



Report on the capacity building on biogas project development

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DiBiCoo – Digital Global Biogas Cooperation

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Executive Summary

In the frame of the DiBiCoo project, ten capacity building training courses in target countries (Argentina, Ethiopia, Indonesia, South Africa and Ghana) were organised. These capacity building training courses were focused on biogas project development.

The trainings' main goal was to set the stage for the commercialization of biogas technologies. Lecturers from the consortium and/or specially invited outside speakers instructed the courses. Each training's material was to be adjusted in accordance with the unique requirements of the target nation. The topics of the training courses included: how to set up a biogas project, planning issues including permits, overall plant design, feedstock management, digestate management, conversion technology, use of the biogas, plant operation and safety, financing and business models for biogas plants, risks, and financing and business models for biogas plants, depending on the target audience of the training courses (planners, potential plant operators, industries, decision makers, policy makers, financing institutes).

This document gives a close look at the content of these capacity building training courses. In total, 475 attendees participated in these 10 capacity building training courses. Half of the trainings were held virtually, another half on site. Most of the participants are plant operators, project developers, policy makers, extensionist, researchers and public.

1. Introduction

1.1 DiBiCoo project

The **Digital Global Biogas Cooperation (DiBiCoo)** project is part of the EU's Horizon 2020 Societal Challenge 'Secure, clean and efficient energy', under the call 'Market Uptake Support'. The target importing emerging and developing countries are Argentina, Ethiopia, Ghana, South Africa and Indonesia. Additionally, the project involves partners from Germany, Austria, Belgium and Latvia. The project started in October 2019 with a 33 months-timeline and a budget of 3 Million Euros. It is implemented by the consortium and coordinated by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

The overall objective of the project is to prepare markets in developing and emerging countries for the import of sustainable biogas/biomethane technologies from Europe. DiBiCoo aims to mutually benefit importing and exporting countries through facilitating dialogue between European biogas industries and biogas stakeholders or developers from emerging and developing markets. The consortium works to advance knowledge transfer and experience sharing to improve local policies that allow increased market uptake by target countries. This will be facilitated through a digital matchmaking platform and classical capacity development mechanisms for improved networking, information sharing, and technical/financial competences. Furthermore, DiBiCoo will identify five demo cases up to investment stages in the 5 importing countries. Thus, the project will help mitigate GHG emissions and increase the share of global renewable energy generation. The project also contributes to the UN Sustainable Development Goals (SDG 7) for 'Affordable and clean energy', among others.

Further information can be found on the DiBiCoo website: www.dibicoo.org

1.2 Objectives of this document

The purpose of this document is to describe the capacity training course held in target countries for potential biogas plant operators and other stakeholders. In total, 10 training courses were held for stakeholders from targeting countries. The objective of the trainings is to set the initial framework for the market uptake of biogas technologies.

Half of the trainings were held virtually, another half on site. Most of the participants are plant operators, project developers, policy makers, extensionist, researchers and public etc. In total, 475 attendees participated in these 10 capacity building training courses.

2. Argentina

A stakeholder survey was conducted by INTA on behalf of DiBiCoo looking at the specific hot topics to be addressed during the capacity building activities. The following tasks were conducted:

- Preliminary survey for the first Argentina capacity training courses
- Exchange of experience and ideas with demo and follower case partners
- Specific survey over the biogas Argentine biogas plants on digestate.

From the surveys and studies done, digestate treatment, application and added value were highlighted. To cover this subject, capacity building was designed to cover the main digestate issues from a national and European perspective. Experts from both were called to prepare a complete program. The objectives included sharing the following information and skills:

- Understanding the difference between manure and digestate
- Local results on digestate analysis
- Local results on digestate agriculture use
- Local legislation on digestate
- European legal framework
- European projects result on digestate analysis and use
- Technologies on nutrient management
- Machinery for post treatment and digestate application.

2.1 First capacity building training course on 16th and 17th December 2021

2.1.1 Event agenda (programme)



Capacity building DiBiCoo

Digested: challenges and opportunities

16 and 17 December 2021, Buenos Aires, Argentina

Opening hours: 08:30 hs to 17:30 hs

Venue: ArgenINTA Foundation Hall

Cerviño y Ocampo - Buenos Aires, Argentina

Language: Spanish and English

These training days are specially designed for operators and project developers who are facing challenges and opportunities presented by a correct transformation and use of digested. It is organized within the framework of the Dibicoo project" (www.dibicoo.org) in cooperation with the National Institute of Agricultural Technology (INTA). The aim is to contribute to the development of biogas technologies, capable of processing different types of biomass. Studies and concepts useful for the employment and transformation of digested, state-of-the-art European technology, will be presented. Opportunities and challenges of this type of product will be discussed.

DiBiCoo is an international project supported by the European Commission's Horizon 2020 programme and implemented by GIZ in cooperation with 12 organisations with experience on four continents. The overall objective is to establish closer cooperation between European technology providers and biogas stakeholders in the participating countries. We will have the assistance and cooperation of two other EU projects Fertimanure and LCBA.

Organizing Committee

Jorge Hilbert, Patricia Bres y Maria Eugenia Beily
INTA – National Institute of Agricultural Technology, Argentina

Assistants in the organization

Sebastian Rojo/Jonatan Manosalva Institute of Rural Engineering INTA

Agenda

THURSDAY 16 TH DECEMBER	
08:30	Accreditation / Registration
09:00	Presentation of the DiBiCoo project, activities carried out and future within the framework of this project. Platform for search and development of solutions. JORGE HILBERT



	INSTITUTE OF RURAL ENGINEERING - INTA
09:15	European Union LCBA project activities and assistance in the search for technology on digested. IGNACIO IBAÑEZ LCBA ARGENTINA
09:30	INTA's role in anaerobic digestion technology in Argentina. Presentation of advances in digested research. PE-I149 by José Mendez and PD-I518 by Nicolas Sosa. JOSE MENDEZ Y NICOLAS SOSA AER TOTORAS - EEA MANFREDI - INTA
10.00	Argentine biomass, main uses and destinations. LUCAS ZANNOVELOMARIA EUGEMIA BEILY IPAF PAGAGONIA INTA
10:30	Round of presentation and experiences in digested management. EVENT PARTICIPANTS
11.00	COFFEE BREAK
11.30	Potentialities of digested – Characteristics. MARIA EUGENIA BEILY IMYZA-INTA
12:00	Differences between manure and digestate. SANDER VANDENDRIES EUROPEAN BIOGAS ASSOCIATION
12:30	Discussion table on current regulations. SENASA, MADyS and MAGYP Governmental agencies from the ministries of environment, and agriculture
13:00	LUNCH BREAK
14:00	Mainstreaming of demonstrated innovative nutrient recovery and recycling systems in EU biogas plants. MARIEKE VERBEKE FLEMISH COORDINATION CENTRE FOR MANURE PROCESSING (VCM)
15.00	Environmental implications of the use of field digests. Comprehensive assessments applying life cycle analysis; Possibilities of positive impacts due to carbon stocks; Negative impacts from emissions to the atmosphere. JORGE HILBERT IIR INTA
15:30	Experiences of application of digested in INTA: Amendment of agricultural and livestock soils with digested in Santa Fe, Argentina. LUCIANO MIERES- EEA RECONQUISTA INTA
16:00	COFFEE BREAK
16.15	Large-scale experiences on the use of biogas plant digestate MERCEDES VAZQUEZ. BIOELECTRICA.

16:45	Workshop to exchange experiences
17:30	Final conclusions of the day debate.
FRIDAY 17 DECEMBER	
9:00	Survey of digested in Argentina. Presentation of the technical report 2021 INTA – MAGyP - Dibicoo. PATRICIA BRES IMYZA ITA INTA
9:30	Legal framework on digested goods in the European Union MARCO GIACOMAZZI POLICY OFFICER RENEWABLE ENERGY HOUSE EUROPEAN BIOGAS ASSOCIATION
10:00	An experience in the recovery of digested nutrients within the framework of the international project H2020-FERTIMANURE. MAURO VITON IMYZA ITA
11:00	COFFEE BREAK
10:30	Nutrient recovery from digested biogas plant processing. BERNARD DROSG INTERNATIONAL ENERGY AGENCY BIOENERGY
11:00	Emissions in biodigesters and digestate in Canada ANDREW VANDERZAAG, HAMBALIOU BALDÉ, RAY DESJARDINS AGRICULTURE AND AGRI FOOD CANADA
11:30	Presentations of the participants exchange methods
12:30	Conclusions
13:00	<i>LUNCH</i>

2.1.2 Points of discussion, results achieved, decision(s) made if any

Several tables of discussion were formally and informally established. One of the main issues under concern was the regulation in each jurisdiction regarding the application of digestate on the fields.

There were different points of view addressed

- Importance of official register to start commercialization
- Lack of appropriate laboratories to pursue all the requirements of different regulation implemented by the national sanitary office SENASA
- INTA is helping with laboratories and field trials.
- CREA an organization of farmers that have a system based on knowledge share among technological groups. A specific group was created on biogas to share experience. To this groups only operators are invited.
- One of the points raised up by governmental agencies was the problem of variability in the composition of digestate.
- There are also concerns regarding that after an official approval a certain digestate may cause sanitary or crops problems.

- Environmental movements and poor image of agricultural practices was also mentioned.
- The requirements for the present approval of a new organic product is linked to the possibility of assuring its composition, the beneficial effects and the environment impact.
- There is a great pressure over the authorities by environmental board of lawyers.
- Developers to proceed with the register of a product must follow the guidelines contained in the resolution 277/2011.
- Since the environmental responsibility is in charge of local authorities there is a possibility of approval at a local level.
- Only dry fraction digestate after composting can be registered. Liquid fractions are not included.

2.1.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

Language is always a barrier and action have been taken to translate in subtitle all the presentations from the European experts.

There were a lot of participants that registered but manifest they were unable to travel due to COVID-19 restrictions. This moved to the decision to make the 2nd capacity building in a virtual format.

2.1.4 Event photos



Figure 2.1 Folder with written material delivered to all participants



Figure 2.2 Oral presentations with debate among all the assistants



Figure 2.3 Specific round table with authorities from different governmental agencies with responsibility in digestate regulation



Figure 2.4 Cooperation between Dibicoo and LCBA another EU project looking to improve the transfer of technology linked with low carbon and circular economy



Figure 2.5 Presentation of the results of Dibicoo survey on digestate covering the industrial scale plants in operation in Argentina



Figure 2.6 Different assistants to the workshop that also had the opportunity to share experience among them

2.1.5 Evaluation

The workshop covered all important aspects of digestate in Argentina and Europe. During the sessions the outcomes of the complete digestate survey performed all over the country with the support of DiBiCoo was presented with important learnings and information.

Several units of INTA presented actions, trials and tests that are under way in different experimental stations covering large agroecosystems. Important results were presented regarding crop and soil performance.

During the workshop to EU projects had the opportunity to present their offer and actions related to digestate and biogas technology. Fertimanure project focus on technology implementation and field tries comparing them.

LCBA showed the potential this project must find appropriate partners in the EU searching for specific needs of biogas developers and operators. We have already made several actions together with good results.

Between the assistants there were three developers and constructors of biogas plants responsible most of the new plants in operation in Argentina. This ensures a good penetration and diffusion of the knowledge that was presented during the capacity building.

The European presentations covered most of the technological aspects of nutrient recovery and post treatment of digestate. The regulation aspect was also well covered, and this is an important start point for local authorities to adapt them to local circumstances.

		Strongly Disagree		Neutral		Strongly Agree		Not applicable		
		1	2	3	4	5			Σ	
1	My overall experience of the Training was positive.				3	4			7	
2	Since the Training, my knowledge of the subject matter has improved.				2	5			7	
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.			1	3	3			7	
4	The content of the workshop was relevant to me/my biogas project.				2	2	3		7	

5	The amount of information was appropriate for the time allowed.				1	5	1	7
6	The site visit provided me with useful information.							
7	The pace and style of the Training was effective.			2	2	2	1	7
8	The given materials and presentations were useful.				1	6	1	7
9	Active participation during the training was encouraged.				3	366	1	7
10	Group work was effective.				3	3	1	7
11	The lecturers and experts responded to questions effectively.		1		3	4		7
12	It was easy to follow the workshop and the seminar's contents were comprehensible.				2	4	1	7
13	The lecturers and experts were knowledgeable about the core topic.				4	3		7
14	The objectives of the workshop were clearly defined.				1	5	1	7
15	The training met its objectives.				1	6		7
16	Pre-workshop notification and communication were sufficient.					6	1	7
17	The capacity building workshop met your expectations.			1	2	3	1	7
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity building workshop.				1	5	1	7
19	I will participate in future workshops on biogas project development.					7		7
20	I consider the event valuable regarding the information you gained per time you spend.				3	2	2	7
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.			1	2	4		7
22	I would have gained the same quantity and quality of information in this time through own research.	1	2	4			1	7
23	The training has helped me to spend less time and money on information gathering in the future.				3	4		7

24	The training helped me to extend my biogas network.				1	5	1	7
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Table 2-1 Evaluation results

2.2 Second capacity building training course on 3rd and 4th March 2022

A second capacity building training was designed specifically for participants from different parts of the country that were unable to attend the physical workshop. The capacity building was adapted for an online format and all the European presentations were translated and subtitled in order to facilitate the understanding among a bigger audience.

The event was promoted through all the social media and specific lists of biogas developers and operators. Specific online participation was developed to receive live feedback from the audience in critical aspects of digestate use and application.

2.2.1 Event agenda (programme)

Proyectos de la Unión Europea participantes



II Capacity building DiBiCoo

Digestate potentials and challenges

3rd and 4th of March 2022

Time: 13:00 hs a 17:30 hs

Virtual INTA Zoom platform

Language Spanish and English subtitles

These training days are specially designed for operators and project developers who are facing challenges and opportunities presented by a correct transformation and use of digested. It is organized within the framework of the "Dibicoo project" (www.dibicoo.org) in cooperation with the National Institute of Agricultural Technology (INTA). The aim is to contribute to the development of biogas technologies, capable of processing different types of biomass. Studies and concepts useful for the employment and transformation of digested, state-of-the-art European technology, will be presented. Opportunities and challenges of this type of product will be discussed.

