Strengthening the biogas sector of Ethiopia through international collaboration: the case of the Digital Global Biogas Cooperation (DiBiCoo)

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Abstract. Even though biogas technology was introduced in Ethiopia in 1957, the technology is still in its infancy stage with more than 98 % of biogas plants installed in Ethiopia at a small-scale level and used for cooking and lighting applications. The Digital Global Biogas Cooperation (DiBiCoo) project facilitates collaboration between European biogas industries and stakeholders from emerging and developing markets through the development and application of innovative digital and non-digital support tools, knowledge transfer and capacity building. The Digital Global Biogas Cooperation helped the Ethiopian biogas sector through capacity building trainings, creating a digital biogas and gasification matchmaking platform to link companies with local biogas actors in the country, and assisting demo case projects up to prefeasibility study stage. Furthermore, it provided practical exposure through virtual and in person biogas plant tour in several countries, and generating several documents related to the Ethiopian biogas sector including an assessment on biogas potential, financial options and a legal frame work to assist the sector. Based on this collaboration, more than 30 stakeholders participated in 11 web seminars, 2 capacity-building trainings, 3 days business model development training in Biogas and more than 10 virtual study tours. One demo case and three-follower cases prefeasibility studies were supported. Thus, the Digital Global Biogas Cooperation is providing much needed support to the biogas sector of Ethiopia.

Keywords: DiBiCoo, Biogas, demo case, follower case, prefeasibility

1. Introduction

Even though biogas technology was introduced in Ethiopia in 1957, the technology is still in its infancy stage with more than 98 % of biogas plants installed in Ethiopia at a small-scale level and used for cooking and lighting applications. Ethiopia's Municipal Solid Waste is majorly organic waste of approximately 65 % and advanced Biogas systems can be adopted for generation of heat and power, cooking and transportation purpose. One of the most vital components of municipal solid waste is food waste such as household food waste, cafeteria and restaurant waste and food-processing waste [1]. Besides, more than 82 % of the Ethiopian population is living in rural areas and most of them are farmers. Thus, by combining food waste, animal waste and agricultural waste, it is possible to generate energy for the rural communities. Thus, Biogas is a recommended technology to convert organic waste into energy. Thus, the DiBiCoo project was very helpful to strengthening the Biogas sector of Ethiopia [2].

2. DiBiCoo project

The EU H2020 project DiBiCoo supports the European biogas/biomethane industry by preparing markets for the export of sustainable biogas/biomethane technologies from Europe to the developing and emerging markets in the project's target countries as shown in figure 1 (Argentina, Ethiopia, Ghana, Indonesia, and South Africa) [2]. With that, the project addresses two main challenges in developing and emerging countries, namely the management and treatment of organic wastes and agricultural residues and the increased demand for renewable energy.

The core activities of DiBiCoo are the active involvement of European technology providers through the European and national biogas associations, the collaboration with the target countries, the development and application of innovative digital and non-digital support and matchmaking tools and actions, knowledge transfer and capacity building as well as the identification of suitable project opportunities in the target countries and the preparation of demo projects up to the investment stage.

