wasn’t a member of any association.

Members of the regional biogas associations were not very positive about the associations. Out of eleven, eight members indicated that the associations did not live up to their expectation or were not as active as they should be. Three of these eight said that being a member of a regional association did not help them or their businesses in any way, because the associations are inactive. Some responses following the question about their satisfaction with the associations were: “That association? Nah, it’s funny, I’ve seen nothing. Actually they are trying to organise themselves, but I think with time probably, they’ll be having something better for the BCE’s but so far, not yet.” (Coenergy, 2014). Another BCE responded: “At first, we thought it would be helpful to us to be members, but eh, now, I don’t see why it helps us, I don’t think so.” (Balance Energy, 2014). The other three BCE’s did not express a strong opinion about the associations, not in a negative or positive way.

Since the regional associations were initiated by the UDBP it focuses mainly on domestic

biogas. Even though they are open to actors with other target groups or interests. Some BCE's mentioned that because of this particular focus, they feel excluded from the associations.

The six members of the Uganda Biogas Association were more positive about the association in general. Being a national association not initiated or supported by the UDBP, the organisation has had struggles with its capacity. Many members or members-to-be could not afford the membership fee. However, if we look at BCE membership, it is more inclusive than the regional associations. Table 4 below shows that both BCE's with an institutional focus and domestic focus are members of the UBA, while not a single BCE with an institutional focus was a member of any regional association. This indicates that, even though they are open to all actors, regional biogas associations seem to involve BCE's that focus on domestic biogas exclusively.

Table 4. BCE membership of different biogas associations by domestic and institutional focus

| <i>Association</i> | <i>Institutional focus</i> | <i>Domestic focus</i> |
|----------------------------------|----------------------------|-----------------------|
| Uganda Biogas Association | 3 | 3 |
| Interregional Biogas Association | 0 | 2 |
| Eastern Biogas Association | 0 | 3 |
| Western Biogas Association | 0 | 4 |

In short, biogas associations in Uganda are scattered and this division within the sector, with multiple associations working towards different goals might be constraining for the sector. This was confirmed by respondents during a focus group discussion. The presence of a strong, active and accessible platform for the biogas sector might have a positive effect on the development of the sector. Such an organisation, the focus group concluded, would ideally be an accessible platform for the promotion of biogas, trainings, knowledge exchange and networking with all different stakeholders and anyone who would have an interest in biogas can become a member.

Currently, an initiative by GIZ, the German development organisation in cooperation with the Government of Uganda, has been trying to realize such an association. This association, the Uganda National Biogas Alliance, would be a branch of a larger, renewable energy alliance, involving associations on biogas, solar, wind and hydro energy. Unlike regional biogas associations, this alliance would include actors from all parts of the sector:

those with an institutional focus, those with a domestic focus, suppliers, buyers, masons, promoters, R&D organisations, students and so on (GIZ, 2014). However, during the time of research, GIZ was still in the process of realizing the alliance and therefore, it is not yet clear what the outcomes of the initiatives are or what effect the alliance has on the sector.

This chapter has discussed two problematic issues that were found in the biogas sector during this research and that need improvement. The first issue that was discussed is the relationship between the BCE, farmer and the UDBP. When buying a biogas digester under the UDBP, farmers are often not aware of the fact that they deal with a private sector. In order to stimulate private sector development and creating a self-sufficient private sector, it is of importance that the exchange relationship between a farmer and the BCE (the buyer and seller) is a successful one, in which both parties are well informed. Too often, this is not the case in the Ugandan (domestic) biogas sector.

Secondly, a division has occurred within the sector between BCE's that operate under the umbrella of the UDBP and those who don't. Because subsidies were given to customers from UDBP associated BCE's, non-UDBP associated BCE's were forced to focus on institutional biogas, resulting in a twofold of BCE's: those who are under the UDBP and focus on domestic biogas and those who operate independently and focus on institutional biogas. Consequently, this has resulted in a division in biogas associations, whereby UDBP associated regional biogas associations and their members only focused on domestic biogas and the only non-UDBP association attracted only BCE members that focused mainly on institutional biogas. Although this division is not necessarily bad, respondents indicated that there is a great need for a national, inclusive and active biogas association to support the sector. Among other reasons, this is because most BCE's that are currently only focusing on domestic biogas, are eager to venture into institutional biogas, but do not have the skills and knowledge to do this. A biogas association can play an important role in this by providing this to its members in the form of, for example, drawings of larger, institutional models. This will be further discussed in the recommendations chapter.

7. BCE's and their capacity

In previous chapters, the main bottlenecks in the private biogas sector in Uganda were discussed. More than once, biogas construction enterprises (BCE's) were involved in these bottlenecks, one way or the other. After describing the BCE's and their characteristics in detail, this chapter will go more in-depth on these important actors in the sector and will aim to reflect their views on the sector, their challenges and their opportunities.