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Organizing Committee

Jorge Hilbert, Patricia Bres y Maria Eugenia Beily
INTA – National Institute of Agricultural Technology, Argentina

Assistants in the organization
Sebastian Rojo/Jonatan Manosalva Institute of Rural Engineering INTA



Program

THURSDAY 3 OF MARCH

- 13 Presentation of the capacity building content, recommendations for all participants.
- 13:10 Presentation of the DiBiCoo project, activities carried out and future within the framework of this project. Platform for search and development of solutions.
JORGE HILBERT
INSTITUTE OF RURAL ENGINEERING - INTA
- 13:25 European Union LCBA project activities and assistance in the search for technology on digested.
IGNACIO IBAÑEZ
LCBA ARGENTINA
- 13:45 INTA's role in anaerobic digestion technology in Argentina. Presentation of advances in digested research. PE-I149 by José Mendez and PD-I518 by
JOSE MENDEZ Y NICOLAS SOSA
AER TOTORAS - EEA MANFREDI – INTA
- 14.00 Agronomic use of digestate
NICOLAS SOSA.
- 14:20 Different feedstocks and effect over digestate
MARIA EUGENIA BEILY
IMYZA-INTA
- 14.40 Online survey
- 15.10 Laboratory analysis of digestates.
MARIA EUGENIA BEILY
IMYZA-INTA
- 15:30 Differences between manure and digestate.
SANDER VANDENDRIES
EUROPEAN BIOGAS ASSOCIATION
- 15:50 Mainstreaming of demonstrated innovative nutrient recovery and recycling systems in EU biogas plants.
MARIEKE VERBEKE
FLEMISH COORDINATION CENTRE FOR MANURE PROCESSING (VCM)
- 16.30 Environmental implications of the use of digestate on agricultural land. Life cycle assessment
Jorge Hilbert
iir inta
- 17:00 Cierre de la primera Jornada

FRIDAY 4 OF MARCH



- 15:00 Bienvenida al segundo día
- 15:10 Experiences of application of digested in INTA: Amendment of agricultural and livestock soils with digested in Santa Fe, Argentina.
LUCIANO MIERES-
EEA RECONQUISTA INTA
- 15:40 Survey of digested in Argentina. Presentation of the technical report 2021 INTA – MAGyP - Dibicoo.
Patricia bres
imyza ita INTA
- 16.10 Online survey
- 16:20 Legal framework on digested goods in the European Union
MARCO GIACOMAZZI
POLICY OFFICER RENEWABLE ENERGY HOUSE EUROPEAN BIOGAS ASSOCIATION
- 16:40 An experience in the recovery of digested nutrients.
MAURO VITON
IMYZA ITA FERTIMANURE PROJECT
- 16:55 Nutrient recovery from digested biogas plant processing.
BERNARD DROSG
INTERNATIONAL ENERGY AGENCY BIOENERGY
- 17:20 Emissions in biodigesters and digestate
ANDREW VANDERZAAG, HAMBALIOU BALDÉ, RAY DESJARDINS
AGRICULTURE AND AGRI FOOD CANADA

2.2.2 Points of discussion, results achieved, decision(s) made if any

Opportunities of participation were designed for assistants to the capacity building during both days. During the first day the first question was related to the local limitation to digestate use and application. Twenty answers were obtained from assistants.

The question was directed to where the digestate is applied, 55 % of participants chose own fields, 15 % in neighbours and 30 % at distance. In response to knowledge of the actual legal framework is sufficient, 75 % of participants answered as insufficient. Finally, on the potential of digestate adding value and revenue to biogas plants, all participants agreed. During the survey of the second day of the capacity building workshop, we asked which of the principal limitations of actual farm machinery were used to distribute digestate. Regarding the need to cover digestate tanks, 53 % agree and 47,7% disagree. Finally, regarding the need to separate liquid fraction and solid 80 % agree.

2.2.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

Online training is very valuable for large countries where more people from different parts can participate. Good results were obtained with online possibilities of answering different

questions. Evaluation forms are very long, and attendants are reluctant to complete long surveys.

2.2.4 Event photos

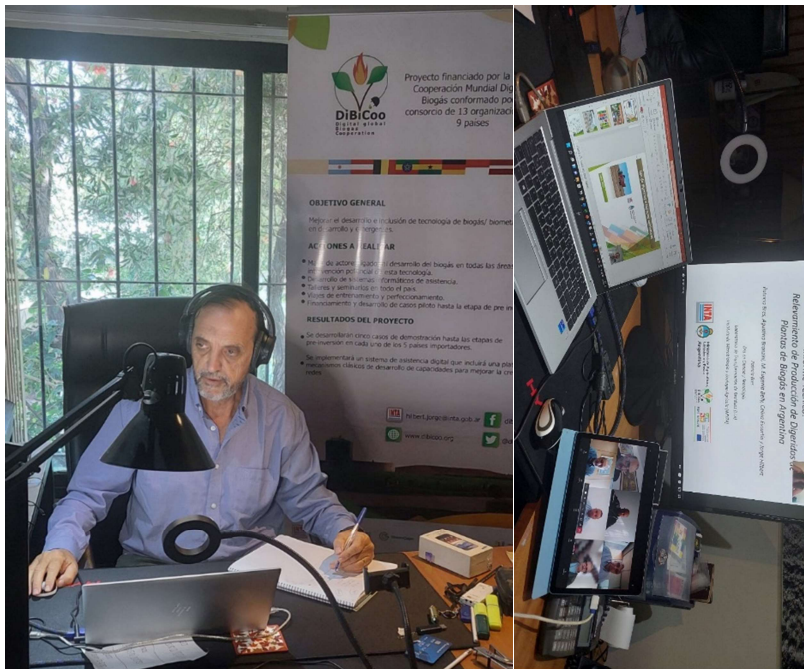


Figure 2.7 Picture during the online event

2.2.5 Evaluation

		Strongly Disagree		Neutral	Strongly Agree		Not applicable	
		1	2	3	4	5		Σ
1	My overall experience of the Training was positive.				5	35		40
2	Since the Training, my knowledge of the subject matter has improved.				5	35		40
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.				4	36		40
4	The content of the workshop was relevant to me/my biogas project.				5	35		40
5	The amount of information was appropriate for the time allowed.				5	35		40
6	The site visit provided me with useful information.						40	40
7	The pace and style of the Training was effective.				5	30	5	40
8	The given materials and presentations were useful.				6	34		40

9	Active participation during the training was encouraged.			5	10	30		40
10	Group work was effective.				5	15	20	40
11	The lecturers and experts responded to questions effectively.			10	20	10		40
12	It was easy to follow the workshop and the seminar's contents were comprehensible.				10	30		40
13	The lecturers and experts were knowledgeable about the core topic.					40		40
14	The objectives of the workshop were clearly defined.					40		40
15	The training met its objectives.				5	35		40
16	Pre-workshop notification and communication were sufficient.				30	10		40
17	The capacity building workshop met your expectations.			1	10	30		40
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity building workshop.				5	35		40
19	I will participate in future workshops on biogas project development.					40		40
20	I consider the event valuable regarding the information you gained per time you spend.					40		40
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.				6	34		40
22	I would have gained the same quantity and quality of information in this time through own research.	28	2	10				40
23	The training has helped me to spend less time and money on information gathering in the future.			11	12	7		40
24	The training helped me to extend my biogas network.				10	22	8	40

Table 2-2. Evaluation results

Comments collected from the audience

- The case of yesterday's, digestion potentialities and today environmental implications of use in the field and then the exhibition of Mercedes Vazquez

- There was no training in the talks but listening to the specialists in topics so end to my current work generated new ideas to apply and information to take into account to avoid possible problems.
- The combination of experiences of local and foreign experts
- It changed my opinion regarding the use and wealth of the digested
- It seemed correct to me how the contents and time were handled, in function of all the exponentials.
- I consider the content and the time allocated to it to be correct.
- Make less extensive days
- Audio, slower some dissertations
- I really liked the presentations and interesting the international experiences
- I found interesting the different forms of treatment of digestate and the methods of its application.
- For me it was very enriching, I do not work in Biodigestion and I expanded my vision on digested most.
- Continue researching this topic to be able to apply it in my region
- I took some materials to continue training and include in my doctoral thesis as bibliographic material. In addition, some recommendations on the use of digestate and quality control of it will also be considered for the essays of my thesis.
- In the future, incorporate this theme: Development of biofertilizers

2.3 Outcomes, results achieved and further recommendations/steps

The capacity building aroused a great attraction reflected by the amount of people that registered attended and followed the activities till the end. Participants were eager to be part of the capacity building and local researchers and different units of INTA also had the opportunity to show the research work done, results and the support experimental station can give to biogas developers and operators. A good mixture of operators and developers attended the workshop. Important results of different EU projects were presented, and more contacts may be established in the future.

All registered candidates for the workshop received the complete information with the link to all the presentations.

We converted this training into a permanent training site where all the presentations can be seen at any time. <https://dibicooarg.wixsite.com/inicio/jornadasdigeridos>



Figure 2.8

3. Ethiopia

3.1 First capacity building training course on 15th February 2021

3.1.1 Event agenda (programme)

**DiBiCoo Capacity Building Training Program
Delivered through: iceaddis**

“Recent Advancement on Biogas Technology and Biogas Project Management”

Day 1: February 15, 2021

Markos Lemma, CEO 9.30 AM - 9.35 AM Moderator iceaddis			
Introduction to DiBiCoo	Sinshaw Alemu DiBiCoo Project Manager	9.35 AM - 10.00 AM	Sinshaw
Recent Advancement on Biogas Technology	Wondwossen Bogale	10.00 AM - 10.40 AM	Sinshaw
Coffee Break (10.40 AM - 11.00 AM)			
Biogas Upgrading and Bottling in Europe and Options for Low-Cost Technology	Frank Hofmann	11.00 AM - 11.30 AM	Sinshaw
Discussion	Frank Hofmann, Wondwossen Bogale	11.30 AM - 12.00 AM	Sinshaw
Lunch: 12 AM - 2PM			
Afternoon session			
Biogas project Management at SNV Ethiopia	Tesfaye Alemayehu Technical Expert Product & Quality	2.00 PM - 2.40 PM	Wondwossen
Discussion	Tesfaye Alemayehu	2.40 PM - 3.00 PM	Wondwossen
Coffee Break: 3.00 PM to 3.20 PM			
Solar Energy Assisted Anaerobic Sequencing Batch Reactor for Tannery wastewater Treatment and Greenhouse Emission Mitigation	Dr. Andualem Mekonnen, AAU	3.20 PM - 3.50 PM	Wondwossen
Discussion	Dr. Andualem Mekonnen	3.50 PM - 4.10 PM	Wondwossen

Day 2: February 16, 2021

Morning Session			Moderator
Biogas Project management: Lesson from South Africa	Yaseen Salie, Green Cape	9.30 AM - 10.00 AM	Wondwossen
Discussion	Yaseen Salie, Green Cape	10.00 AM - 10.20 AM	Wondwossen
Coffee Break: 10.20 AM to 10.50 AM			

Overview of National Biogas Project in Ethiopia	Temesgen Tefera, National Biogas Program (NBP) Manager of Ethiopia	10.50 AM - 11.30 AM	Wondwossen
Discussion	Temesgen Tefera	11.30 AM - 11.50 AM	Wondwossen
Lunch: 12 AM to 2 PM			
Afternoon session			
Biogas Project Management - Steps from the first idea towards a Biogas plant in operation	Frank Hofmann	2.00 PM -2.30 PM	Sinshaw
Discussion	Frank Hofmann	2.30 PM -2.50 PM	Sinshaw
Coffee Break: 2.50 PM to 3.10 PM			
Biomethane Production in case of Argentina	Jorge Hilbert, INTA	3.10 PM - 3.40 PM	Sinshaw
Discussion	Jorge Hilbert	3.40 PM - 4.00 PM	Sinshaw

Day 3: February 17, 2021

Morning Session			Moderator
Site Visit Trip	Holeta Biogas Plant	8.30 AM - 12.00 PM	
Removal of Hydrogen Sulphide from Biogas	Dr. Ibrahim, Addis Ababa Institute of Technology	2.00 PM- 2.50 PM	Sinshaw
Small Scale Biogas Installation Experience	Mr. Melaku Hailu Blueflame Biogas Solution Ethiopia	2.50 - 3.20 PM	Sinshaw
Discussion	Dr. Ibrahim and Mr. Melaku	3.20 PM - 3.40 PM	Sinshaw
Discussion and way forward	Sinshaw and Wondwossen	3.30-3.50 PM	
Concluding Remark	Sinshaw, DiBiCoo Project Manager	3.50 PM-4.00 PM	Sinshaw

3.1.2 Points of discussion, results achieved, decision(s) made if any

There were several points raised and discussed. To mention a few of them

1. **DiBiCoo:** The participants were introduced to DiBiCoo project. Most of the participants have been involved in small-scale Biogas projects. The participants were eager to learn about the European Biogas Technologies, as most of them are large scale and state of the art system. The Biogas sector in Ethiopia is still under development and there are more than 20,000 small-scale biogas plants has already been installed and 40 medium size biogas plants under construction. Based on the discussion, the participants believed adopting the Biogas technologies from Europe is a very great strategy for Ethiopia as the European Biogas Technologies are very well advanced and high quality products.
2. **Biogas Technologies:** as most of the participants' experience are in small-scale biogas plant, several points were raised and discussed on European biogas technologies. Experience from European Biogas Association has been shared in detail

manner concerning the biogas technologies, biogas upgrading and economics of biogas upgrading, types of upgrading technologies and biogas projects management.

