# Follow-up strategy for the extension of the tool for other RES technologies

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DiBiCoo – Digital Global Biogas Cooperation
Grant Agreement N°857804

## Executive Summary of D4.5

The purpose of this document is to describe the possibility of taking the developed Biogas and Gasification Matchmaking Platform (www.biogasplatform.eu) and deploying it for other renewable energy sources (like solar, wind, hydropower, etc.). This can be done by filling the empty system with the appropriate data. During the development of the platform, WIP, GIZ, AEA and EBA are promoting the tool to other RE sectors, especially the European renewable energy associations to make them aware of this possibility.

This deliverable describes, in a nutshell, the activities required to make the deployment of the empty platform. This action should be taken by the IT specialist, and not by the general user as specific knowledge is necessary for successful platform deployment. Knowledge and expertise in software development (back-end, front-end, databases), cloud infrastructure and internet technologies are needed for the successful implementation of the described steps and deployment of the platform for public use for other RES.

All questions about the platform can be addressed to the DiBiCoo project team from Latvia University of Life Sciences and Technologies (vitalijs.komasilovs@llu.lv; aleksejs.zacepins@llu.lv).

**Digital global Biogas Cooperation**

## Summary of the 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.

# <u>Contents</u>

## List of Abbreviations

| | |
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| API | Application programming interface |
| BMP | Biogas and Gasification Matchmaking platform |
| CSS | Cascading Style Sheets |
| D | Deliverable |
| HTTP | Hypertext Transfer Protocol |
| IT | Information Technologies |
| LLU | Latvia University of Life Sciences and Technologies |
| RES | Renewable energy sources |

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## Introduction

One of the advantages of the Biogas and Gasification Matchmaking Platform is its general applicability to other renewable energy technologies besides biogas, such as hydropower, geothermal, heat pumps, solar energy, wind power, and solid biomass conversion. As the developed platform is open-source, any stakeholder can use it for their own purposes.

We can distinguish two potential scenarios for the extension of the platform for other RE sectors:

1. Extension of the developed Biogas and Gasification Matchmaking Platform with other renewable energy sources and creation of one universal platform with all possible energy sources;
2. Usage of the developed system backbone (architecture) to fill in with the respective data for other renewable energy sources.

Within the DiBiCoo project, based on the grant agreement, the second scenario is selected for the detailed description.

During the DiBiCoo project life-time project partners promoted the developed platform to a wide audience (see also D4.7 Report on the promotion of the tool) as well as specifically to other RE sectors, approaching especially the European renewable energy associations. Together with the general information about the Biogas and Gasification Matchmaking Platform option that the platform is open-source and can be used by them was communicated (see Chapter 6).

# 1 Creating of a new platform based on a developed architecture

This section describes the actions and effort needed to successfully implement a new platform based on a developed platform architecture and code.

Activities and actions required for the establishment of an empty platform can be divided into several steps:

1. Preparation of the infrastructure
2. Deployment of the project code and essential configuration
3. Additional configuration

Basic actions within these steps in a nutshell are described below:

1. Set-up of a Google Cloud infrastructure
2. Creation of a separate domain name for the platform
3. Set-up of the Auth0 tenant for the user management functionality
4. Deployment of the prepared project (code) on a cloud infrastructure
5. Project configuration (e.g. category list, external services, additional settings)
6. Modification and adaptation of the project code and textual information for a new energy source
7. Additional information

It should be emphasized that this process should be led by the IT specialist, and not by the general user. Knowledge and expertise in software development (back-end, front-end, databases), cloud infrastructure and internet technologies are needed for the successful implementation of the described steps and deployment of the platform for public use.

# 2 Infrastructure

This section describes the essential infrastructure and its configuration needed to run the Biogas and Gasification Matchmaking Platform. Depending on the peculiarities and needs of other RES platforms, new infrastructure entities might be added or replaced.

## 2.1 Google cloud

Biogas and Gasification Matchmaking (BMP) platform is deployed on a Google Cloud Platform (https://cloud.google.com/). Google Cloud Platform, offered by Google, is a suite of cloud computing services that runs on the same infrastructure that Google uses internally for its end-user products. It was selected based on LLU partner experience and the set of provided services needed for the platform, in particular datastore, scalable front-end and back-end hosting, integration with mapping and file storage services.