7.1. BCE Characteristics

Biogas construction enterprises are generally micro and small enterprises that, as the name implies, construct biogas installations. Before the Uganda Domestic Biogas Programme started in 2009 there were practically no BCE's in the country. Although biogas digesters had been constructed by some NGO-projects before that time, one could not speak of a private sector. With its start in 2009, the UDBP trained local technicians, engineers and construction workers to become biogas masons. Later, these masons were stimulated to unite and form companies. Most BCE's are micro-and small enterprises (MSE's). According to the definition of MSE's of the government of Uganda, micro enterprises are companies having less than 5 employees and small enterprises are companies having less than 50 employees (see table 4).

Table 5. Definitions of Micro and Small enterprises

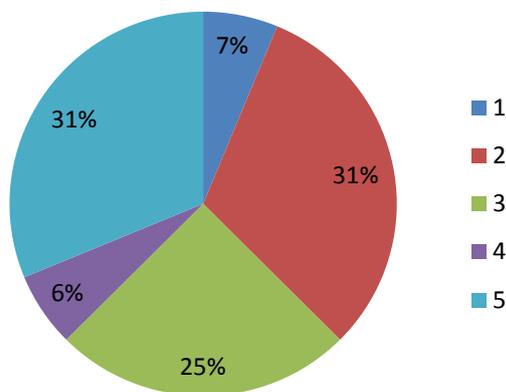
| | <i>Employment</i> | <i>Value of assets*</i> | <i>Annual Turnover</i> |
|------------------|-------------------|-------------------------|---------------------------------|
| Micro enterprise | < 5 employees | < Shs 2.5 million | < Shs 10 million |
| Small Enterprise | 5 < 50 employees | <Shs 50 million | Shs 10 million – Shs 50 million |

Source: MFPED (1999) as cited in Stephenson and St-Onge (2005)

Using this criteria to categorize the encountered BCE's, 5 out of 16 BCE's would be small enterprises (see figure 13 below), while the other 11 are microenterprises, having less than 5 employees. However, a qualitative criterion states that often, microenterprises are not officially registered companies. They don't pay taxes and are characterized by weak management and low capability. Small enterprises are generally tax-paying registered

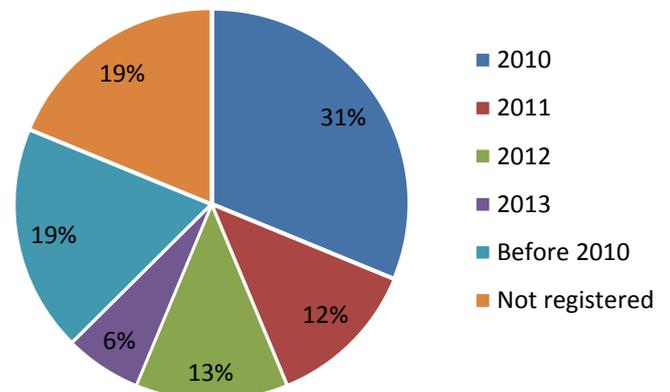
companies, with a stronger and more capable management (Stephenson & St-Onge, 2005, p. 5). Applying the criteria of registration, 3 BCE's qualify as micro enterprises, (See figure 14) while the other 13 are registered companies and qualify as small enterprises. Although no exact data was collected on the growth rates of BCE's, most BCE's would classify within the framework of Liedholm and Mead (1999) as non-growing or slowly growing enterprises. These categories were discussed in the theoretical framework above and indicate that most BCE's either did not grow since their startup and were only surviving, or had a very slow growth since their start.

Figure 14. Number of employees of BCE's.



Data source: BCE interviews

Figure 15. BCE Registration per year



Data source: Uganda Registration Services Bureau

As described in chapter 5, the core activity of these companies is the construction of biogas plants. However, since not many people are aware of biogas technology, BCE's spend a lot of time promoting their product. In addition, they carry out after-sales services (checking up on the plants they sold or repair dysfunctional plants) and user trainings (teaching users how to mix dung and feed the digester in a right way). Since biogas wasn't a widespread technology in Uganda before 2009, most BCE's have come up in 2010 or after. This is shown in figure 6 above. Those companies that were founded before 2010 were already existing construction or engineering companies that took up biogas later on. From the size and the age of the BCE's, it is clear that they are not large developed enterprises. Biogas as well as the biogas sector is new in Uganda and therefore the sector doesn't run smoothly yet, with the supply and the

demand in balance.

The next section will discuss the challenges the BCE's in the biogas sector are facing and how they perceive their positions in the sector. Among the challenges the BCE's indicated during the interviews, five challenges have been selected on the basis of the number of references to that challenges during the conducted interviews. The challenges are related to technical capacity, financial capacity, subsidy withdrawal, transport and masons. The coding matrix which forms the basis for this analysis is shown in annex 1.

7.2. BCE challenges

During the research, it became clear that most BCE's struggle with their capacity and viability in the sector. This section will discuss the challenges that they face in becoming independent and viable businesses. From the interviews that were held and problem trees that were sketched during the participatory workshops, four main challenges were identified that will be discussed in this section: technical capacity, financial capacity, masons and the subsidy withdrawal.

7.2.1. Technical capacity

Second-most mentioned challenge by BCE's is a lack of technical capacity. For this study, technical capacity is defined by the ability develop, manage and execute projects. For BCE's, this encompasses a lack of managerial skills running a business, but in particular, technical skills to construct and maintain high quality biogas digesters. Of all interviewed BCE's, 12 out of 16 BCE's referred to technical capacity as one of their main challenges, indicating that this capacity often lacks (See annex 2: coding matrix.)