3. **Economics of Biogas upgrading:** detail discussion has been made on economics of biogas upgrading technology: The reduction of the investment cost as the size of the biogas upgrading system becomes larger, efficient biogas upgrading technologies presented and discussed from different perspective point of view.
4. **Future collaboration:** discussion has been made on how to use the DiBiCoo project for future collaboration with the European biogas market to advance the Ethiopian biogas sector.
5. **Sludge management:** One of the top issues during the site visit was that the visited 80 m³ biogas plant did not have a proper sludge management system. The owner of the biogas plant asked the participant to suggest a sustainable solution as the amount of sludge is becoming larger and larger.

3.1.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

The participants were eager to be part of the capacity building and asked to be part of the next capacity building training session. Besides, all the participants want to be part of biogas sector development in Ethiopia. The national Biogas coordination office took the initiatives to create a team of experts among the participants in developing the Biogas sector of Ethiopia.

3.1.4 Event photos



Figure 3.1 Event picture



Figure 3.2 Event picture



Figure 3.3 Event picture

3.1.5 Evaluation

		Strongly Disagree		Neutral	Strongly Agree		Not applicable	Σ
		1	2	3	4	5		
1	My overall experience of the Training was positive.				3	9		12
2	Since the Training, my knowledge of the subject matter has improved.				3	9		12
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.			2	2	8		12
4	The content of the workshop was relevant to me/my biogas project.			1	2	9		12
5	The amount of information was appropriate for the time allowed.				3	9		12
6	The site visit provided me with useful information.				3	9		12
7	The pace and style of the Training was effective.			1	4	7		12
8	The given materials and presentations were useful.				5	7		12
9	Active participation during the training was encouraged.			1	3	8		12
10	Group work was effective.	1	1	1	1	2	6	12
11	The lecturers and experts responded to questions effectively.		1		5	6		12
12	It was easy to follow the workshop and the seminar's contents were comprehensible.				6	6		12
13	The lecturers and experts were knowledgeable about the core topic.				3	9		12
14	The objectives of the workshop were clearly defined.			2	3	7		12
15	The training met its objectives.				6	6		12

16	Pre-workshop notification and communication were sufficient.			1	5	6		12
17	The capacity-building workshop met your expectations.			1	5	6		12
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity building workshop.			2	3	7		12
19	I will participate in future workshops on biogas project development.					12		12
20	I consider the event valuable regarding the information you gained per time you spend.				4	8		12
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.				4	7	1	12
22	I would have gained the same quantity and quality of information in this time through own research.			4	1	6	1	12
23	The training has helped me to spend less time and money on information gathering in the future.				4	8		12
24	The training helped me to extend my biogas network.				3	9		12

Table 3-1. Evaluation results

3.2 Second capacity building training course on 29th October 2021

3.2.1 Event agenda (programme)

2nd Capacity Building Program

Feedstock Management and Business Models to Manage a

Commercial/Institutional Biogas Plant: International Lessons and Local context

Oct 29, 2021

Objective: the second capacity-building workshop is a continuation of the training for our Ethiopian Biogas Stakeholders. This session focuses on Feedstock Management and Business Models to Manage a Commercial/Institutional Biogas Plant: International Lessons and Local context.

Session	Presenter/	Timeline
	Responsible	
Opening Remarks	Dr. Wondwossen Bogale	9.30 - 9.35 AM
Feedstock for Sustainable Biogas Production and its Supply Chain Management:	Franz Kirchmeyr, Compost & Biogas Association of Austria; AKBOE	9.35 – 10.10 AM

Q&A on Presentation of Feedstock	Franz/Sinshaw/Wondwossen	10.10 - 10.30 AM
Coffee Break (10.30 AM – 11.00 AM)		
Business models to manage a commercial/institutional biogas plant	Attila Kovacs (PhD); Secretary General at European Renewable Gas Registry (ERGaR)	11.00 AM – 12:00 PM
Discussion on Presentation	Dr. Attila/ Sinshaw/Wondwossen	12.00 – 12.30 PM
Lunch: 12:30 – 2:00 PM (Organizers)		
Lesson from Solar Energy Business model in Ethiopia	Sinshaw Alemu	2.00 – 2.30 PM
The business case for biogas from solid waste in South Africa	Dwight Rosslee; SELECTRA, South Africa	2.30 – 3.00 PM
Lessons/Discussions	Wondwossen/Sinshaw	3.00 - 3.30 PM
Coffee Break (3.30 PM – 4.00 PM)		
Virtual Study Tour Videos	Projected	4:00 - 4:20 PM
Discussions and the Way forward	Temesgen Tefera (TBC)/Dr. Wodwossen	4.20 PM – 4.50 PM
Concluding Remarks	Wondwossen/Rep/Sinshaw Alemu	4.50 - 5 PM

3.2.2 Points of discussion, results achieved, decision(s) made if any

Several discussion points were raised among the participants especially on how to make small-scale biogas economically viable, 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. The presenters elaborated and shared their experience in detail. Besides, experience also shared amongst the participants and models to manage a commercial/institutional biogas plant within an international and local context was shared.

3.2.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

This is the second capacity building training. The comment during the first capacity building were incorporated while preparing the second capacity building training.

3.2.4 Event photos



Figure 3.4 Picture during the training course

3.2.5 Evaluation

		Strongly Disagree		Neutral	Strongly Agree		Not applicable	
		1	2	3	4	5		Σ
1	My overall experience of the Training was positive.				9	19		28
2	Since the Training, my knowledge of the subject matter has improved.				12	16		28
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.				10	18		28
4	The content of the workshop was relevant to me/my biogas project.				8	20		28
5	The amount of information was appropriate for the time allowed.				5	23		28
6	The site visit provided me with useful information.				-	-		-
7	The pace and style of the Training was effective.				12	16		28
8	The given materials and presentations were useful.				3	24		28
9	Active participation during the training was encouraged.				3	25		28
10	Group work was effective.				10	18		28
11	The lecturers and experts responded to questions effectively.				12	16		28
12	It was easy to follow the workshop and the seminar's contents were comprehensible.				4	24		28
13	The lecturers and experts were knowledgeable about the core topic.					28		28
14	The objectives of the workshop were clearly defined.				3	25		28
15	The training met its objectives.				14	14		28

16	Pre-workshop notification and communication were sufficient.				3	25		28
17	The capacity-building workshop met your expectations.				13	15		28
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity building workshop.				14	14		28
19	I will participate in future workshops on biogas project development.					28		28
20	I consider the event valuable regarding the information you gained per time you spend.				13	15		28
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.				4	24		28
22	I would have gained the same quantity and quality of information in this time through own research.				3	25		28
23	The training has helped me to spend less time and money on information gathering in the future.				10	18		28
24	The training helped me to extend my biogas network.					28		28

Table 3-2. Evaluation results

4. Ghana

4.1 First capacity building training course on 25th and 26th August 2021

4.1.1 Event agenda (programme)

Day 1: Wednesday 25th August 2021

Time	Topic	Speaker, Affiliation
9:30-9:40	Welcome	Mr. Lovans Owusu-Takyi
9:40-10:00	Introduction to DiBiCoo	Dr. Mutala Mohammed, Ghana Project Lead
10:00-10:40	Advancements in biogas Technology	Dr. Wondwossen Bogale, ICEADDIS, Ethiopia
10:40-11:00	Coffee Break	
11:00-11:40	European biogas technologies	Frank Hofmann, FvB
11:40-12:10	Discussion	Frank Hofmann & Mutala Mohammed
12:10-13:40	Lunch Break	
13:40-14:20	Anaerobic Baffled Bio-Digester (ABBD) technology	Dr. Andy Quarshie, Researcher, CSIR-IIR
14:20-15:00	Discussion	Dr. Andy Quarshie & Mutala Mohammed

Day 2: Thursday, 26th August 2021

Time	Topic	Speaker, Affiliation
9:30-10:10	Biogas for electricity generation	Raymond Okrofu (Ghanaian Expert) + Frank Hoffman
10:10-10:40	Discussion	Mutala Mohammed & Frank Hofmann
10:40-11:00	Coffee Break	
11:00-11:40	Revenue options for biogas projects	Frank Hofmann, FvB
11:40-12:10	Discussion	Frank Hofmann & Mutala Mohammed
12:10--13:40	Lunch Break	
13:40-14:20	Biogas Project management: Lesson from South Africa	Yaseen Salie, GreenCape, South Africa
14:20-14:50	Discussion	Yaseen Salie & Mutala Mohammed
14:50-15:10	Feedback from participants	Mutala Mohammed & Lovans Owusu-Takyi
15:10-15:20	Concluding Remarks	Mutala Mohammed, Ghana Project Lead

4.1.2 Points of discussion, results achieved, decision(s) made if any

There were several points raised and discussed. To mention a few of them;

1. **DiBiCoo**: The participants for the workshop included participants from government, project developers, financial institutions, non-governmental organisations (NGOs) research institutions etc. The topics for the workshop were based on a preliminary need assessment by stakeholders. The participants were taking through some of the recent

technological and research advancements in biogas. With biogas still at its adoption stage in Ghana, participants were eager to learn more about commercial biogas digesters as most of them are involved in the installation of small-scale biogas digesters.

2. **Biogas Technologies:** as most of the participants' experience are in small-scale biogas plant, several points raised and discussed on European biogas technologies. experience from European Biogas Association has been shared in detail manner concerning the biogas technologies, biogas upgrading and economics of biogas upgrading, types of upgrading technologies and biogas projects management.
3. **Anaerobic Baffled Bio-Digester (ABBD):** detailed discussions were made on the Anaerobic Baffled Bio-Digester, ABBD, a technology designed and developed by the Institute of Industrial Research of the Council for Scientific and Industrial Research (CSIR). The ABBD evolved from an adaptation of the Fixed-Dome Biogas Digester, FDBG, and the Anaerobic Baffled Reactor, ABR, with the objective of using locally available materials and skills and reducing the construction time for such units. The ABBD, is a waste treatment plant based on biological treatment of waste which is compatible with the local technological conditions of Ghana such as building materials availability, the skills of artisans, state of technology in terms of waste treatment plants, etc. The ABBD is designed to be part of a DEWATS which is based on biological treatment of wastewater and incorporates both primary and secondary treatment stages of waste.
4. **Biogas to electricity generation:** Detail discussion was made on the generation of electricity from biogas, Mr Raymond Okrofu (Ghanian Expert), former country director for Safi Sana Ghana (the largest biogas facility in the country) detailed how their biogas plant in Ghana is used to generate electricity. Waste from the market and some food processing industries and sorted out and feed into the plant and it is allowed to go through the anaerobic process to generate biogas which is used to feed the Combined Heat and Power (CHP) Generator. The 100kW biogas facility feeds the energy generated into the national grid.
5. **Revenue options for biogas and Biogas applications:** Frank Hofmann (FvB) from Biogas Association of Germany (FvB) gave detailed presentation on the topic. It was revealed that many biogas plants receive a substantial part of their income by Gate Fees for waste treatment, these gate fees depend on quality, quantity, and the region the waste is generated in. He also said during the storage of organic material (like manure or palm oil mill effluents) methane emissions occur. Due to the closed process taking place in the biogas plant and gas utilization, those methane emissions are avoided, and the methane is combusted into carbon dioxide (CO₂) which help companies to qualify for **Greenhouse Gas (GHG) certificates, and Carbon credits financing**. He also highlighted that many biogases plant receives their main income by electricity generation via CHP / genset engine which can operate up to above 8,000 h/annum delivering reliable electricity, avoids black outs in the grid and the surplus electricity can be sold or feed into the public grid.
6. **Economics of Biogas upgrading:** detail discussion has been made on economics of biogas upgrading technology. The reduction of the investment cost as the size of the biogas upgrading system becomes larger, efficient biogas upgrading technologies presented and discussed from different perspective point of view.

7. **Financing Opportunity for Biogas project:** The Private Financing Advisory Network (PFAN) Country coordinator was the last presenter for the capacity building workshop, she explained all the funding opportunities available for project developers and stakeholders looking to enter the larger biogas project market. She highlighted that, PFAN as a global network of climate and clean energy financing experts, offers free business coaching and investment facilitation to entrepreneurs developing climate and clean energy projects in emerging markets like biogas. She said PFAN advises low-carbon, climate resilient businesses in developing countries and matches projects to appropriate private financing.

4.1.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

The participants were eager to be part of the capacity building. In addition, all the participants were keen to be part of biogas sector development in Ghana. Thus, the national biogas coordination office (Biogas Association of Ghana, BAG) took the initiatives to create a team of experts among the participants in developing the biogas sector of Ghana. The take-away from the workshop was the willingness and readiness of PFAN to partner with DiBiCoo project to help in organizing business development trainings for project developers based on the experience that most of the proposals they receive do not meet the standard. They were advised to visit the DiBiCoo official website to read more about the project and listen to the past and the upcoming webinars to learn more about the project. Stakeholders at the workshop suggested financing options for biogas projects as topic that should be tackled at the next capacity building training workshop.

