Stakeholder collaboration and learning during the concept design phase of an urban biogas project

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Abstract

Anaerobic digestion (AD) of organic matter to produce biogas is a waste management option for waste streams high in organic matter which are unsuitable for thermal treatment. In Africa, the implementation of this technology is slow compared to developed countries, more so in the urban areas in contrast with rural areas. An understanding of factors behind the low rate of implementation of this technology is needed. As a response to this challenge a research group at the University of Cape Town (UCT) set-up a multi-disciplinary team to implement a biogas digester on the UCT campus as a demonstration project. This paper aims at documenting notes on stakeholder collaboration and learning during the concept design phase to implement an urban biogas project. One of the findings of the project thus far is that a significant proportion of time needs to be dedicated to establishing key stakeholders and decision makers. Education, training and good relationship with stakeholders and the technology provider were also found to the important in the concept design of the project.

Keywords

Anaerobic digester, Biogas, Stakeholders, Consultation

1. Introduction

Anaerobic digestion (AD) of organic matter to produce biogas is a waste management option for waste streams high in organic matter which are unsuitable for thermal treatment. In developing countries, AD has potential to address some of the increasing waste management problems caused by among other things escalating waste generation in urban areas, a consequence of growing urban migration (Trois, 2010; Mbuligwe and Kassenga, 2004). Biogas produced from AD has wide application including cooking, heating and electricity generation. Unlike in developed countries where the technology is widely employed at different levels both in the urban and rural settings, in developing countries it is largely confined to rural areas. Structures and processes within institutions in urban areas are thought to be some of the barriers for dissemination of biodigester installations. As a response to this challenge a research group at the University of Cape Town (UCT) set-up a multi-disciplinary team to implement a biogas digester on the UCT campus as a demonstration project. This initiative is in line with UCT's green campus initiative where one of the aims to become a carbon-neutral campus. Although there is an initiative on campus to source-separate dry waste from organic waste, the latter ends up in a landfill where it generates methane, a potent greenhouse gas which contributes to global warming. The project will make use of organic waste generated from a residence kitchen to be anaerobically digested in a pre-fabricated digester.

This paper presents and analyses the experiences gained during the concept design phase of a project to install a 6m^3 pre-fabricated biogas digester on the UCT campus. A range of stakeholders within the institutional framework played significant roles, which need to be evaluated and understood for the successful implementation of other such sustainable energy technologies. An existing technology, biogas from anaerobic digestion of source-separated wet waste to generate cooking gas, was selected to challenge innovative implementation, rather than innovative technology, within an institution.

2. Method

The method of this paper is using a qualitative approach and drawing on information from project documentation, personal communication with stakeholders and firsthand experience. The project documentation has been developed by the project management team with the intention to inform the university's management about achieved goals and experienced constraints.

The central hypothesis in this paper is that the implementation of renewable energy projects in institutions is subject to specific institutional constraints which once identified and

overcome, could allow for simpler multiplication of such projects. The research questions subsequently are: Where are the barriers to implementing a biogas project within the University structure? Secondly, how can one overcome these institutional barriers? And finally, how should the lessons learnt from this experience be disseminated?

3. Concept design procedure

The objective of the study is to challenge innovative implementation, rather than innovative technology, within an institution. There is an agreement in literature that issues related to 'innovative implementation' of projects and technology is complex (Mondal, et al, 2010; Negro et al, 2007). A study by Karpenstein-Machan and Schmuck (2007) looking at ecological and social implementation of sustainability project in a German village concluded that:

"The crucial point in implementing innovative sustainability projects like the described one is to convince people, that a new idea, a vision may serve their own interests as well as the interests of future generations and therefore is worth to be realised. The corresponding process of creating and fostering the motivation of individuals and groups in the village to participate in such a sustainability project will be termed "social implementation". Such a social implementation approach is necessary in all projects where the sheer information regarding a technically possible alternative to existing modes (of energy production based mainly on fossil resources) is not sufficient to implement the desired change" (Karpenstein-Machan, 2007).

In an attempt to address the 'social implementation' of the UCT project the procedure employed in the design of the concept phase was as follows.:

1. A project working team which comprised of four representatives from three participating university departments was formed. The project development was led by the Environmental and Process Systems Engineering Group. The other two departments, Energy Research Centre and Properties and Services departments were strategically selected both due to their expertise and involvement at different levels of the project. In addition, the private sector partner, AGAMA Energy had some involvement early during the project.

2. The next step was for the project team to meet and forumulate a strategy. This included identifying stakeholders and defining timescales. Meetings were held regularly from the early stages of the project and each of the team members were allocated tasks to report back in the next meeting. The frequency of the meetings

declined as the project progressed, primarily due to delayed responses of stakeholders.

3. Following this, the stakeholder consultation focusing on the identification of a pilot activity site began. This entailed one-to-one consultations with stakeholders from different representatives from university management and communications via e-mail. After some delibarations, meetings and site visits, a location for the pilot site was selected.