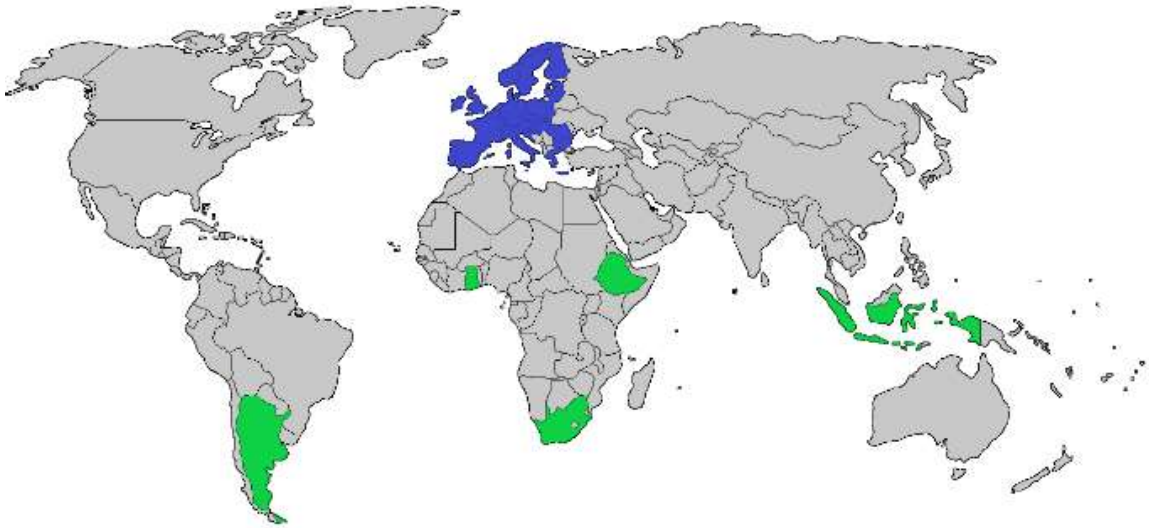

Figure 1: World map with DiBiCoo's exporting (blue) and importing (green) countries [2]

As for the demo projects, 5 projects (one per target country) were selected from 52 applicants. The eligibility of applications was assessed, and a preliminary technical and financial assessment was conducted. A pre-feasibility study will examine and evaluate the 5 demo projects selected by the consortium in more detail [3-5].

In terms of physical capacity building, knowledge transfer and matchmaking events, the COVID-19 pandemic has had a major impact on the project. Therefore, in 2021, all these events were converted into virtual events, so that they can be implemented largely.

3. Project results

3.1 Demo case prefeasibility study

Aquatic biodiversity of Lake Tana, the largest lake in Ethiopia, is at extreme risk due to the aggressive invasion of water hyacinth, locally named as Enboch. Finding innovative technology to generate energy from water hyacinth is very crucial to save the lake. Thus, DiBiCoo project has been supporting the prefeasibility study of Biogas production from water hyacinth. At Lake Tana, biogas production will be combined with environmental protection measures by using water hyacinth and organic wastes for the generation of electric power [2]. The plant material is collected and, together with agricultural residues utilized to produce estimated 13 GWh electricity per year. The consortium consists of Bahir Dar University, and Lake Tana and other Water bodies Protection and Development Agency.

3.2 Web seminars

Enabling knowledge exchange, creating capacity and facilitating technology transfer are integral parts of the Digital global Biogas Cooperation (DiBiCoo) project [2]. The aim of the web seminar series is to inform about cooperation opportunities, to familiarize industry stakeholders with European technologies and to share lessons learned and best practices on successful biogas, biomethane and gasification project management. A total of 11 web seminar were presented on the following topic by top Biogas experts from all over the world: Introduction to DiBiCoo, Webinars and Demo Cases, Overview of European Biogas Technologies and Adaptations in Emerging / Developing Markets, Importance of Feed Stock in Anaerobic Digestion: Characteristic & Potentials, Pretreatment of Feedstock in Anaerobic Digestion Importance of Feedstock in Anaerobic Digestion, Sustainable Biogas Production and Use, Biomethane (CNG & LNG) And Waste Treatment, Safety Measures for Biogas Plants, Values, Post-treatment & Digestate Application II, Biogas Project Management and Lessons from Other Projects, Thermal Gasification of Wooden Biomass and Biogas Plants: Legal Framework Conditions and Policy Considerations.