4.1.4 Event photos



Figure 4.1 Group picture during the event



Figure 4.2 Picture during the event

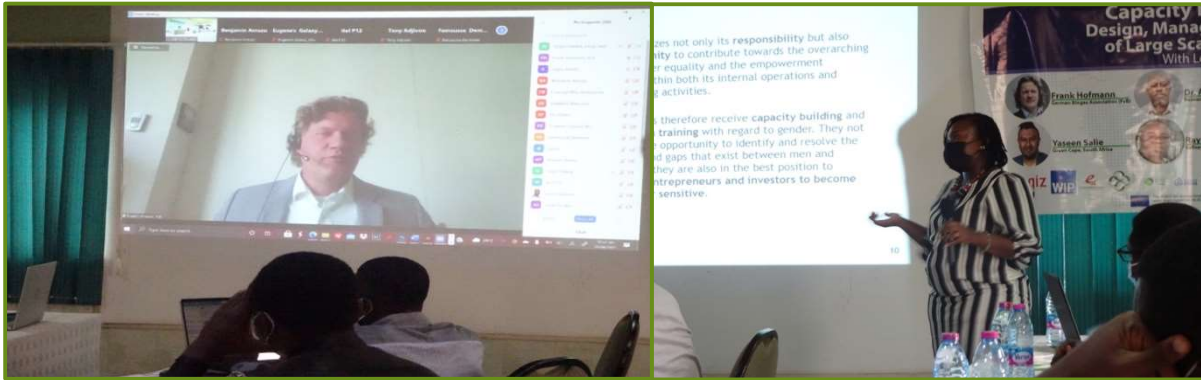


Figure 4.3 A participant asking question

4.1.5 Evaluation

		Strongly Disagree	Disagree	Neutral	Strongly Agree		Not applicable
1	My overall experience of the Training was positive.	1		1	17	12	
2	Since the Training, my knowledge of the subject matter has improved.			3	16	12	
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.			5	13	13	
4	The content of the workshop was relevant to me/my biogas project.			1	18	11	
5	The amount of information was appropriate for the time allowed.			3	18	9	
6	The site visit provided me with useful information.			5	8	8	
7	The pace and style of the Training was effective.			4	18	8	
8	The given materials and presentations were useful.			2	19	8	

9	Active participation during the training was encouraged.			1	15	15	
10	Group work was effective.			3	9	8	
11	The lecturers and experts responded to questions effectively.			1	19	13	
12	It was easy to follow the workshop and the seminar's contents were comprehensible.			3	20	8	
13	The lecturers and experts were knowledgeable about the core topic.				18	13	
14	The objectives of the workshop were clearly defined.			1	16	10	
15	The training met its objectives.			4	19	5	
16	Pre-workshop notification and communication were sufficient.	1	3	8	14	4	
17	The capacity-building workshop met your expectations.			4	19	8	
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity-building workshop.			3	20	8	
19	I will participate in future workshops on biogas project development.				18	13	

20	I consider the event valuable regarding the information you gained per time you spend.			2	20	9	
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.			3	17	11	
22	I would have gained the same quantity and quality of information in this time through own research.	1	4	4	16	5	
23	The training has helped me to spend less time and money on information gathering in the future.	1		6	17	5	
24	The training helped me to extend my biogas network.			2	18	10	

Table 4.1. Evaluation results

4.2 Second capacity building training course on 14 April 2022

4.2.1 Event agenda (programme)



Institute For Sustainable Energy And Environmental Solutions
www.iseesghana.org

Digital Global Biogas Cooperation Project
www.dibicoo.org

CAPACITY BUILDING STUDY TOUR
for
BIOGAS & MUNICIPAL WASTE MANAGEMENT PRACTITIONERS

14TH APRIL - 2022 **8 : 0 0 AM** **MIKLIN HOTEL, ACCRA**

Lovans Owusu-Takyi
Director, ISEES
Facilitator

Dr. Mutala Mohammed
Project-Lead, DiBiCoo
Facilitator

0248-737439 / 0249-492835 **dibico@isees.edu.gh**

Time	Topic	Speaker, Affiliation
6:30-7:00	Arrival of participants	Participants
7:10-7:20	Registration	Mr. Lovans Owusu-Takyi
7:20-7:30	Introduction	Mr. Lovans Owusu-Takyi
7:30-11:45	Visit to SafiSana, Presentations, Site tour & discussions	Facilitator, SafiSana
12:05-16:40	Visit to HPW, Presentations, Site tour & discussions	Facilitator, HPW

4.2.2 Points of discussion, results achieved, decision(s) made if any

There were several points raised and discussed. To mention a few of them;

DiBiCoo: The participants were taken through the agenda of the workshop by Mr. Lovans Owusu - Takyi; the Director for Institute for Sustainable Energy and Environmental Solutions (ISEES) and at the same time assisted in the moderation of the program. The field trip was conducted in two different sites and information was gathered to highlight the previous activities that were discussed and undertaken and to practically experience how the biogas works. The field trip successfully began at the converging point (Miklin Hotel) where participants were addressed and informed of the purpose of the meeting and what is expected out of the trip. The participants were introduced on the program outline and also briefed on DiBiCoo activities with each participant highlighting their expectations for the trip. Even though these stakeholders were already familiar with biogas technologies mainly with small scale biogas digesters they were excited to experience the working of large scale digesters for energy generation and heating.

Field Trip to SafiSana: The first site to visit was the SafiSana biogas plant which is located in Ashaiman, a suburb of the Greater Accra Region, the capital city of Ghana. SafiSana was established in the year 2006 under a Public Private Partnership (PPP) between investors from Netherlands and the Ashaiman Municipal Assembly in a build-operate-transfer (BOT) agreement. It is a renewable energy company that uses biogas to generate electricity. The

electricity produced by SafiSana company is produced and transmitted directly into the national grid, with the Electricity Company of Ghana being the main off-taker. The categories of waste used in producing the biogas include organic industrial waste, market waste, animal waste and faecal matter. The company also deals in the production of compost as the by-product from the biogas digesters. It is also involved in the nursing of seedlings for clients. SafiSana currently generates 100kW from a mix of feedstock. The effluent from the anaerobic digester is dewatered and the dry matter is used to produce some 2.5 tonnes of organic fertilizer daily. Also, the plant generates about 2,000 litres of wastewater daily. The water is biologically treated and reused on agricultural fields for irrigation purposes

Description	
Waste Treated per Day	30 tonnes
Gas Produced	1000 m ³
Electricity Produced	100Kw
Business Model	Feed-in-tariff (to national grid)
By-product	Compost
Related Business	Nursery + Seedling + Farming + Compost

Figure 4.2 Factsheet of Safi Sana

The participants were from ministries and districts as well as biogas practitioners from various organisations for the study tour.

At Safisana: The staff of Safisana gladly welcomed the participants to their premises and introduced the participants to the operations of the plant. A presentation was made by the plant supervisor regarding the operations and safety measures while the participants tour the plant. The plant supervisor explained how the plant operates and systems they have implemented to ensure that the plant works efficiently. A pictorial presentation was done and was later followed by the discussions based on the concerns raised by the participants.

Site Visitation: After the visitation, the participants were taken to the various compartments of the plant, from where they connect the power to the national grid to where the substrate is being discharged into the plant and from there to their treatment plant. The tour continued to where the effluent discharged is being treated and used for fertiliser, where a lot of tested fertilisers has been stored. Lastly, the participants were taken to some backyard garden that has been undertaken at the back of the facility where the organic fertiliser produced in the factory is being used.

4.2.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

It was recommended by almost all the participants that more training like this will go a long way to support them to always think deeper into bringing something unique into the system. So DiBiCoo should consider engaging them more on some of these trainings and also try to bring a lot of people on board to have more knowledge about some of these things.

4.2.4 Event photos



Figure 4.4 Picture of the event



Figure 4.5 Picture of the event



Figure 4.6 Picture of the event

4.2.5 Evaluation

		Strongly Disagree		Neutral	Strongly Agree		Not applicable	
		1	2	3	4	5		
1	My overall experience of the Training was positive.				10	35		Σ
2	Since the Training, my knowledge of the subject matter has improved.					45		45
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.			12	22	11		45
4	The content of the workshop was relevant to me/my biogas project.			13		32		45
5	The amount of information was appropriate for the time allowed.	8	4	2	10	21		45
6	The site visit provided me with useful information.				11	34		45
7	The pace and style of the Training was effective.			6	22	17		45
8	The given materials and presentations were useful.			8	13	24		45
9	Active participation during the training was encouraged.				7	38		45
10	Group work was effective.			22	13	10		45

11	The lecturers and experts responded to questions effectively.				5	40		45
12	It was easy to follow the workshop and the seminar's contents were comprehensible.			4	11	30		45
13	The lecturers and experts were knowledgeable about the core topic.				3	42		45
14	The objectives of the workshop were clearly defined.				1	44		45
15	The training met its objectives.				3	42		45
16	Pre-workshop notification and communication were sufficient.			10	2	33		45
17	The capacity-building workshop met your expectations.				1	44		45
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity-building workshop.			1	4	40		45
19	I will participate in future workshops on biogas project development.					45		45
20	I consider the event valuable regarding the information you gained per time you spend.				7	38		45
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.			14	10	21		45
22	I would have gained the same quantity and quality of information in this time through own research.	45						45
23	The training has helped me to spend less time and money on information gathering in the future.			14	5	26		45
24	The training helped me to extend my biogas network.					45		45

Table 4.3. Evaluation results

5 Indonesia

Fast expansion of biogas technology development in recent years has proved the utility of biogas plants not only in providing a clean fuel for cooking and power generation but also in reducing the environmental pollution by reducing significant volume of waste. However, biogas technology development holds various challenges, and its successful implementation depends not just on the installation of a suitable system but also on operation and maintenance of that system as well as the appropriate framework conditions including policy and financing scheme to make it a viable and economic alternative. In view of the above, RDI organized capacity building series to accelerate the biogas industry in Indonesia. The first capacity building was held in April 2021 and covered the holistic planning of biogas development, while the second capacity building was held in June 2021 and focused on the business model and project financing of the biogas industry. Due to Covid-19 pandemic, this activity was carried out virtually.

5.1 First capacity building training course on 14th and 15th April 2021

5.1.1 Event agenda (programme)

DiBiCoo Capacity Building series#1 entitled Holistic Planning and Implementation of Biogas Development Technology in Indonesia on 14 and 15 April 2021 virtually via Zoom Platform in Bahasa Indonesia. The first day of this training (14/04) invited a few speakers such as Hari Yuwono as a Coordinator Indonesia Private Financing Advisory Network (PFAN), Yaseen Saile from GreenCape South Africa, and Abdul Hadi from PT Raja Gas Kharisma on the first session of the day. The second day (15/04) also invited experts from chemical engineering at the Bandung Institute of Technology, Prof. Ir. Tjandra Setiadi, M.Eng., Ph.D., Anggit Raksajati, ST., Ph.D., and Ir. Sanggono Adisasmito, Ph.D. to share about biogas upgrading product and its digestate utilisation.

April 14, 2021		
Time	Activity	Speaker
07:50-08:00	Pre-event registration	
08:00-08:05	Introduction to training	Moderator: Yudha Prambudia, senior research fellow RDI
08:05-08:10	Welcoming speech	Ministry of Energy and Mineral Resources
08:10-09:25	Sessions 1: Planning and building biogas plant	by Hari Yuwono, Indonesia Coordinator of Private Financing Advisory Network
09:25-10:05	Session 2: Economy of biogas plant	Part 1 by Yaseen Saile, GreenCape
10:05-10:40		Part 2 by Berliana Yusuf, GGGI Indonesia
10:40-10:50	Break (10 Minutes)	
10:50-12:05	Session 3: Document and Assessment Requirement	by Abdul Hadi, PT Raja Gas Kharisma
12:05-12:15	Wrap up	Moderator: Yudha Prambudia, senior research fellow RDI

April 15, 2021		
Time	Activity	Notes
07:50-08:00	Pre-event registration	
08:00-08:10	Opening	Moderator: Yudha Prambudia, senior research fellow RDI
08:10-09:15	Sessions 1: Utilisation of digestate	by Tjandra Setiadi, , Expert in Chemical Engineering Product Design and Development, Bandung Institute of Technology
09:15-10:20	Session 2: Biogas upgrading technology	by Anggit Raksajati, Expert in Chemical Reaction Technology and Catalyst, Bandung Institute of Technology
10:20-10:30	Break (10 Minutes)	
10:30-11:35	Session 3: Bio-CNG prospect and challenges	by Sanggono Adisasmito, Expert in Energy and Processing System of Chemical Engineering, Bandung Institute of Technology
11:35-12:00	Session 4: Lesson learned Bio-CNG in Indonesia	by Abdul Hadi, PT. Raja Gas Kharisma
12:00-12:20	Q&A session	
12:20-12:25	Closing Remark	Felix Colmorgen, WIP
12:25-12:30	Wrap up	Moderator: Yudha Prambudia, senior research fellow RDI

5.1.2 Points of discussion, results achieved, decision(s) made if any

The first session delivered by Hari Yuwono highlighted the factors that influence biogas installation and risks that may occur during its construction. There are a lot of factors affecting the success rate of industrial scale biogas installation, whether it is technical, non-technical, strategic, or operational issues such as determination of feedstock, business aspects, marketing, pricing, production capacity, design, investment calculation, risk analysis, etc. An optimal construction of biogas production installation can be done by considering these important factors. Meanwhile, risks that may occur during the construction of biogas installation consist of credit risk, market risk, liquidity risk, and operational risk. Operational risk consists of legal issues, equipment, leakage potential, fire, strong wind, toxic gas, natural disaster, and equipment damage. Risk identification and mitigation must be considered carefully.

Additionally, in the economy of biogas project development, Yaseen Saile and Berliana Yusuf have brought the context of South Africa and Indonesia respectively. This session concluded that biogas development must consider the local context. The technology must be built on feedstock availability and business case viability. Technical viability does not mean financial viability. Financial viability does not mean bankability. Bankability does not ensure project implementation success. Detailed consideration is needed to assess all risks and improve implementation success. A model is needed to handle the risks and uncertainties that we may face during the biogas development. Despite the economic feasibility of biogas development, a good regulation and investment climate is needed to support biogas development. The last session was completed by Abdul Hadi who shared what documents and assessment should be prepared for completing the biogas project.

On the second day, Tjandra Setiadi started the training with digestate utilization. If not properly sanitized, digestate may still contain a high amount of pathogens. However, there are several challenges in the utilization of digestate, such as lack of regulations and clear SOPs regarding the proper utilization of digestate and its advantages. In addition to this, Anggit Raksajati came with technology to upgrade biogas products other than digestate. He highlighted that if the quality of biogas can be improved by reducing the CO₂ content, biogas could be utilized as substitution of natural gas, fuels, etc. Specifically, on biogas conversion to bio-CNG for the

transportation fuel, Sanggono Adisasmito brought its challenges and prospects in Indonesia. Transmission pipes and bottled gas must be utilized while bio-CNG filling stations must be well developed. In the meantime, government regulations must be reinforced to improve the consumption of bio-CNG in Indonesia. His session was then followed by practical mechanism of biogas to bio-CNG PT Raja Gas Kharisma (PT RGK) by Abdul Hadi. The bio-CNG project of PT RGK is the first and, currently, the only bio-CNG project in Indonesia.