4. The subsequent step was consultation with other stakeholders based in the Student and Residence department - including the sub-contracted catering company, and the Properties and Services department. Once the location for a pilot study had been identified, it was decided that the food waste generated in the residence kitchens be monitored to ensure the viability of a biogas unit. However the catering company recommended that in order to undertake the kitchen waste monitoring properly, the kitchen staff needed to be trained in waste separation and collection.

5. The kitchen staff were given some training after which the waste was monitored for 3 weeks, and the results showed that there would be sufficient organic waste (a minimum of 40kg/day) that it is needed to maximise the daily organic loading rate for the 6 m^3 pre-fabricated digester, that would make this a viable project for the selected kitchen.

6. It appeared from one of the stakeholder meetings that some of the parties were concerned with the idea of having a digester in close proximity to the kitchen. Several issues were raised which included the safety, issues of smells and flies. A workshop was arranged where a biogas expert from technology providers responded to the stakeholder queries in an informal question and answer session. Furthermore it was decided that a site visit to an installed institutional biogas facility would be benfecial to observe how similar digesters installed elsewhere operate. The visit was very valuable for addressing discomfort with any remaining concerns about the project.

7. Once the stakeholders were at ease, a concept design report documenting experiences from consultations and plans going forward was put together by the working team for UCT management's approval.

8. Once the approval was made, the engineering company was appointed to carry out detailed design of the project and work towards installation.

Building on the findings of research on social success factors and barriers of renewable energy projects in rural Germany (see Karpenstein-Machan & Schmuk, 2007) a series of 'theoretical success factors' for a biogas project on the UCT campus were drawn up. Based on firsthand findings experienced during the project, these theoretical factors were used to assess what the actual 'experienced success factors' were, as outlined below.

4. An assessment of social success factors and barriers

Table 1: A summary of theoretical and experienced social factors

Theoretical and experienced social success factors and barriers for the biogas project UCT (adapted from Karpenstein-Machan & Schmuck, 2007)	
Theoretical success factors	**Experienced success factors**
a) Good contact with university media b) Neutral project managing team c) Persistency and motivation of management team d) Personal contact and relationships with the different stakeholders/ institutional people e) Dissemination of information to stakeholders f) Site visits of similar installations g) Engagement for something positive, money saving etc h) Initiation celebration, cooking sessions could be done i) Well-established advocate	a) There has not been any contact with the campus media been yet. b) Despite the fact that the project team consisted mainly of university employees, neutrality was possible through diverse backgrounds and departmental associations of parties involved. This has been proven to be important. c) The project team and in particular the project manager has been very persistent which was indeed necessary to keep the stakeholders interested and willing to participate. The project team has held personal meetings with each stakeholder over the time. A friendly and cooperative working relationship was was established and has proved valuable. d) Information has been constantly disseminated in meetings and via email. e) The site visit of a similar installation on a farm is perceived as the breakthrough in the design process. Stakeholders and the project team became excited, and any remaining doubts and worries were discussed with the farm residents and system operators. f) The cause for the project team to become active was the intention to showcast a pilot installation of a renewable energy technology on campus. This cause, following the broader vision of a carbon neutral campus, opened doors for the communication of the

	project. The financial savings from rising gas costs for Student and Residence department is a secondary incentive, however it is expected to become more important if the project is to be replicated. g) As the project is still at implementation stage, there have not yet been any entertainment or leisure events held around the project. However on completion an initiation celebration is possible. h) The project initiator is a senior level researcher at the university which proved crucial for getting the relevant stakeholders on board early on in the project.
Theoretical barriers	**Experienced barriers**
a) Negative image of cooking on "dirty" gas, made out of waste b) Doubts about costs etc. and if economically feasible	a) Biogas did indeed have a negative image for many of the stakeholders. Smell, pollution and flies were associated with it. The workshop with the biogas expert and site visit allowed for these to be proven wrong. b) The economical feasibility behind the project was not analysed in depth for this project as funding was intentionally set aside for this project , but will certainly play a crucial role in future projects in this and other institutions.

4. Lessons learnt

The lessons learnt suggest that project implementation even in a large institution like a university has to consider that 1) it must not be underestimated that in terms of the critical path of the project implementation a significant proportion must be dedicated to finding key stakeholders and sufficient time needs to be allocated to identifying the key decision makers within an institution, 2) ownership of the project and technology within an institution is crucial to the project's success and sustainability, 3) appropriate training and education on the chosen technology is necessary for stakeholders at all levels and needs to be matched to the role of those people in the implementation process, and 4) communication strategies need to be tailored to the stakeholders' responsibilities and the expected outcomes / concerns of the project (i.e. workshops, reports, field trips). It was also found that for the private sector to become involved in sustainable energy projects in institutions, it is important to have a well-functioning institutional project team in order to drive the project internally.

5. Conclusions

The aim of this paper was to document notes on stakeholder collaboration and learning during the concept design phase to implement an urban biogas project on the UCT campus. Although the project is work in progress, it has been determined thus far that a significant proportion of time needs to be dedicated to establishing key stakeholders and decision makers. Also, it needs to be clear who the project drivers are, and while training and education of stakeholders has been found to play a major role in the successful concept design phase of the project. Finally, it was established that a well functioning institutional project team is crucial when the private sector is the technology provider.

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