3.3 Capacity building

Two-capacity building training delivered for Ethiopian Biogas stakeholders. The first capacity building training session prepared to cover very important and timely topics for Ethiopian Biogas market: recent advancement in biogas technology and Biogas project Management. Thus, the one of the capacity building training session intended to focuses on the recent advancement of Biogas technology that covers the following topics: Technological advancement in biogas, Biogas Upgrading and Bottling technologies, Solar Energy Assisted Anaerobic Sequencing Batch Reactor for Tannery wastewater Treatment and Greenhouse Emission Mitigation, Hydrogen sulphide removal technologies and Biomethane Production. Concerning the Biogas project management, the following topics were covered: Biogas Project Management - Steps from the first idea towards a Biogas plant in operation, practical experience of Ethiopia Biogas Project management and Biogas Project management : Lesson from South Africa. Experts from Germen Biogas association, Greencape (South Africa), INTA (Argentina) and local experts are participated in delivering the training for three days. The training session held in a mixed mode where local experts gave the training face to face and experts from Germany, South Africa and Argentina delivered their training virtually. The participants also visited a Biogas plant outside of Addis Ababa, Holeta. The visited biogas plant has a capacity of 80 m^3 digester and 27 m^3 of gas holder. Future collaborative areas within the DiBiCoo objectives have been discussed in detail. The second capacity building in Ethiopia focused on “Feedstock Management and Business Models to Manage a Commercial/Institutional Biogas Plant: International Lessons and Local context”. In this capacity building, Business model small-scale biogas economical, business model selection for municipal solid waste biogas plant, feedstock pre-treatment cost and logistic issues, legal aspect of Biogas project, on the business case for Biogas from solid waste in South Africa, etc. were covered. The presenters elaborated and shared their experience in detail. Besides, experience also shared within the participants. In general, the participants received detailed insights on Feedstock Management and Business Models to Manage a Commercial/Institutional Biogas Plant: International Lessons and Local context.

3.4 International Biogas plant visits

To gain international experience in biogas technology, the DiBiCoo project funded Biogas plant visits in Germany, South Africa and Indonesia. Six individuals were able to visit several Biogas plants. The biogas plants visited were different in their feedstock and their use of Biogas after generation. Municipal solid waste, agricultural plants, cattle dung and organic waste were used as a feedstock. In general, the Biogas was used to generate combined heat and power, and upgraded the generated biogas to produce methane and injection to the grid. The incentive mechanism in Europe also helps the biogas sector immensely [7,8].

3.5 Biogas business model training

The biogas business model training was given for three days focusing on Value Proposition Canvas, Lean Canvas, Business Model Canvas, Exploration of the local biogas market and showcasing of good

practice examples involving expert advice, Pitch training involving short pitches on the participants' integration of the learnings into their business model design and Individual business case development. The lessons gained through the training were very valuable for the participants.

3.6 Virtual Biogas and gasification tours

DiBiCoo is offering a deep insight into different concepts of aerobic digestion through a virtual study tours in Austria, Germany, South Africa and Argentina. The video is also uploaded on the DiBiCoo YouTube channel where anyone can access and view it [6].

4. Conclusions

The Digital Global Biogas Cooperation helped the Ethiopian biogas sector through capacity building trainings, creating a digital biogas and gasification matchmaking platform to link companies with local biogas actors in the country, and assisting demo case projects up to prefeasibility study stage. Furthermore, it provided practical exposure through virtual and in person biogas plant tour in several countries, and generating several documents related to the Ethiopian biogas sector including an assessment on biogas potential, financial options and a legal framework to assist the sector. Based on this collaboration, more than 30 stakeholders participated in 11 web seminars, 2 capacity-building trainings, 3 days business model development training in Biogas and more than 10 virtual study tours. One demo case and three-follower cases prefeasibility studies were supported. The biogas business model training were given for three days on Value Proposition Canvas, Lean Canvas, and Business Model Canvas, Exploration of the local biogas market and showcasing of good practice examples involving expert advice, Pitch training involving short pitches on the participants' integration of the learning into their business model design and Individual business case development. To gain international experience in biogas technology, the DiBiCoo project funded Biogas plant visits in Germany, South Africa and Indonesia. DiBiCoo offered a deep insight into different concepts of aerobic digestion through a virtual study tours in Austria, Germany, South Africa and Argentina. The video is also uploaded on the DiBiCoo YouTube channel where anyone can access and view it. Thus, the Digital Global Biogas Cooperation is providing much needed support to the biogas sector of Ethiopia.

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