5.1.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

RDI-DiBiCoo Capacity Building Series consisted of three parts of training events, namely pre-event, the event, and post-event. During the pre-event, RDI engaged with various biogas stakeholders to determine which topics match their interest. Concurrently, RDI also discussed with potential trainers to prepare the training materials and its delivering methods. This approach was effective for RDI to conceptualize the training event according to the needs of stakeholders and the capacity of the trainers. Coordination meetings with all trainers and technical rehearsal were also carried out prior to the event to prevent discoordination in running the event flow.

RDI decided to hold a one-hour training session for each topic and divided six sessions within two consecutive days for about 4 hours per day. For ensuring that the trainees focus on the training session and get benefits as much as they can, our speakers/trainers gave them a pre-and post-test to measure their competence improvement before and after the training. RDI also applied attendance forms in the beginning and at the end of training, we called it Check-in and Checkout, to keep the trainees attending the entire series of training.

As for the post-event, the training certificate was awarded for those trainees who attended all training sessions and completed all pre-and post-tests that showed an increase in score. RDI also distributed the event notes to all trainees which consisted of a summary of the whole event and discussion points which might be important to make actionable decisions in the future. These attendance, assessment, and post-event mechanisms have succeeded in attracting the attention of the trainees and maintaining their commitment and seriousness in participating in this event.

5.1.4 Event photos

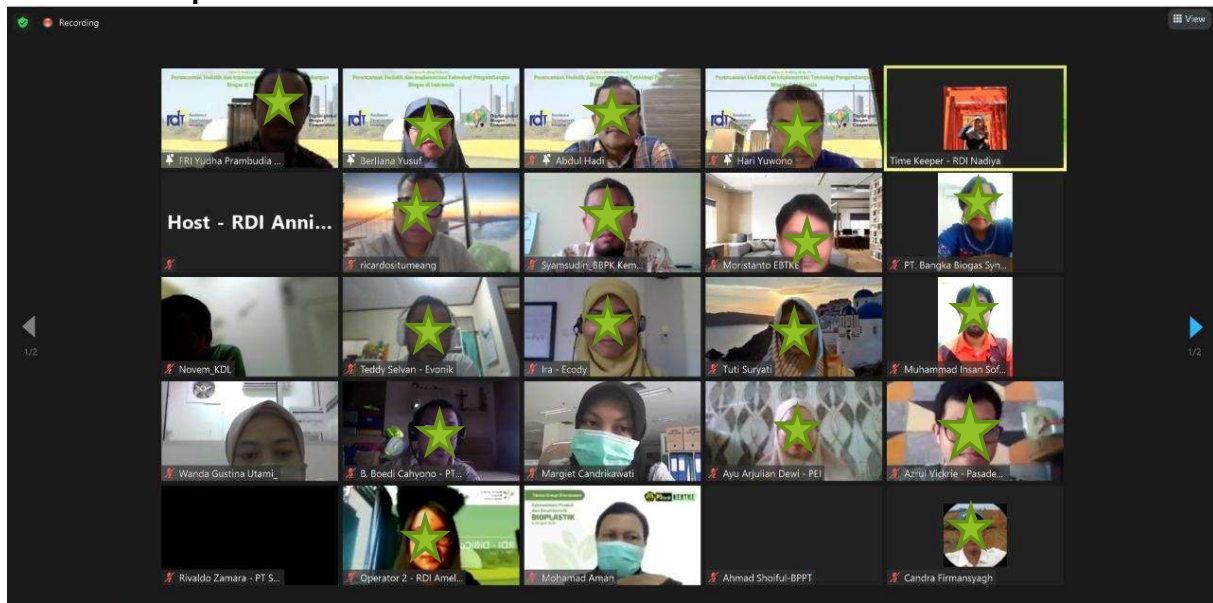


Figure 5.1 Screenshot of the event

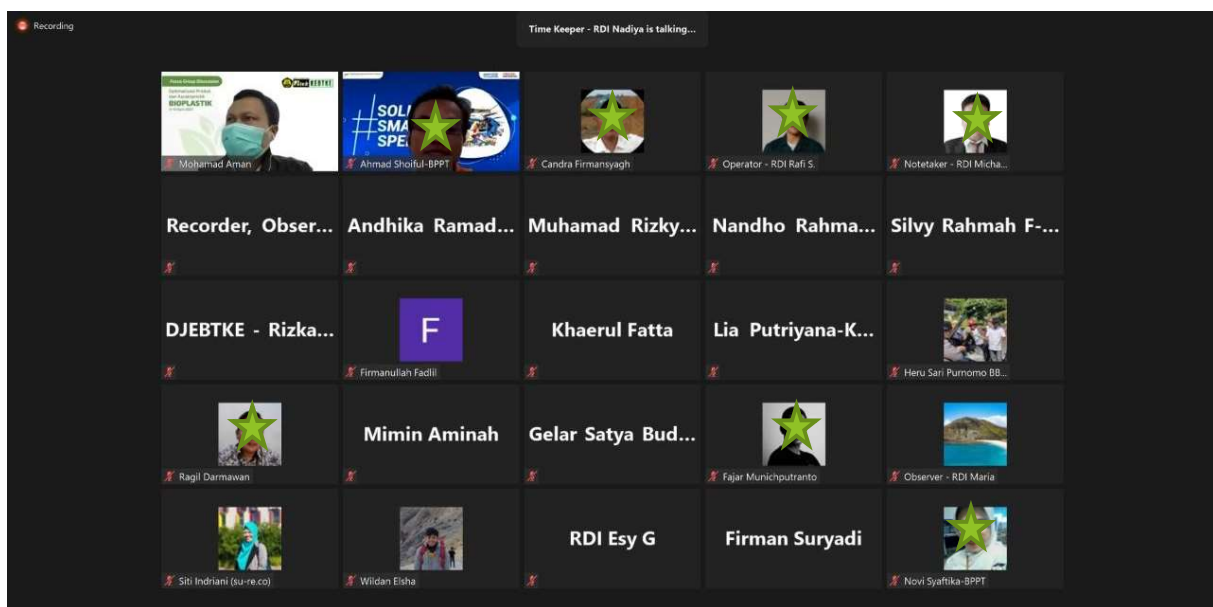


Figure 5.2 Screenshot of the event

5.1.5 Evaluation

At the end of the training or second day, RDI distributed the event evaluation form to all trainees. The event received very good impressions, appreciation, and constructive comments from 24 of 39 participants attended as summarized in the following table.

No	Questions	Σ				
		1	2	3	4	5
1	My overall experience of the Training was positive.	0	0	0	11	13
2	Since the Training, my knowledge of the subject matter has improved.	0	0	1	12	11
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.	0	1	3	13	7
4	The content of the workshop was relevant to me/my biogas project.	0	0	1	13	10

5	The amount of information was appropriate for the time allowed.	0	0	2	8	14
6	The site visit provided me with useful information.	Not applicable				
7	The pace and style of the Training was effective.	0	0	2	11	11
8	The given materials and presentations were useful.	0	0	0	7	17
9	Active participation during the training was encouraged.	0	0	4	11	9
10	Group work was effective.	Not applicable				
11	The lecturers and experts responded to questions effectively.	0	0	1	12	11
12	It was easy to follow the workshop and the seminar's contents were comprehensible.	0	0	1	9	14
13	The lecturers and experts were knowledgeable about the core topic.	0	0	1	10	13
14	The objectives of the workshop were clearly defined.	0	0	0	14	10
15	The training met its objectives.	0	0	2	10	12
16	Pre-workshop notification and communication were sufficient.	0	0	0	12	12
17	The capacity building workshop met your expectations.	0	0	0	13	11
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity building workshop.	0	0	1	13	10
19	I will participate in future workshops on biogas project development.	0	0	1	11	12
20	I consider the event valuable regarding the information you gained per time you spend.	0	0	1	10	13
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.	0	0	0	11	13
22	I would have gained the same quantity and quality of information in this time through my own research.	0	0	5	9	10
23	The training has helped me to spend less time and money on information gathering in the future.	0	0	0	12	12
24	The training helped me to extend my biogas network.	0	1	0	11	12

Table 5-1. Evaluation results

25. What were the major strengths of the training? What did you find most useful?

- The relevance between contents and trainers received a lot of appreciation from participants. These are due to prior engagement conducted between RDI as organizer with biogas key stakeholders and trainers in mapping and discussing the topics needed for the training.
- The materials related to bio-CNG, financial analysis, and general information to start the biogas project (technical procedures) were found to give the most useful information to the trainees.

26. Which aspects of the training could be improved and how (content- and timewise)?

- Time extension / split training sessions
It mostly said that one-hour per session is still too short. If there was a time concern, the training could last more than two days. However, longer the training, stronger commitment was needed especially to keep following the training sessions.
- Networking session (between participants and trainer/speaker-participants) was still absent. The chat box feature at Zoom was deactivated by the organizer so that the participants could not have a chat directly with anyone else except the organizers from RDI.
- The trainees wanted to have more discussion sessions and longer Q&A sessions. Time management needs to be improved so that sufficient allocation for presenting materials and discussion sessions can be facilitated.
- Regarding the effectiveness of materials delivering methods, there were some suggestions to share trainer's PPT the day before the event and requests to provide more practical examples rather than theory or wrapping the materials in the form of video / other interactive approaches. RDI has shared reading materials prior to the event to give a general overview especially for those who are not familiar with the terms used in biogas aspects. Sending the trainers/speaker's presentations slide in advance is feared to make the registrants feel no longer need to attend since they have received the contents already.

27. Did anything strike you as interesting, new, provocative, or meaningful during the training?

- Interesting video about the Bio-CNG project in Kalimantan was played on the last session of the second day training and has attracted a lot of attention as well as triggered active participation in its discussion session. However, only one session provided the video.
- Pre- and Post-test and Check-in and Check-out systems were found new and quite effective for most of the trainees.

28. Can you identify one change that you will make in your practice, or one idea that you will put into practice, as a result of this training?

- Based on the topics of the training, most of the trainees gave the responses that
- They were encouraged to conduct further research on Biogas market and economic stream/biogas product
 - They would consider business prospect of Bio-CNG as well as composting (digestate utilization)
 - They were encouraged to have or make clear financing scheme and timeline arrangement for project management

29. What part of the training format should be changed to improve discussion?

- Interactive and simpler quiz format
Pre- and Post-tests were conducted through google form. There were some comments from trainees to use other interactive and simpler quiz platforms instead of filling in google forms.
- Interactive discussion (Live) with trainers/speakers instead of Padlet
The organizers (RDI), have deactivated the chat feature at Zoom intentionally to avoid destruction on the chat, and we managed questions from participants through questions board link (using padlet application). However, it did not meet the expectations of the participants who actually wanted to interact with other participants or directly have a chat with the trainers. Padlet might be an uncommon application for the participants thus was not effective to collect or manage questions.

30. Any other comments?

- One of the trainers on the second day had quite a bad connection resulting in less clear sound. Both organizer (RDI) and trainers should make sure that they will have a good connection on the day of the event or trainers could ask RDI to help them by showing their slides instead of controlling it by themselves.
- The materials would be more conveyed if complemented by a field study tour or possibly virtual study tour due to this pandemic.

5.2 Second capacity building training course on 14th and 15th July 2021

5.2.1 Event agenda (programme)

There are a lot of factors affecting the success rate of industrial scale biogas installation, whether it is technical, non-technical, strategic, or operational issues such as determination of feedstock, business aspects, marketing, pricing, production capacity, design, investment calculation, and risk analysis. Bankability does not ensure project implementation success. Detailed consideration is needed to assess all risks and improve implementation success. Therefore, the DiBiCoo Capacity Building Series #2 with the topic of “Sustainable Biogas Project Financing and Bankability”, was held on July 14-15th 2021 via Zoom Platform and opened by Trois Dilisusendi, representative of Directorate of Bioenergy, Ministry of Energy and Mineral Resources Indonesia.

July 14, 2021		
Time	Activity	Speaker
12:50-13:00	Pre-event registration	
13:00-13:05	Introduction to training	Moderator: Yensen Aliamin, research fellow RDI
13:05-13:10	Welcoming speech	Ministry of Energy and Mineral Resources
13:10-13:15	Welcoming speech	Dominik Rutz (WIP), DiBiCoo Representative
13:15-13:30	Sessions 1: Policy on Financing Renewable Energy	Agunan Paulus Samosir (Ministry of Finance)
13:35-14:40	Session 2: Cost Estimation and Supply Security	Gusti Satria Wira Tenaya (GGGI Indonesia)
14:40-14:45	Break (5 Min)	
14:45-15:50	Session 3: Financial Risks Management to Fund Biogas	Elis Mudjiwati (LPPI)

	Projects	
15:50-16:25	Sharing session: Lesson learned from Financial Institution	Pradana Murti (PT Sarana Multi Infrastruktur)
16:25-16:30	Wrap up	Moderator recap training, announcement for the Day-2

July 15, 2021		
Time	Activity	Notes
12:50-13:00	Pre-event registration	
13:00-13:10	Opening	Moderator: Yensen Aliamin, research fellow RDI
13:10-14:15	Sessions 1: Scaling up blended finance in Biogas project	Bangkit Oetomo (TLFF)
14:15-14:20	Break (5 Min)	
14:20-15:45	Session 2: Emission Trading System (ETS) opportunity in Biogas Project	Moekti H Soejachmoen & Paul Butarbutar (IRID)
15:50-16:20	Sharing session: Indonesia's Journey of Sustainable Finance for Renewable Energy	Istiana Maftuchah, representative from OJK
16:20-16:25	Closing remark	Dominik Rutz (WIP), DiBiCoo representative
16:25-16:30	Wrap up	Moderator
12:25-12:30	Wrap up	Moderator: Yudha Prambudia, senior research fellow RDI

5.2.2 Points of discussion, results achieved, decision(s) made if any

The first day (14/07) of this session focused on measuring the estimation cost of the biogas project by Satria Wira Tenaya from GGGI Indonesia and the risks assessment and management of biogas project from bank institution perspective by Elis Mudjiwati from Indonesian Banking Development Institution (LPPI). Satria and Elis agreed that the supply chain from feedstock to supply tariffs has become challenges in the course of the biogas project. In biogas projects, banks pay special attention to evaluate projects in terms of raw material supply as well as project revenues and costs, so that biogas and renewable energy projects become more bankable.