A lack of technical capacity was often mentioned by BCE's regarding institutional biogas. Many of them simply lack the technical skills to construct larger biogas digesters, because they were trained only to construct small, domestic biogas digesters. However, they also indicated that they were eager to learn and build their capacity in building larger digesters:

We stick to them [domestic digesters] because there is nowhere where we can acquire that skill of the institutional plants. Because you know, those measurements of the digesters are very critical. And you can't imagine, you have to get someone to design

the plant properly, because when you do it improperly, you can have a malfunctioning plant. So we fear to plan it ourselves. But to get those people who are skilled, architects who can design us that plant or the what, it is not easy. (Sustainable Future, 2014)

As the quote above indicates, the access to skills and knowledge is a problem and this is true for many BCE's. Gaining access to the drawings of larger (institutional) digesters or other models than the CAMARTEC model is a difficulty for 8 out of a total of 16 BCE's.

Institutions are there and they can afford the digesters. But we don't have the opportunity of getting those drawings. And at times, for example now, there are some farmers who want bigger digesters so that they can pack the gas in the cylinders for commercial benefits. But since we don't have those drawings... Then we say to that one, if you want to construct, you construct the smaller. Because we have the drawings of that one. (Balance Energy, 2014)

The eight BCE's are all participating in the UDBP, and received training in constructing domestic biogas exclusively: "I was asking the programme to train us in institutional digesters, but they told us that they were focusing on domestic digesters, not commercial digesters." (Balance Energy, 2014) In short, BCE's indicated a lack of capacity concerning their technical skills. They also indicated that accessing the knowledge that would expand their technical capacity is often not accessible to them.

7.2.2. Financial capacity

In total, 10 BCE's referred 26 times to a lack of financial capacity as a challenge they were facing. During analysis, the code (lack of) financial capacity was given to any expression involving BCE's not having enough funds to run their business the way they would like to. Generally, this meant that they did not have enough financial capital to employ permanent staff when necessary and reach out to farmers in remote areas to market their product or to provide after-sales services. For marketing and promotion in particular, a lot of investment is required from a BCE. For BCE's, phone calls to follow up on potential clients is necessary but costly. Furthermore, transport to area's where (potential) clients live is considered expensive by BCE's. Many of them do not have the capital invest in a car or truck and use

their own or hired motorbike(s), bicycles or public transport to move around and reach out to their clients, which can cost a BCE a lot of money. Furthermore, BCE's have to finance the transport of their masons to field sites. Some BCE's try to include these costs in the costs of the digester, but charging for this can make the digester unaffordable for the client: "We've got discussions going with farmers on how to support our masons' movements back and forth. There is always trouble and again we can't over charge clients because we know they won't be able to afford that much" (Green Energy, 2014). Nine out of 16 BCE's indicated transport and its costs as a challenge; one BCE even pointed transport out as their main challenge:

The most challenging difficulty is the movement, the reaching out to people. Yes, it's a very big challenge and it takes a lot of money. We go by motorbike, it is old and it is just one and we are three people all that want to go to the field. That is the biggest challenge....So the small profit we make, we put it back into the motorcycle. Not in expanding the business. (Sustainable Future, 2014)

This shows that a lack of financial capital has severe consequences for many BCE's. A lack of capital constrains them to reach out and market their product or to follow up on already constructed plants, possibly resulting in low productivity and bad maintained plants

7.2.3. Masons

Related to the challenge of a lack of financial capital, 8 BCE's mentioned to encounter challenges regarding their masons. The first challenge discussed here regarding masons is them producing 'shady' or 'substandard' work. Constructing a biogas plant is precise work and if done improperly, the digester can become dysfunctional easily. The defect then has to be repaired which again involves labour, material and transport costs. The second challenge regarding masons is that, since most BCE's do not construct enough plants to keep their masons full-time employed, most masons work on-call, under a zero-hour contract. Whenever there is a plant to construct, the mason comes to work. However, this causes masons to find other construction work when there isn't a biogas digester to construct. This way, they might be busy constructing elsewhere when they get a call from a BCE:

Some of them [masons] are now engaged in some other construction companies. Some of them are still engaged in some after-sales services for me, to keep them busy. Because once you leave them, they might go and then when you get the work and you expect them, getting them back might be hard. (W&E Agricultural Engineers, 2014)

After working for other construction companies in different sectors, masons often need a refreshment training, before they can return to constructing biogas plants, again involving time and costs.

7.2.4. Subsidy withdrawal

For BCE's that participated in the UDBP, the subsidy reduction and, in the end, withdrawal of the subsidy provided by the UDBP was the most discussed challenge. The transition from a sector with subsidies to a sector without subsidies has had a major effect on the private sector. All 13 BCE's under the UDBP indicated that they were struggling with the fact that there is no subsidy for farmers after January 2014. They explained that many of their potential clients simply could not afford the digester without a subsidy (or credit options, see chapter 6), leading to a severe loss of business after January 2010.