In order to start a new RES platform, the owner should register on Google Cloud and create a new project. Certain services require a Billing account to be configured with a valid payment method (credit or debit card). Though it does not mean that actual money withdrawals will occur due to the free quota available on the Google Cloud. More information about the Google Cloud quotas can be found here: https://cloud.google.com/appengine/quotas

The number of API keys and service accounts should be added if specific features of the platform are in use:

- **Maps API** key used by Web application to render the global map;
- **Geocode API** key used for address translation to coordinates;
- **Google Analytics** service account used to fetch statistics in an automated way;
- service account for **Continuous Integration** tool if one is used.

Technically it is possible to use a single entity for all of the mentioned services, but from a security perspective it is advised to separate them.

Various service credentials (secrets) are stored in the ENV_SETTINGS collection of the Datastore. These credentials are used by the back-end to access external services. Details about specific values for the external services are provided in the next chapters.

## 2.2 <u>Domain</u>

By default, applications hosted on Google Cloud are available on domain

<project-name>.appspot.com, but custom domain names are preferable.

The domain name can be bought from any registrar of choice (for example https://www.do-main.com/, https://www.namecheap.com/, etc.). After that the domain should be assigned to the project on the Google Cloud. Usually the ownership of the domain should be verified. The details of the verification process depend on the selected registrar and are often provided in the corresponding user manual.

## 2.3 <u>Auth0</u>

BMP solution uses authentication and authorization services provided by Auth0 universal platform (https://auth0.com/). Auth0 is a ready-to-use platform with a wide range of built-in authorization related functionality and integration options. In particular, BMP uses specific authorization flows for Web applications, completely delegates user credential handling and access administration functionality to the platform. From a development perspective, usage of the Auth0 platform simplifies user administration tasks, removes the need to create custom solutions for secure user credential storage, user Sign-in and Log-in flows. Upon Log In, users are forwarded to the Auth0 hosted Web page, where they have options to Sign Up or Log In using their own credentials or social media accounts. After successful authentication, the user is forwarded back to the BMP user interface. User authentication process is demonstrated in the Figure 1 below:
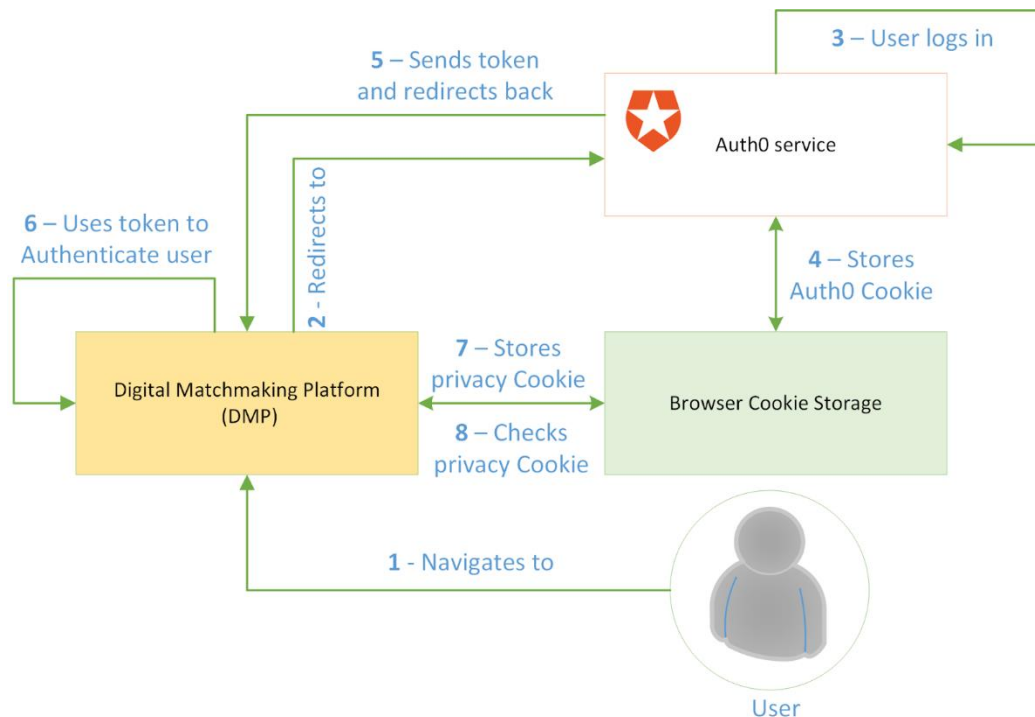
*Figure 1. User authentication process within the Auth0 service*