In addition to the training sessions, the second capacity building also invited Agunan Samosir from Fiscal Policy Agency Ministry of Finance and Pradana Murti from PT SMI to share shortly about biogas financing from public sectors and private sectors respectively. Agunan pointed out that the development of biogas by taking advantage of waste emissions has far advancement potential, such as by being LPG substitutes or use in power plants. Technology is still one of the most discussed aspects in biogas governance, when in fact coordination on funding and institutional aspects should be considered more. Pradana added that the problem of financing renewable energy projects does not lie in the limited sources of funds but in the credibility and bankability of the project.

The second day (15/07) was no less interesting. Scaling up blended finance schemes in financing biogas projects were presented by Bangkit Oetomo from Tropical Landscape Finance Facility (TLFF). This session wrapped well the concept of blended finance scheme which has several objectives such as (risk mitigation) de-risking, replication and inclusivity for

scale-up renewable energy projects. Blended finance can also form an impact narrative to build a mutually supportive environment and social impact, sponsors also need to have signals so they can understand commitment and engagement, and participate in understanding the development of the project. Moreover, trainees' curiosity about carbon trading opportunities as potential revenue for biogas projects has been answered by Moekti H Soejachmoen featuring Paul Butarbutar from Indonesia Research Institute for Decarbonization (IRID). Lastly, to bring Indonesia's sustainable financing journey, Istiana Maftuchah, senior analyst of sustainable financing, presented the Financial Services Authority (OJK)' roles in financing renewable energy projects including biogas. Istiana informed that the green taxonomy of green sector classification will also be launched by OJK this year as reference for financial services institutions and basis of sustainable business and investment. A taxonomy is also expected to make it easier for business actors in improving the quality of risk management.

5.2.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

The second series of RDI-DiBiCoo Capacity Building consisted of three parts of training events, namely pre-event, the event, and post-event. Learning from the first series, approaching key stakeholders related to energy financing worked very well in assisting RDI develop the event concept, determine the topics, and correspond with potential trainers. Not only disseminated information via email to all DiBiCoo mail lists that RDI has had, quick calls and short virtual meetings have also been made to promote DiBiCoo program and the event. Through these activities, six of ten bank institutions, one private financing institute, Financial Services Authority of Indonesia (OJK), and Fiscal Policy Agency (Ministry of Finance Indonesia) have been informed. In addition, half of participants who joined the event were also from financial institutions. In the pre-event stage, coordination meetings with all trainers and technical rehearsal were also carried out prior to the event to prevent discoordination in running the event flow.

With a one-hour training session per topic, this second capacity building presented various financing schemes (public funds, blended finance, corporate finance, and carbon trade) from different perspectives (government, research institute, and financial service institutions [bank & non-bank]) in more practice-based materials within two days. Pre- and Post-tests as well as Check-in and Check-out were again applied with the same mechanism as before. In terms of discussion sessions, the Padlet Questions Board was no longer used. All questions should be placed in the Zoom chat box by following the questions format given by RDI. So as not to miss the questions or feedback in the Zoom chat box, Q&A manager from RDI was assigned to keep tracking all inputs there.

As for the post-event, requirements for issuing certificates were still the same as the first training. Post-event report has also consisted of a summary of the whole event and discussion points which might be important to make actionable decisions in the future. These attendance, assessment and certificate, as well as a post-event report have succeeded in attracting the attention of the trainees and maintaining their commitment and seriousness during the training.

5.2.4 Event photos



Figure 5.3 Screenshot of the event

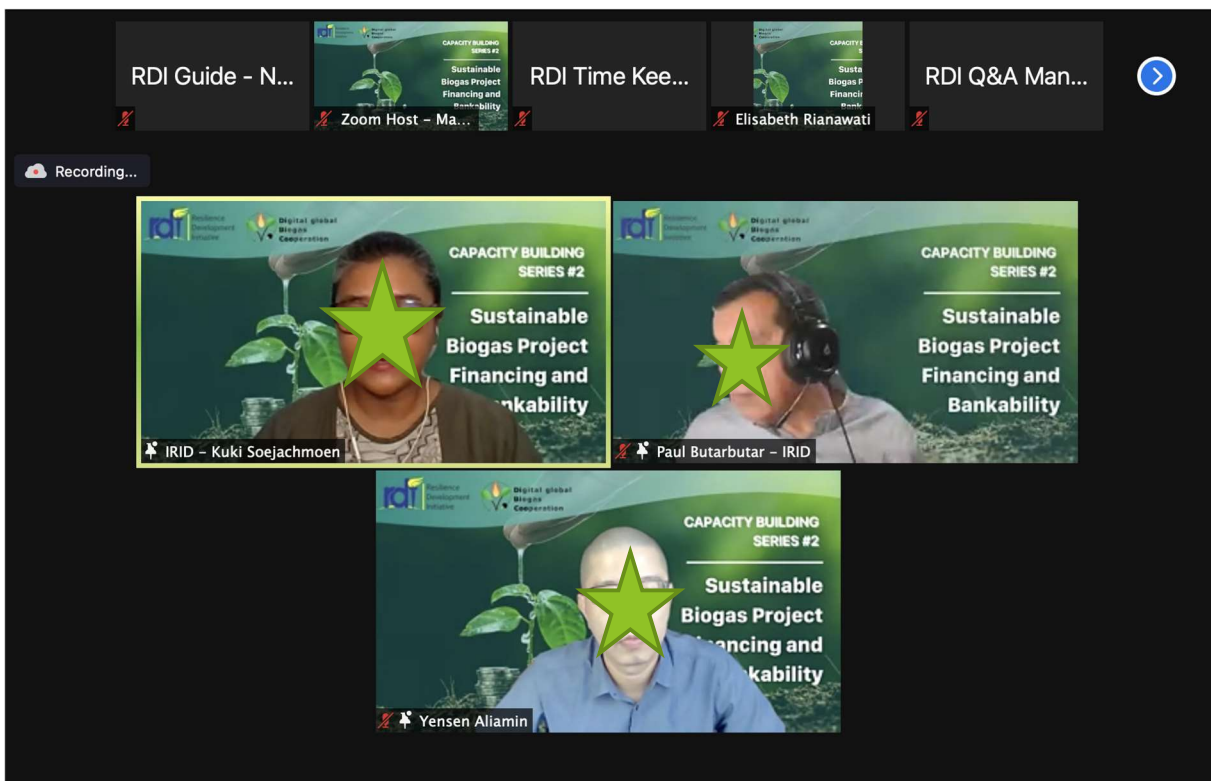


Figure 5.4 Screenshot of the event

5.2.6 Evaluation

Same as in the previous event, RDI distributed the event evaluation form to all trainees at the end of the training or second day. The event received very good impressions, appreciation, and constructive comments from 34 of 44 participants attended as summarized in the following table.

No	Questions	Σ				
		1	2	3	4	5
1	My overall experience of the Training was positive.	0	0	0	23	11
2	Since the Training, my knowledge of the subject matter has improved.	0	0	0	22	12
3	I will be able to apply the topics discussed in the workshop on my (future) biogas project.	0	0	11	15	8
4	The content of the workshop was relevant to me/my biogas project.	0	0	7	17	10
5	The amount of information was appropriate for the time allowed.	0	0	4	19	11
6	The site visit provided me with useful information.	Not Applicable				
7	The pace and style of the Training was effective.	0	0	3	20	11
8	The given materials and presentations were useful.	0	0	0	20	14
9	Active participation during the training was encouraged.	0	1	6	17	10
10	Group work was effective.	Not Applicable				
11	The lecturers and experts responded to questions effectively.	0	0	0	21	13
12	It was easy to follow the workshop and the seminar's contents were comprehensible.	0	1	2	21	10
13	The lecturers and experts were knowledgeable about the core topic.	0	0	0	18	16
14	The objectives of the workshop were clearly defined.	0	0	0	23	11
15	The training met its objectives.	0	0	2	21	11
16	Pre-workshop notification and communication were sufficient.	0	1	1	19	13
17	The capacity building workshop met your expectations.	0	0	1	22	11
18	I have a much better understanding of the topic(s) and components AFTER participating in the capacity building workshop.	0	0	4	19	11
19	I will participate in future workshops on biogas project development.	0	0	2	19	13
20	I consider the event valuable regarding the information you gained per time you spend.	0	0	0	22	12
21	The training helped me to reduce the time needed to gather relevant information on biogas partners, technologies etc.	0	0	3	22	9
22	I would have gained the same quantity and quality of information in this time through my own research.	0	2	7	17	8
23	The training has helped me to spend less time and money on information gathering in the future.	0	0	6	19	9
24	The training helped me to extend my biogas network.	0	1	3	20	10

Table 5.2. Evaluation results

25. What were the major strengths of the training? What did you find most useful?

- The trainers presented in all sessions were relevant to the designated topics and experts in those fields. The accuracy of the materials and the effectiveness of its delivery process could not be separated from regular coordination facilitated by RDI with the trainers.
- Engagement with several key stakeholders from financial institutions was also conducted to inform the DiBiCoo program and the training concept has been made, asking for their participation and feedback or inputs for improvisation.
- By learning from the previous capacity building, this second training offered more practical experiences from government as well as private financing institutions which were exclusive or could not be found in usual open sources.
- The topics, considered as new and most useful, were identification of risks and its mitigations in financing biogas projects and carbon trading opportunities from these projects.

26. Which aspects of the training could be improved and how (content- and timewise)?

- Similar to the first training, time allocation for each session was still too short for most of the trainees. Consequently, if the training needs to be extended, stronger commitment and seriousness of all participants are required.
- The trainees wanted to have more discussion sessions and longer Q&A sessions. Time management needs to be improved so that sufficient allocation for presenting materials and discussion sessions can be facilitated. The Delivery method also needs to be modified by possibly including discussion or brainstorming in the middle of the process instead of putting the session at the end. Using interactive video is worth trying rather than conventional presentation displays. However, these alternatives will come back to the capacity of the trainers.
- Further topics that could be explored are networking with bank/private funder, biogas advantages for profit-oriented business, factors that could make biogas project bankable.

27. Did anything strike you as interesting, new, provocative, or meaningful during the training?

- Opportunity to get knowledge directly from the experts through this training event was valuable for most of the trainees, considering that the interaction between biogas developers and financial institutions, including banks, is very limited except through certain connections.
- Pre- and Post-test and Check-in and Check-out systems were again found as a new and simple but effective way for most of the trainees.

28. Can you identify one change that you will make in your practice, or one idea that you will put into practice, as a result of this training?

Based on the topics of the training, most of the trainees gave the responses that

- They were encouraged to explore more about the idea of carbon finance in biogas project
- They were encouraged to follow up the potential of green loans for broader renewable energy projects
- Bank and other financial institution will start to consider biogas developer as potential clients
- Bank and other financial institution will develop the strategic plan for more systematic bioenergy project financing
- Bank and other financial institution will inform the potential financing scheme for clients especially those who engage in biogas sector

29. What part of the training format should be changed to improve discussion?

- Interactive and simpler quiz format
Since Pre- and Post-tests were conducted through google form, some participants could not access the links because they were restricted by the office's VPN. Other online quiz platforms can actually be utilized but the organizer (RDI) should ensure that the participants are familiar with the platform and not taking too much time for assistance. Besides giving Pre- and Post-tests before and after the session, quiz also could be put in the middle of training.
- In addition to the quiz, the trainees wanted to have a live discussion or Q&A session with trainers. This actually has been allowed and facilitated by the moderator. However, since the time was limited and there were many questions in the chat box, some trainees might not have the opportunity to raise their hand and ask questions directly. RDI has asked all participants to write down their questions, and if the question could not be addressed during the discussion or Q&A session, the question would still be answered by the trainer and included in the post-event report. This report will be distributed to participants no later than 2 weeks after the event. Some responses to the evaluation form also stated that if the discussion or Q&A session was limited, breakout room could be an alternative.
- Materials about biogas financing often use the terms that are quite unfamiliar especially for those who are not having economic and management background. How to simplify the terms of biogas or RE financing before the training became a concern. Even though RDI as organizer has shared reading materials prior to the event, this did not help the trainees to understand the context discussed during the training.

30. Any other comments?

- Capacity building on the topic related to biogas financing is as rare as renewable energy financing in general. This training was found as real action in transferring knowledge and promoting RE thus there are needs for similar events for the context of RE sources other than biogas.

6 South Africa

6.1 First capacity building training course from 28th and 29th July 2021

6.1.1 Event agenda (programme)

Description of the capacity building training course

The aim of this capacity building course will be to provide insight and encourage best practices in mitigation financing risks of biogas project development and implementation. The objectives include sharing the following information and skills:

- Understanding the difference between project development and implementation finance
- Comparison of the investment cash flow profiles between biogas and other renewable and green economy projects
- Technical risks (from a finance perspective) that need to be managed and mitigated when developing and implementing a biogas project
- Understanding how to de-risk a biogas project from a local and global perspective
- Viable biogas business case models in the local context
- Global trends in green finance and the impact of biogas in South Africa
- Financing needs and gaps in bioenergy markets / projects

The target audience is to include primarily financing institutions and investors interested in entering and growing their presence within the biogas market. The secondary audience would be biogas project developers keen to gain a better understanding on how to de-risk the development and implementation of their project for financing.