It is a big shock. I mean, there has been a very big decline compared to when the subsidy was there and then it's not there. Now you are going to have to convince somebody to spend all 2.5 million on biogas.(...) So for now, obviously compared to the first phase, it's really doing badly but we have to live on. We can say there are still responding to the changes in the market, but maybe after 6 months people will realize: there is no more subsidy but we need the technology. (NEW Energy, 2014)

For BCE Uganda Agricultural Engineers, the subsidy withdrawal had even more severe consequences. After asking what changed for his business after the subsidy withdrew, the manager answered: "Definitely we changed. We no longer have work now." (UAE, 2014). Since the subsidy only withdrew in January 2014 and this research was carried out from February till March, it is too early to describe the effects of this change. BCE's are slowly adapting to this new situation in the market, which is not always easy. For example, BCE's indicated that they used to profit from the subsidy by using it as a marketing strategy. Before January 2014, BCE's would approach farmers by advertising the involvement of the UDBP and a subsidy. However, in the absence of subsidies, marketing strategies had to change:

We used to market based on the subsidy, but now, we are emphasizing on the benefits. We have to emphasize on the benefits of the biogas before you even go to the bill of quantities. Because once you give the bill of quantities to somebody before you tell him the benefits, he may never attend to hear about the benefits. So we emphasize now on the benefits. (W&E Agricultural Engineers, 2014)

It must be noted that all BCE's are different enterprises, in different areas facing many different challenges. While some BCE's are strong and well-managed enterprises, the majority are just small and struggle with their viability. The challenges described in the above were the challenges that were encountered most during semi-structured interviews with the BCE's. In addition, some challenges relate strongly to one another. For example, a BCE with limited technical and managerial capacity and/or financial capacity will be likely to have more difficulty adapting to the absence of subsidies.

By way of conclusion, the majority of MSE's in the biogas sector in Uganda lack the capacity to run an independent, viable business. To stimulate private sector development in the biogas sector in Uganda, it is of importance that the technical, managerial and financial capacity of BCE's increases. The next chapter will discuss possible recommendations to support BCE's and stimulate private sector development

8. Conclusion & Discussion

In the above, this study has aimed to provide an overview of the private biogas sector in Uganda and has showed the existent bottlenecks within the sector from the perspectives of biogas construction enterprises: micro and small enterprises that promote, sell, construct and maintain biogas plants in the country. Section 8.1 will first discuss the limitations that could have had an effect on the findings of the research. Section 8.2 will then discuss the main findings of this research and will thereby answer the main research question that was posed in the introduction: *What are the bottlenecks for private sector development in the biogas sector in Uganda as perceived by MSE's and how can these bottlenecks be overcome in order to stimulate private sector development?* After answering this research question section 8.3 and 8.4 will discuss the theoretical and practical implications of this study and its findings. This chapter will conclude by discussing implications for future research in section 8.5.

8.1. Summary of the findings

An answer to the main research question as described above would consist of two parts: describing the bottlenecks within the sector as perceived by BCE's within the sector and providing recommendations on how these bottlenecks, or constraints, can be overcome to increase private sector development. To start with the descriptive part of the research question, several bottlenecks were found that seem to hinder private sector development. A distinction has been made between bottlenecks that are not directly linked to BCE's and those that are linked to BCE's.

First of all, externally, biogas technology is relatively expensive. Those who would profit most from the technology, poor farmers, generally cannot afford it. In the absence of affordable credit options and with very few possibilities to lower the price of a biogas plant, biogas is a product that is very hard to sell. Second, a problematic relationship between the farmer and the BCE is caused by interference from the Uganda Domestic Biogas Programme and its partners. Too often, clients did not know that the product they bought was sold to them by a private company. Instead, they were under the impression that the UDBP constructed the technology for them. Whenever there was a problem with the plant, the farmer would contact the UDBP after which the UDBP would send a BCE to the site to resolve the problem. In an ideal situation, this interference of the UDBP is not necessary since it hinders the private sector from operating independently. In an ideal situation, the farmer would contact the BCE directly. The third bottleneck that was found also relates to the UDBP. The UDBP initiated

the spread of biogas technology in Uganda, but in doing this, it only focused on domestic biogas, supporting the sector with, among others, promotion and a subsidy on biogas plants. By only including domestic biogas plants, it excluded larger-scale biogas, or institutional biogas. There has been a demand for this institutional biogas that for a long time that could not be met by the supply, since technicians and masons had only been trained in constructing small, domestic biogas plants. However, over time, some BCE's were encountered that operated independently of the UDBP. Since they could not compete with the subsidies that the UDBP provided for domestic biogas plants, these BCE's ventured into institutional biogas. This has been considered a bottleneck for the private sector, since a division clearly existed between beneficiaries and non-beneficiaries of the UDBP, creating a rather exclusive sector. The final external bottleneck that was found relates to this division. In Uganda, four biogas associations exist, but are considered to be weak and inactive. Ideally, these associations are platforms in which all stakeholders of the sector are united, exchange ideas, knowledge and promote biogas. Three out of four associations are regional associations that were initiated by the UDBP to support the domestic biogas sector, the other one operates independently of the UDBP. Actors within the sector indicated that there is a need for a national, active and inclusive biogas association that can meet the needs of the sector when it comes to, for example, knowledge exchange and cooperation.

Internal to the BCE's, several more bottlenecks were found. First of all, BCE's struggle with their technical capacity. Many do not have the technical skills to meet the demand for institutional biogas, since most BCE's have only been trained to construct a specific type of small plants. Furthermore, many BCE's lack managerial skills to run a business, since many were not trained to do so. Secondly, many BCE's lack financial capital, they do not have the resources to make required investments to go out and promote biogas, or follow up on their products. This results in, for example, the inability of BCE's to promote or construct their products in rural areas and bad maintained plants. Third, BCE's struggle with their personnel, in particular their masons. Masons are hired based upon availability of the work. Whenever there is a biogas plant to construct, they get a call to come and construct/repair. However, when there is no work, masons move to other companies and construction sectors to find work. When a BCE needs them again, they might not be available or need a refresher training. Finally, the fourth bottleneck relates to the withdrawal of the subsidy that has been provided by the UDBP until January 2014. After January 2014, clients are expected to pay the full price of a domestic biogas digester, which they often can't. This

meant a major loss of business for most BCE's dealing with domestic biogas. They need to adapt to these new circumstances, but that is not easily done when also dealing with limited technical and financial capacity as described in the above.

In short, challenges or bottlenecks that were described in this section were all found to be constraining the private sector in one way or another, affecting many actors in the sector. Also, many of these challenges are related to each other. For example, a lack of financial capacity can result in a lack of technical capacity, for example when a BCE does not have the funds to take part in trainings. The other way around, a lack of managerial and technical skills can also result in a lack of financial capacity, when for example the company is run in an inefficient way. To ensure private sector development it is important that these challenges are addressed. This will be discussed in section 8.3, which discusses practical implications and recommendations. First however, section 8.2 will discuss theoretical implications.

8.2 Theoretical implications

This section will discuss implications that these findings have on the theory that was discussed in the theoretical framework. How do these empirical findings relate back to the theory, how does this research add to the theory or how does the theory add to the findings of this research?

The first theoretical concepts that were discussed in the theoretical framework showed ways in which the private sector can be able to contribute to development. Theory on 'Shared value creation' by Porter and Kramer (2011) and 'Bottom of the Pyramid' approaches by Prahalad and Hart (2002) and theory on micro, small and medium enterprises showed ways in which the private sector can be an agent of development and how businesses can make a profit while creating societal value simultaneously. Many authors have been critical about these ideas. Arora and Romijn (2012) pointed out that there exist no empirical proof that the private sector can contribute to this development and that the win-win situation of creating both business value and societal value is heavily romanticized. Based on the empirical findings of this research, this critique seems justified. Although this research did not focus on whether or not the private sector creates both business value and societal value, it did indicate that it is not self-evident that the private sector is able to do just this. On the other hand, the findings of this research also do not prove that the private sector is not able to create a win-win situation. This research however, does show that there are many challenges for the private sector to become viable and be able to create societal value at the same time. This indicates

that some nuances might be necessary and again, confirming that the private sector is not a panacea to development.

In section 2.3 and 2.4, ways in which micro and small enterprises can contribute to development were described. In particular, it was described how MSE's in different stages can be supported in their growth and viability by external assistance programmes. The Uganda Domestic Biogas Programme is one of these assistance programmes, a planned intervention aiming to support BCE's in their growth process. However, the findings of this research indicated that this programme is not always successful in achieving this. Viewing the sector from an actor perspective, as proposed by theory of Norman Long (2001), might help to better understand why certain challenges have occurred. From an actor perspective, one would see the biogas sector in Uganda and the UDBP involvement as a large social arena in which all sort of actors, like BCE's and the UDBP, are located. All these actors act upon different situations and different interests, resulting in a process of continuous negotiations. Problematic relationships between the BCE's and the UDBP might then be explained by clashing interests within this arena, seeing both BCE's as the UDBP as actors with their own interests. Furthermore, Long recognizes that outcomes of planned interventions may be resulting from factors that lie outside the development programme (Long, 2001, p. 31). This means taking into account more context that can be of influence on the outcomes such an intervention. This perspective has been useful for this research by allowing to take into account many factors outside the UDBP.

8.3 Practical implications: recommendations

Since the findings of this research are mostly of descriptive nature, the implications of this research will mainly contribute to the existing knowledge about the biogas sector in Uganda and its actors. However, based on the empirical data and the discussed theory, some recommendations can be given to organisations aiming to assist private sector development. This section will not give recommendations on how to solve each of the specific challenges in the above. However, three main recommendations will be given that are considered to be most urgent based on the findings of this study. With the third recommendation, this section will aim to provide advice to policymakers in the Ugandan biogas sector that might also be applicable in a more general sense to other policymakers who aim to stimulate private sector development and help the private sector contribute to development. In Uganda, the private sector can potentially contribute to, for example the alleviation of energy poverty and a decrease of deforestation through the spread of biogas technology. However, the findings of

this research indicate that the private biogas sector is struggling to do this. Therefore, the following recommendations are aimed to help the sector become viable.