Contact and registration details

Format: Event Mobi platform (<https://eventmobi.com/finance-biogas/>)

Contact: Yaseen Salie yaseen@green-cape.co.za

Date and time of the capacity building training course

Date: 28-29 July 2021

Time: 14h00 – 18h00 SAST (2.5 hours of content & 1.5 optional networking)

Day 1: Wednesday, 28 July 2021

Time	Topic	Speaker / Facilitator, Affiliation
14:00-14:05	Welcome	Collins Nyamadzawo, Senior Analyst (GreenCape)
14:05-14:15	SABIA intro/ market position paper	Jason Gifford, Chairperson (Southern African Biogas Industry Association)
14:15-14:40	Global trends in green finance and their potential impact on the South African biogas sector	Tasneem Mayet, Senior Policy Manager (World Biogas Association)
14:40-15:00	Biogas and Finance 101	Yaseen Salie, Project Manager (GreenCape)
15:00-15:10	Break	
15:10-15:25	DiBiCoo – Market uptake and Capacity building activities	Felix Colmorgen, Project Manager (WIP Renewable Energies)
15:25-15:50	The risk mitigation approach to biogas projects	Yaseen Salie, Project Manager (GreenCape)
15:50-16:10	Interactive session – Working examples for large scale biogas project	Yaseen Salie, Project Manager (GreenCape) & Tawanda Sango, Senior Analyst (GreenCape)

16:10-16:30	Feedback/Discussion and close out	Yaseen Salie, Project Manager (GreenCape) & Tawanda Sango, Senior Analyst (GreenCape)
16:30-18:00	Virtual networking session	All stakeholders

Day 2: Thursday, 29 July 2021

Time	Topic	Speaker / Facilitator, Affiliation
14:00-14:05	Welcome	Mandisa Mkhize, Senior Analyst (GreenCape)
14:05-14:10	Summary of previous day	Mandisa Mkhize, Senior Analyst (GreenCape)
14:10-14:35	De-risking biogas project investments – European perspective	Dominik Rutz, Head of Bioenergy & Bioeconomy unit (WIP Renewable Energies)
14:35-15:00	Demo case and technical & financial model consideration and process	Bernhard Wlcek, Project lead (Austrian Energy Agency)
15:00-15:05	Break	
15:05-15:30	The South African Climate Finance Landscape 2020/2021	Jack Radmore, Energy & Green Finance Programme Manager (GreenCape)
15:30-16:25	Panel discussion - Financing needs and gaps in bioenergy markets / projects	<p>Moderator: Raldo Kruger, Expert Water Analyst (GreenCape)</p> <p>Panel: Jack Radmore, Energy & Green Finance Programme Manager (GreenCape) Dominik Rutz, Head of Bioenergy & Bioeconomy unit (WIP Renewable Energies) Jason Gifford, Chairperson (Southern African Biogas Industry Association) Francis Jackson, Special Advisor (GreenCape)</p>
16:25-16:30	Next steps and close out	Yaseen Salie, Project Manager (GreenCape)
16:30-18:00	Virtual networking session	All stakeholders

Focus of the discussion was on what a bankable project from the financing sector

- What would they consider?
- Would they consider an on-farm solution? – Is it bankable or is it perceived as a risk?
- If not, where do they see the market?

6.1.2 Points of discussion, results achieved, decision(s) made if any

The first day was delivered with a theme of biogas market potential and unlocking said potential. The first session was delivered by the chairperson of the Southern African Biogas Industry Association (SABIA), Jason Gifford. Jason provided an overview of the market potential of biogas as an energy provision technology and the activities that SABIA are currently undertaking to address specific gaps and barriers in the South African biogas industry is currently facing. With Tasneem Mayet highlighting the impact that biogas markets could have on future green and climate change finance trends in the following session and Yaseen Salie providing a breakdown on biogas and finance definitions as introduction prior to session of risk mitigation and interactive session after the break.

Yaseen Salie further shared a risk mitigation approach for biogas business case development following the day 1 break. This session highlighted risk considerations for biogas projects within a South African context. The approach was further demonstrated and discussed with

the virtual audience in form of polls and questions within an interactive session. The session was well received and day 1 was closed out.

The second day was delivered with a theme of addressing the financing needs and gaps in bioenergy markets and projects as well as the learning and insights that could be gained from established markets within the European Union. Dominic Rutz provided insights from a European study that highlighted the process for de-risking biogas project investments followed by Bernhard Wlcek the technical and financial considerations and process used to support the selected demo cases for the DiBiCoo project.

Jack Radmore shared an overview of the South African Climate Finance Landscape following the break on day 2 as an introduction to the panel discussion on the financing needs and gaps in the bioenergy markets/projects within South Africa. The panel discussion closed out the day 2 programme.

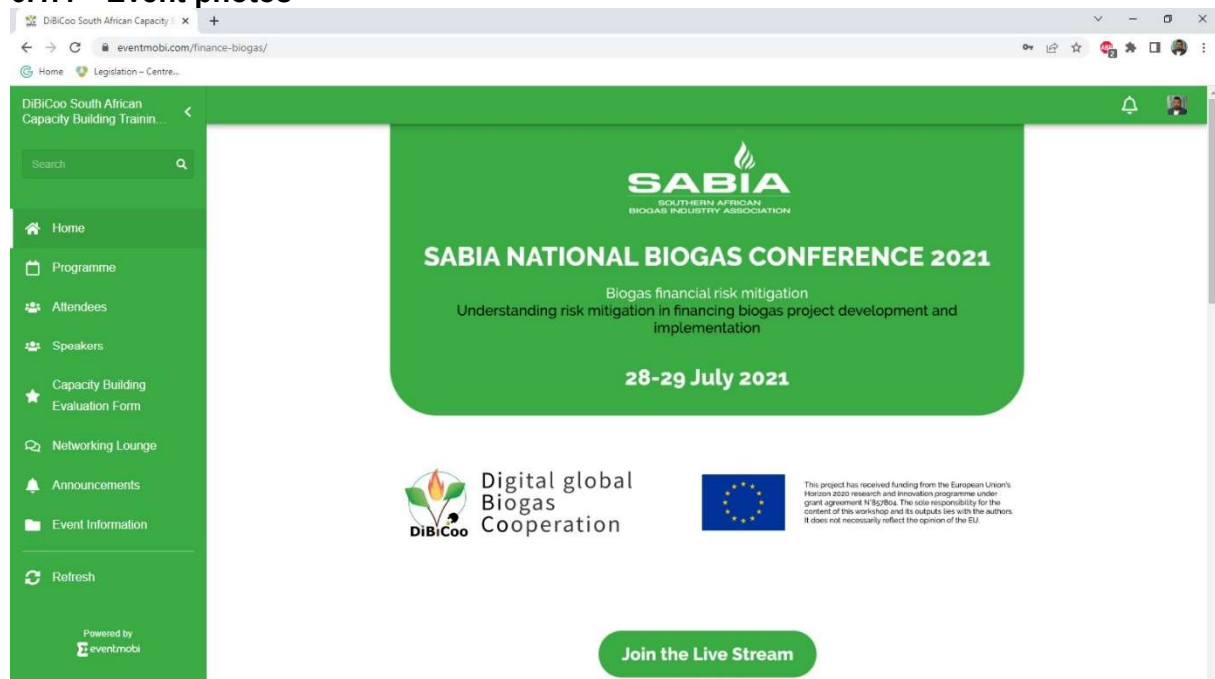
The workshop content provided the audience with a better understanding on business case risk mitigation for biogas projects. The audience responded well the content presented and were keen to engage during the interactive and panel discussion sessions.

The recording of all sessions can be found at <https://eventapp.co.za/finance-biogas>

6.1.3 Recommendations and lessons learnt for the next capacity building trainings course(s)

As a result of the COVID-19 pandemic restrictions, the delivery of this workshop was completed in a virtual format. Although, the selected platform allowed for the delivery of all relevant content, it greatly reduced the ability to network and engage with audience on a more detailed level in one-on-one conversations.

6.1.4 Event photos



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FEATURED SPEAKERS

 Jason Gifford Chairperson South African Biogas Industry Association	 Felix Colmorgen Project Manager WIP Renewable Energies	 Tasneem Mayet Senior Policy Manager World Biogas Association	 Yaseen Saleh Bioenergy Analyst GreenCape
 Jack Radmore Energy and Green Finance Programme Manager GreenCape	 Raldo Kruger Senior Water Sector Analyst GreenCape	 Bernhard Wicek Project Lead Austrian Energy Agency (AEA)	 Dominik Rutz Head of the Bioenergy & Bioeconomy Unit WIP Renewable Energies

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SABIA NATIONAL BIOGAS CONFERENCE 2021

Event 2: Biogas financial risk mitigation
Understanding risk mitigation in financing biogas project
development and implementation

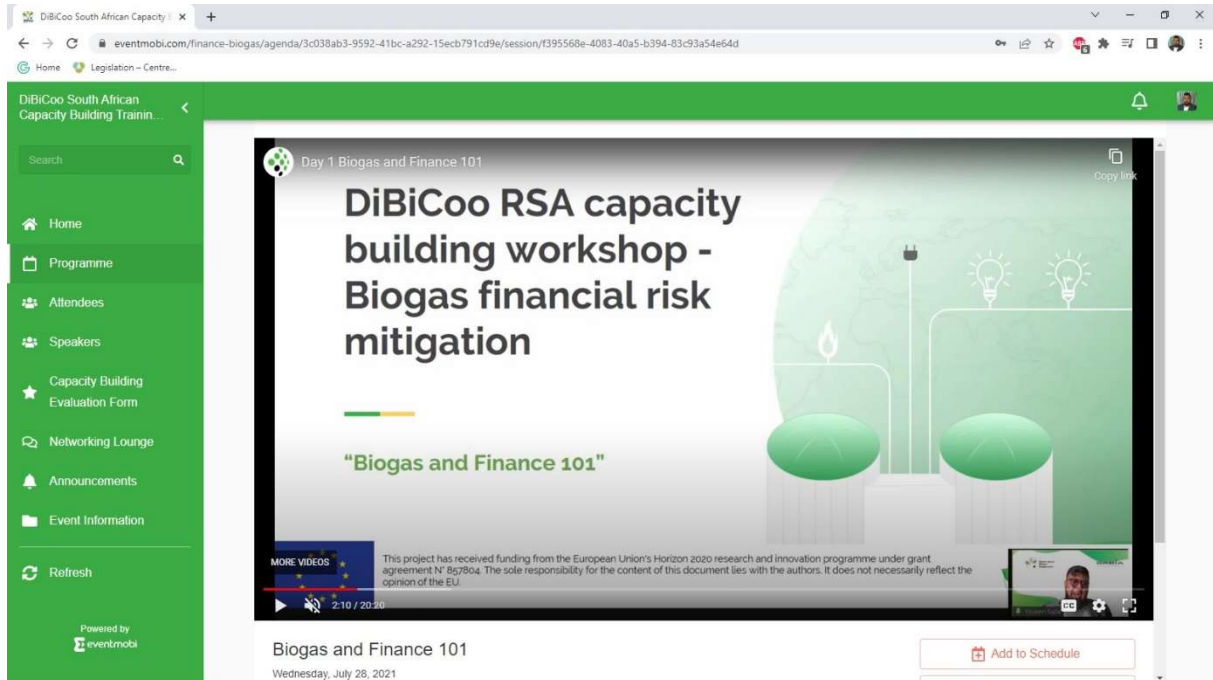
In proud partnership with



SABIA intro/ market position paper

Wednesday, July 28, 2021

Add to Schedule



Day 1 Biogas and Finance 101

DiBiCoo RSA capacity building workshop - Biogas financial risk mitigation

"Biogas and Finance 101"

MORE VIDEOS

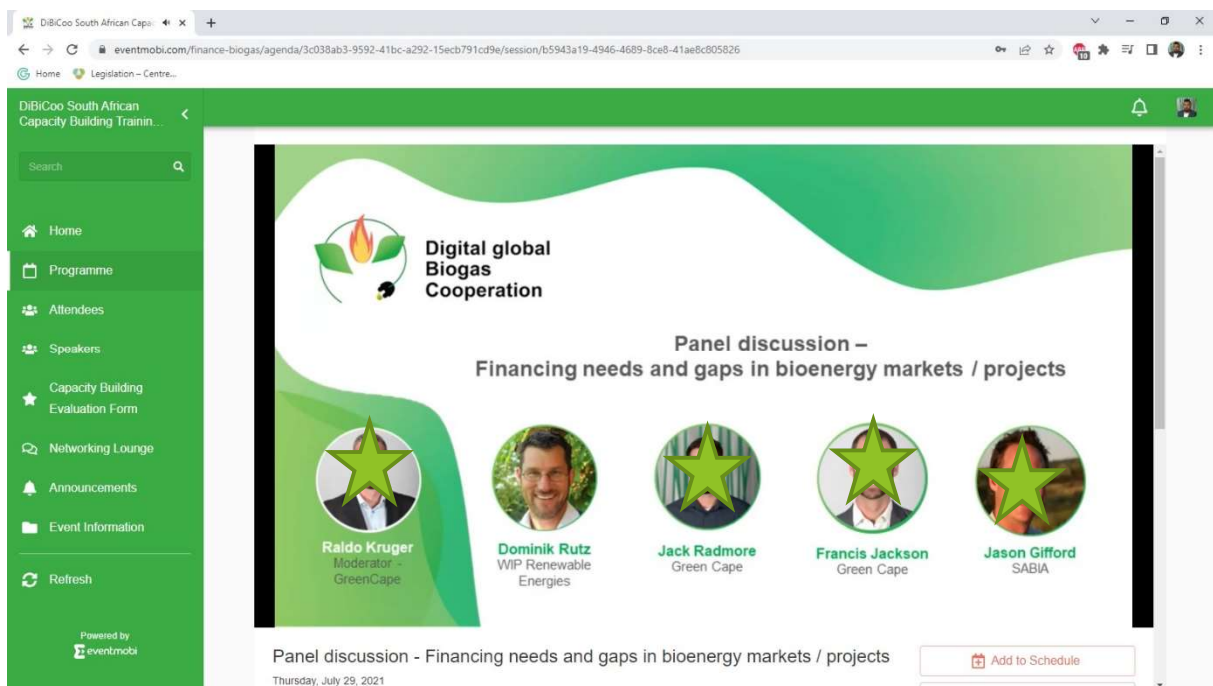
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 827804. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the EU.