The first recommendation relates to the affordability of biogas. One of the main constraints for the biogas sector in Uganda was the fact that those who would profit the most from the technology could not afford it. In the absence of subsidies for domestic biogas, it is highly necessary that access to affordable credit increases to make the technology accessible to poor farmers. Although the UDBP is actively researching options to provide credit in cooperation with different financial, very few farmers are able to access loans so far. However, some innovative ways of providing loans have been encountered during this research without the involvement of financial institutions. It is therefore recommended to explore options to access credit outside the realm of financial institutions, like paying debts off with milk.

Second, several constraints that were found within the biogas sector in Uganda were related to the role of the UDBP and its implementing partners. As an assistance programme, the UDBP aims towards an independent and commercially viable biogas sector. However, certain parts of the UDBP structures that were described in the above were found to be constraining private sector development. In many cases, the role of BCE's, the UDBP and implementing partners were not clear. For example, implementing partners that were selling appliances or providing after sales-services took over responsibilities of BCE's. For many BCE's that were interviewed, the roles of the UDBP and, in particular implementing partners, were unclear. It is therefore recommended that these roles and responsibilities are made clear towards both BCE's and IP's. Strongly related to this, many BCE's did not have a direct link with their clients because clients were under the impression that the UDBP constructed their plants instead of a BCE. This is an outcome of the fact that promotion of the UDBP so far, has been directed towards the promotion of the programme. It is recommended that not only the programme gets promoted, but more importantly, the private sector and the BCE's get promoted. Furthermore, clients should be informed about who they are dealing with and whom they can contact in case of a malfunctioning plant.

The third recommendation relates to BCE's and their support. Only a BCE that is viable is able to contribute to the goals of the UDBP, income and employment generation and the alleviation of energy poverty. Therefore, support should be directed to strengthening the private sector actors and in particular, BCE's. How this can be done is discussed in section 2.4. Liedholm and Mead (1999) have set out different strategies to support growth of MSE's,

differentiating between startup, non-growing, slowly growing, and graduate enterprises. In the case of BCE's in Uganda, where mostly non-growing and slowly growing enterprises were encountered, the authors recommend several financial and non-financial ways of assistance. For non-growing enterprises, assistance can involve increasing access to credit, assist in improving management or different production systems. However, for slow-growing enterprises, assistance gets more complex. These enterprises need more specific assistance and require research into the needs of the enterprise. (Liedholm & Mead, 1999, p.109-112). Although different types of assistance have been given to starting and slow growing enterprises, the biogas sector in Uganda lacked this specified and short-term assistance to slow-growing enterprises. It is therefore necessary that assistance is tailored to the specific type of enterprise in order to tackle issues such as a lack of technical and financial capacity.

Even though this research has been done within the specific context of the Ugandan biogas sector, the findings of this research might also be useful in different contexts. To assess the extent to which this research has implications to different times and geological contexts, the quality criterion of transferability will be used that was proposed by Becker *et al.* (2006, as cited by Sumner and Tribe, 2008), as: 'the extent to which a set of findings are relevant to other settings than the one or ones from which they are derived' (Becker *et al.*, as cited by Sumner and Tribe, 2008, p. 114). Applying this criterion to the conducted study on the biogas sector in Uganda, it is clear that this study has taken place within a specific context. However, some of the overall findings of the study can certainly be transferrable: the challenges MSE's like biogas construction enterprises generally deal with and how they can be assisted in contributing to development. In addition, since more biogas programmes are and have been initiated all over the world, experiences from the Ugandan context can be very useful for the implementation of other (biogas) programmes. Furthermore, the theoretical as well as the practical implications of the research findings contribute to the debate about the role of the private sector in development.

8.4 Implications for future research

The role of the private sector in development has grown in the last years. More and more, the private sector addresses the needs of poor in developing countries (Desai & Potter, 2008, p. 500). Nevertheless, as Arora and Romijn (2011) argue: '...in existent literature, there is a serious lack of empirical support for the win-win proposition....' (Arora & Romijn, 2012).

This ‘win-win proposition’, or the fact that the private sector can contribute to development processes by simultaneously profiting from it as was proposed by BoP and shared value approaches, thus still lacks empirical evidence. On the other hand there exists no strong proof that the private sector does not have this potential. Finding empirical evidence for either statement has not been within the aim or scope of this research, but would certainly add value to the knowledge and literature on the subject. Furthermore, by providing empirical evidence of a successful or unsuccessful role of the private sector in development, lessons for the future can be learned.

Considering the private sector in Uganda, several options lie open for further research. For one, research on the availability of credit options, and how to increase access to biogas technology would be particularly valuable. Furthermore, a more in-depth study on the particular needs of BCE’s within the sector would be very useful for providing the right assistance to the sector in order for it to become independent and commercially viable. Another interesting field of research relates to a knowledge gap on productive biogas. SNV in cooperation with FACT foundation (2014) conducted case studies on productive biogas in five different countries, among which Uganda, exploring the options on productive biogas. While conducting this research, productive biogas was mentioned by several respondents, indicating that it was interesting but not much was known about it. More research is needed about the potentials and the right circumstances for this kind of application of biogas. In addition, it would be interesting to know more whether or not productive biogas can have positive effects on (energy) poverty, deforestation, private sector development and so on.

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Annex 1. List of respondents in-depth interviews

Central Uganda

21-02-2014 GET FiT Uganda, senior consultant
25-02-2014 Renewable Energy Incubator, incubator engineer
26-02-2014 BCE Biogaz, founding manager
03-03-2014 BCE Green Energy, agricultural engineer
03-03-2014 Heifer Projects International, programme coordinator
04-03-2014 BCE CEWU, founding manager
04-03-2014 SNV, Renewable Energy Advisor
06-03-2014 Millennium Biogas, founding manager
07-03-2014 BCE NEW Energy, founding manager
11-03-2014 BCE SEE, founding manager
12-03-2014 BCE Uganda Crane Constuctions, biogas engineer
07-04-2014 GIZ, Energy expert
09-04-2014 BCE Green & Renewable solutions, founding manager
29-04 BCE Coenergy, assistant manager

Eastern Uganda

17-03-2014 BCE East Uganda Engineers , founding manager
18-03-2014 BCE W&E Agricultural Engineers, founding manager
20-03-2014 IP TEDDO, programme manager
20-03-2014 BCE Energy from Waste, founding manager

Western Uganda

31-03-2014 Heifer Projects international, regional coordinator
31-03-2014 BCE Balance Energy, founding managers
01-04-2014 BCE Trust Biogas, founding manager
01-04-2014 BCE U-gas, founding manager
02-04-2014 IP UCCCU, programme worker
02-04-2014 IP UCCCU, manager
02-04-2014 BCE Sustainable future, founding manager
03-04-2014 BCE UAE

Annex 2. Coding Matrix BCE challenges

| | Financial capacity | Technical capacity | Subsidy reduction | Transport | Masons |
|---------------------------------|--------------------|--------------------|-------------------|-----------|-----------|
| Sustainable Future | 1 | 2 | 1 | 1 | 1 |
| SEE | 5 | 3 | 5 | 2 | 5 |
| East Uganda Engineers | 2 | 1 | 2 | 1 | 1 |
| Green Energy | 3 | 2 | 3 | 2 | 2 |
| NEW Energy | 0 | 1 | 4 | 2 | 2 |
| Biogaz | 0 | 2 | 0 | 0 | 0 |
| UAE | 2 | 4 | 3 | 3 | 1 |
| Energy from Waste | 2 | 1 | 5 | 2 | 0 |
| Balance Energy | 3 | 3 | 3 | 1 | 0 |
| W&E Agricultural Engineers | 1 | 0 | 2 | 0 | 2 |
| U-gas | 0 | 1 | 3 | 0 | 0 |
| Coenergy | 0 | 0 | 2 | 0 | 1 |
| Green & Renewable Solutions | 3 | 4 | 0 | 1 | 0 |
| Uganda Crane Constructions | 0 | 0 | 1 | 0 | 2 |
| CEWU | 1 | 1 | 0 | 0 | 7 |
| Trust Biogas | 3 | 0 | 4 | 2 | 0 |
| Total of references | 26 | 25 | 37 | 17 | 21 |
| Total of BCE's referring | 12 | 12 | 13 | 10 | 9 |

Annex 3. Stakeholder table

| Sector | Scope | Stakeholder group | Benefits for stakeholder group | Downside risks | Resources offered |
|------------|----------------|--|--|--|---|
| Government | National | Ministry of energy and mining development (MEMD) | Alignment with energy policy Contributes to nations development | Loss of funds, corruption in energy sector | Favourable legislation, funding |
| NGO | National | UDBP | Alignment with project aims and objectives | Project failure, loss of funding from donors | Funding (subsidy), capacity building, knowledge and other support |
| NGO | National | Implementing Partners (IP's) | Alignment with non-profit goals & strategies | Inefficiency, dependency of funds unsustainability | Funding, capacity building, knowledge and other support |
| Private | Regional/local | Biogas construction enterprises (BCE's) | Business opportunities Profit | Loss of working capital, unaware public , low capacity | Labour, skill |
| Private | Local | Biogas masons | Employment, gain of skills, knowledge & experience | Loss of employment due to instable sector or not enough work | Labour, skill |

Down to biogas business: the private biogas sector in Uganda

| | | | | | |
|----------------|-------------------|---|--|--|---|
| Public/Private | Local | Institutions or companies using biogas technology | Access to (renewable energy), cost sufficiency, fertilizer etc. | Initial investment, insufficient returns from biogas | Demand for biogas technology, buyer of services |
| Private | Local | Microfinance institutions (MFI's & MDI's) & SACCO's | Business opportunities Profit | Loss of funds due to inability of clients to pay off debts | Access to credit |
| Community | Local | Consumers/households | Access to efficient source of renewable energy, health improvement, saving time & money, women empowerment | Initial investment, insufficient returns, breakdown of plant or short plant lifespan | Demand for biogas technology, buyer of services, promotion of technology through mouth-to-mouth advertisement |
| Sector | Scope | Stakeholder group | Benefits for stakeholder group | Downside risks | Resources offered |
| Private | Regional | Biogas association | Promotion of biogas, support & service | | Platform for training, support and promotion |
| Private | National/regional | Appliance manufacturers | Business opportunities, profit | Loss of business if technology does not spread. Imported goods could be competition because they are cheaper | Appliances for biogas technology, R&D, lowering the cost of the appliances, job creation, longer lifespan products than imported appliances |