2:10 / 20:20

Biogas and Finance 101

Wednesday, July 28, 2021

Add to Schedule



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 **Digital global Biogas Cooperation**


Panel discussion – Financing needs and gaps in bioenergy markets / projects

 **Raido Kruger**
Moderator - GreenCape

 **Dominik Rutz**
WIP Renewable Energies

 **Jack Radmore**
Green Cape

 **Francis Jackson**
Green Cape

 **Jason Gifford**
SABIA

Panel discussion - Financing needs and gaps in bioenergy markets / projects

Thursday, July 29, 2021

Add to Schedule

6.1.5 Evaluation

The workshop was well received based on the level of engagement we received over the duration of the workshop planning, delivery and post event activities.

The participants were afforded an opportunity to complete an online evaluation form to provide formal feedback on the workshop, its content and delivery. Unfortunately, no there was no online evaluation forms that were completed. We were unsure if this was as result of technical difficulties and/or if it was not promoted or easily accessible to the participants of the workshop.

6.2 Second capacity building training course held on 23rd March 2022

6.2.1 Event agenda (programme)

Description of the capacity building training course

The aim of this capacity building course will be to provide insight and encourage best practices for digestate management and beneficiation within biogas project development and implementation. The objectives include sharing the following information and skills:

- Understanding the current context and impact of digestate on biogas project development and implementation in South Africa
- Overview of current and upcoming activities of SABIA with regards to the management and usage of digestate in South Africa
- Argentina sharing the learnings and insights of their life cycle assessment studies for biogas and digestate
- Case study of digestate management and beneficiation practices within South Africa
- Identifying utilization pathways for digestate management and beneficiation within South Africa

The target audience is to include turnkey providers, project owners, municipalities and investors and off take clients interested in the management and beneficiation of digestate produced by biogas plants. The secondary audience would be agriculture stakeholders and regulators keen to gain a better understanding on how to de-risk the usage of digestate within agriculture sector.

Date and time of the capacity building training course

Date(s): 23rd March 2022

Time: 14h00 – 17h00 SAST (17h00-19h00 for dinner)

Format/Venue: Hybrid event (GreenCape offices and Enlit Africa virtual platform)

Wednesday, 23 March 2022

Time	Topic	Speaker / Facilitator, Affiliation	Comments
14:00-14:05	Welcome	Thula Zondi (GreenCape)	Opening and welcome
14:05-14:20	Presentation 1: Current context of digestate in South Africa	Yaseen Salie (GreenCape)	Presentation providing an overview of the current digestate context in RSA
14:20-14:40	Presentation 2: SABIA's activities with regards to digestate	Dr Gamuchirai Mutezo (SABIA)	SABIA presentation providing an overview and strategy for digestate management and valorization in RSA
14:40-15:00	Presentation 3: LCA studies on biogas and digestate within Argentina	Jorge Hilbert (INTA)	Presentation on the life cycle assessment (LCA) studies conducted in Argentina for biogas and digestate
15:00-15:20	Presentation 4: Case study	Jaryd Ridgeway (Green Matter Organics)	Digestate value add solution case study
15:20-15:30	Interactive session explanation	Yaseen Salie (GreenCape)	Provide an explanation on process to follow after the break.
15:30-15:40	Break		
15:40-16:40	Interactive session – World Café style discussion on digestate beneficiation	Energy – Mandisa Mkhize & Reshmi Wolvers Water – Ashton Mpofu & Raldo Kruger	4 stations with different themes – energy, water, CE, legislation impact Four sessions with the following timings (15 min; 15 min; 10 min & 10 min)

		Circular Economy – Tawanda Sango & Nicholas Fordyce Legislative impact – Dr Eugene van Rensburg (University of Stellenbosch) & Yaseen Salie	
16:40-16:55	Feedback from facilitators	Energy – Mandisa Mkhize Water – Ashton Mpofu Circular Economy – Tawanda Sango Legislative impact – Yaseen Salie	2-3 minutes to provide feedback from each session. Q&A and discussion from interactive session
16:55-17:00	Close out and final thoughts	Yaseen Salie (GreenCape)	Closing of the workshop
17:00-19:00	Networking dinner	All stakeholders	For people attending in person – Light canapé/buffet style dinner

6.2.2 Points of discussion, results achieved, decision(s) made if any

With digestate management being a critical aspect for implementation and operations for biogas plants within South Africa, Yaseen Salie provided an overview of the current impact of digestate management on biogas plants in South Africa. Biogas plants that are implemented with poor, or no, digestate management plans often end up incurring additional costs to dispose of as an unforeseen expense to the project. South African legislation makes it difficult for biogas plants to sell digestate as a fertilizer with registering it the proper authorities. As a result, Dr Gamuchirai Mutezo presented on the current activities and strategy the Southern African Biogas Industry Association has undertaken to address the challenges in establishing viable digestate usage and management options.

In addition, Jorge Hilbert and Jaryd Ridgeway provided insight to life cycle assessment studies on digestate completed in Argentina and digestate valorisation technology case study. Both highlighted the nutrient recycling benefits of digestate and the importance of extracting the value from digestate produced by biogas plants.

The workshop utilised the world café style facilitation methodology to gain insight on the most ideal practice for digestate management within South Africa. There were four discussion topic rooms which included the legislative impact and using digestate in energy, water and circular economy applications. In summary, the discussions highlighted that the most viable utilisation pathway for digestate in South Africa is within the agriculture sector as it promotes nutrient recycling. However, the biggest barrier to unlocking this utilisation pathway is addressing the fertilizer and feeds act that governs the trading of soil nutrient products and applications. Samples of the notes taken in discussion can be found below:

DiBiCoo Capacity Building Workshop – Water sector breakout room

What can you do with digestate in this sector

Opportunities/ Barriers

- Logistics of transportation of digestate (industrial, market for digestate could be close; municipal market location of digestate off-takers more difficult.
- Municipal wastewater more variable (seasonal) and with contaminants; best to separate organic waste at source.
- Industrial more consistent
- Wastewater for irrigation.
- N contamination
- **Fertiliser / land application**
- Extraction of fibres (pre-screening);
- Co-digestion / co-composting
- Rehabilitation crops (mine restoration)
- **Thermal application of pellets**
- Synthetic fertiliser more acceptable and lower capex
- Agri-processing
- Poorly functioning WWTWs
- Legislation around fertiliser

Is this idea economically viable?

Enablers

- Consistent feedstock
- Composting and land application most economically viable

Does it have any social or environmental drivers

Drivers

- Use of water for non-potable purposes
- Recycling of water, eg irrigation of non-food crops.
- Organic waste management
- Zero waste policies

DiBiCoo Workshop - Circular Economy Working Session

-
- What can we do with digestate in terms of the CE?
- Is this economically viable from a CE perspective?
 - If yes, how do we further enhance viability
 - If no, what do we need to do to make it viable
- What are the social or environmental drivers in digestate management or beneficiation?
-

Notes:

Opportunities

-
- Use as a substrate - for example in mudroom production.
- Vermicompost

Drivers

- Nutrient recovery, particularly phosphorus. Not economically viable yet (environmental).
- Recovery of these nutrients can lead to them being circulated back into industry (viability).
- Agriculture waste - extract solids for dry fertilizer or as a source of heat, or as pellets. Liquid part is high in Nitrogen (also fetches a high price as liquid fertilizer €6/litre). Driver - organic food market. In 2015 organic fertilizer price started to rise - linked to organic food production. Certificates needed to show only organic fertilizers are used.
- Health and sanitation drivers - Heaps of waste that are difficult to deal with. Turn these heaps into organic fertilizers

Barriers

- Lack of knowledge. Research needed.
- Adding value to waste
- Solving solutions of health and sanitation
- CAPEX for biodigesters
- Legislation - classifying the
- Changing feedstock increases variability in quality output

S1

- **Argentina capacity building workshop for DiBiCoo**
 - Commercialisation – have a register
 - Lack of regulations with regards to digestate
 - Issue around variability on composition of digestate
 - Sanitary issues with regards to crops impact
 - Environmental movement and organisations lobbying for benefits
 - Environmental responsibility with local authorities
 - Only dry fraction can be registered and liquid fraction can not be included
- **Similar to RSA in terms to strict composition legislation**
 - Digestate is still viewed as a waste
- **Indonesia – regulations is constantly changing with ministerial changes**
 - Project developers interested in developing more projects in palm oil sector, however the focus is electricity consumption – but digestate produced is classified as hazard material
 - Mill owners use digestate for plantation but can be restricted due regulation
- **Ethiopia – Only two industrial scale plants**
 - Smaller projects and bio-digestors
 - Digestate considered as a waste
 - Legislation does have an impact of digestate

S2

- Work with energy generators (utility providers) to highlight potential digestate opportunities and develop framework
- Indonesia – developing a tariff for electricity generation from biogas or digestate
 - Previously good tariff for private sector but not national utility company
 - Tariffs have been shifted to compete with coal prices – 2017
 - 2019 – renewal of regulations
 - IPP to supply to third parties and not just state owned entity as a solution
 - Biomethane for transportation fuel but digestate not defined
 - Digestate more for land application – COD/BOD more relevant in terms of usage
 - Not all sites have land for usage
- Ethiopia
 - CSOs and associations that make up sector that guide regulators in developing legislation – it is often overlooked to include sector experts
- RSA are biogas projects & experts interested in benefiting digestate

S3

- Germany
 - Different areas that legislation apply but classification is key – However, is digestate. Where does it end and become a new product?
 - Nutrient regulation in application of digestate in agriculture
 - Digestate storage needed to have covers to reduce GHG as it stored for 6 months where it cannot be applied
 - Digestate still emits GHG after it has left the digester in small quantities
 - Once digestate used in agriculture land, crops need to be planted immediately
- Indonesia
 - Biogas project focus is RE but digestate is overlooked
 - No synergy between energy and agriculture
 - Uptake slow by agriculture sector and synergy with energy
- RSA
 - Most digestate does go into lagoons and maturation pools
 - Storage of digestate legislation limited
 - Training and expertise of policy and legislation develops is in questions, do they have the relevant background
 - Consultation of sector experts are critical for legislation and policy development

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- Austria
 - Focus is WW treatment and depends on feedstock
 - Sterilisation on feedstock or digestate
 - Digestate is best organic fertilizer
 - Very little additional processing required before usage
 - Legislation on input side – guides the classification of digestate from a legislative point of view
 - Legislation for output – wrt usage and utilisation; laboratory methodology is defined as standard
- Feedstock can guide the usage and composition impact of digestate
- Regulations defined via region – relevant to developing markets
- RSA
 - Could have a standard that is a guide. As soon as standard listed in legislation it becomes mandatory in terms of OHS
 - Environmental – categories that governs legislation that needs to amended to include standards as a guide
 - Guidelines from EU on classification of feedstock and digestion relationship would be helpful to adopt in development

6.2.3 Event photos

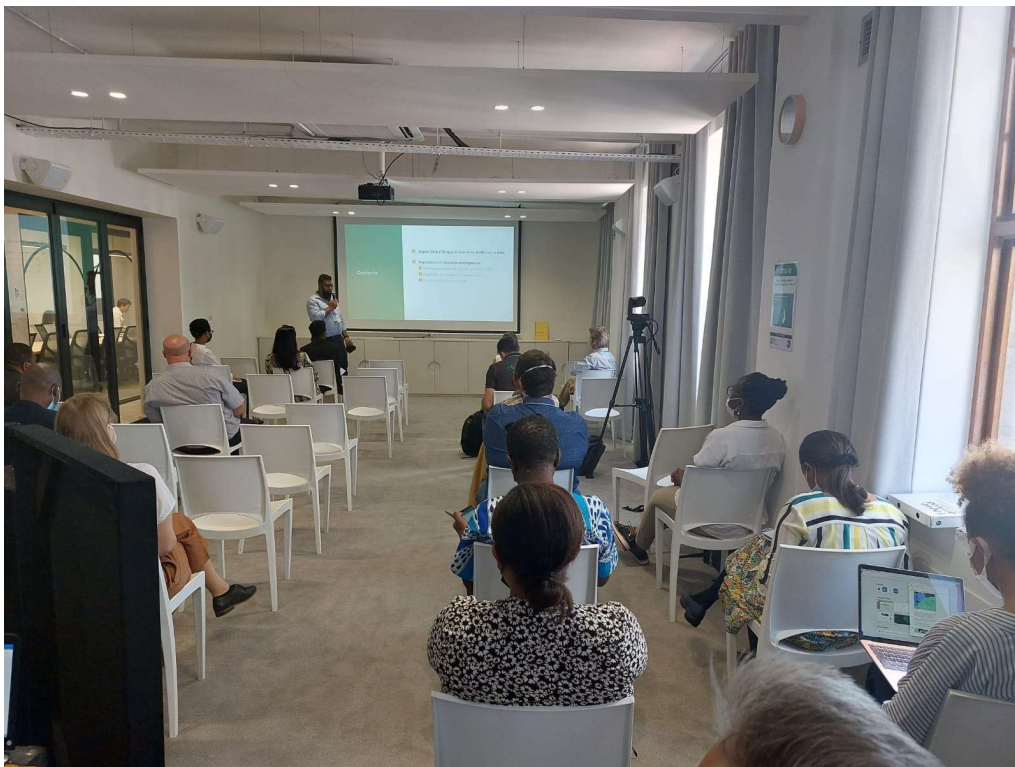


Figure 6.1 Picture during the event



Figure 6.2 Picture during the event

6.2.4 Evaluation

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DiBiCoo Consortium Partners

Coordinator



Partners from exporting countries



Partners from importing countries





Digital global Biogas Cooperation

Project website: www.dibicoo.org

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Staff member (<Consortium Member>/name) if not otherwise stated.

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