Down to biogas business: the private biogas sector in Uganda

| | | | |
|----------------|-------------------------|--|--|
| Public/Private | International, National | Research & Development: Universities and research institutes, NAADS, ATAAS | Research on increasing plant efficiency and more possibilities for feedstock |
|----------------|-------------------------|--|--|

Figuur 1

Annex 4: Survey End-users

Gender of respondent: F/M

Age of the respondent:

Location:

1. I use biogas as a (please encircle what's applicable)

- Institution
- Household

2. Since when do you have a biogas digester?

3. How did you get to know biogas?

- Through friends/family/neighbours
- Through sales agents
- Through media campaigns
- Other, namely ...

4. What is the size of your digester?

- 4 m³
- 6 m³
- 9 m³
- 13 m³
- Other, namely ...

5. How have you paid for your digester?

- Own savings
- Through a SACCO
- Through a microfinance institution
- Through a commercial bank
- Other, namely...

6. Is your digester operational at the moment?

- Yes
- No, reason:

7. For what purpose(s) do you use your biogas digester? (Multiple answers possible)

- Cooking
- Lighting
- Fertilizer
- Other, namely...

8. How satisfied are you with the following products of the digester

Biogas Sector Uganda

| | Very unsatisfied | | Neutral | Very Satisfied | | Not applicable |
|-----------------|------------------|---|---------|----------------|---|----------------|
| Gas for cooking | 1 | 2 | 3 | 4 | 5 | O |
| Lighting | 1 | 2 | 3 | 4 | 5 | O |
| Fertilizer | 1 | 2 | 3 | 4 | 5 | O |

9. Would you recommend a biogas digester to your neighbours?

- Yes
- No

10. What company has installed your biogas digester?

11. On a scale from 1-5, how satisfied are you with the following services of this company:

| | Very unsatisfied | | Neutral | Very Satisfied | |
|---------------------------|------------------|---|---------|----------------|---|
| Construction Process | 1 | 2 | 3 | 4 | 5 |
| Quality of the digester | 1 | 2 | 3 | 4 | 5 |
| Quality of the appliances | 1 | 2 | 3 | 4 | 5 |
| Price of the Digester | 1 | 2 | 3 | 4 | 5 |
| User training | 1 | 2 | 3 | 4 | 5 |
| After-sales services | 1 | 2 | 3 | 4 | 5 |

12. What advice would you give to the Biogas construction enterprise that has installed your digester?

13. Would you recommend this company to your friends or neighbours?

If no, why not?

Annex 5: Interview Guide BCE's

Respondent:

Organisation:

Date:

Time:

- *Recorder*

- *Research statement/ Letter of introduction*

- *Informed consent*

1. Could you tell me something about yourself and how you got involved in Biogas?

2. Could you tell me something about your company?

- Why did you decide to start up?

- When did you start your company?

- What's the size of the company?

- Where do you operate?

- What are your main activities?

- How many employees do you have?

- Who are your customers?

- How is business at the moment?

- How many digesters do you construct each month on average/ have you constructed?

- Are you involved with the UDBP and/or an implementing partner? How is your relation?

3. What are the main activities of your company?

- Do you deliver after-sales services?

- Do you do marketing or promotion of your products and services?

4. What are the threats you encounter in your business?

- How do you deal with these threats?

- What could be opportunities?

- What advice would you give other BCE's?

5. What do you think makes a BCE's a good/bad business.

- What are the most important standards to live up to?

6. Who are the key stakeholders within the biogas sector, according to you?

- What is their interest?

- Who do you think, has the most influence, is the most powerful actor in the sector? Why?

- Do you consider yourself a powerful actor in the sector?

- What other stakeholders in the sector do you deal with?

- How is your relationship with them?

- Do you have contact with other BCE's?

7. According to you, what are the threats to the sector you encounter?

Annex 6: Interview Guide other stakeholders

Respondent:

Organisation:

Date:

Time:

- *Recorder*

- *Research statement*

- *Informed consent*

1. Could you tell me something about your organisation?

- What is your role in the organisation?

2. How did your organisation get involved in biogas in Uganda?

3. What is your organisations current role in the sector?

- What is your interest in the sector?

- What are you current objectives?

- How do you pursue them?

- What is the role of your organisation in the biogas sector in the future?

4. Could you briefly describe the sector and its main stakeholders for me?

- Who are the most powerful actors?

- What is their interest?

5. Could you tell me something more about BCE's?

- *Do you support BCE's?*

- *What are your experiences with BCE's?*

- *What are difficulties BCE's encounter?*

- *What could BCE's do to improve their services?*

- *Are there things other stakeholders can do to improve the BCE's?*

6. Could you tell me something about the promoters/ IP's?

- What is their role in the sector?

- How is their relation with the other stakeholders?

7. Could you tell me something about the role of finance institutions in the sector?

8. Could you describe the role of the biogas associations?

9. According to you, what is the main challenges to the sector?

- What are other challenges to the sector?

- What are the challenges for your organisation?

- How do you deal with these challenges?

- Where do the opportunities lie in the sector?