In order to use Auth0 for the new RES platform the owner should register on the Auth0 platform and create a new tenant (namespace) for the project.

Following entities should be configured for the RES platform:

- **API** pointing to RES platform's back-end, with audience identifier following recommended naming "https://<domain-name>/api/".
- **Single Page Application** pointing to the created API and used by RES platform's front-end.
- **Machine to Machine Application** pointing to the Auth0 management API and used by RES platform's back-end for resolving user names. In addition, the credentials from this application should be added to the Google Cloud datastore:
  - Key (ENV_SETTINGS, 'AUTH0')
  - client_id
  - client_secret
- **Admin user role** assigned to desired users and configured with "admin" permission for the created API. Admin user role can be used to add new administrators if necessary and manage the registered users.

## 2.4  MailJet

E-mail distribution to the wide audience is a well known use-case and is covered by a variety of online service providers. BMP uses MailJet (https://www.mailjet.com/) service to send e-mail notifications to the platform users.

In order to use this feature in new RES platform, the owner should register on the MailJet platform and configure his profile:

- specify organization details;

- add email domain (verification is highly recommended to avoid false-positive spam detections);
- create new API key used by RES platform back-end;
- create a template for the notification emails.

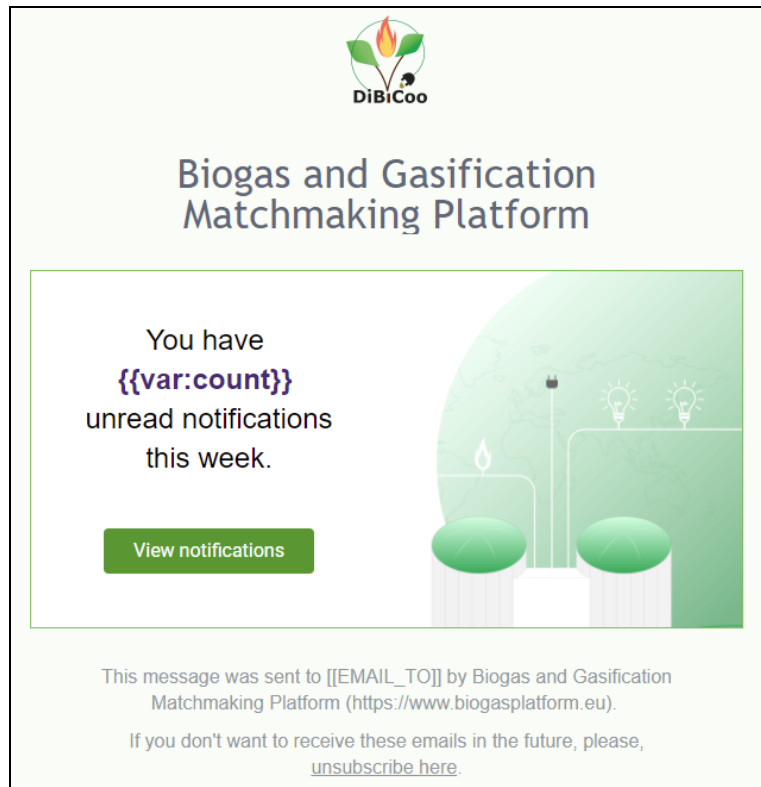As an example, the template used by BMP is as follows:



*Figure 2. E-mail notification template*

In addition, the details should be added to the Google Cloud datastore:

- Key (ENV_SETTINGS, 'MAIL_JET')
- apiKey
- secret
- template (id of the created template)

## 2.5  Analytics

BMP uses Google Analytics (https://analytics.google.com/) to collect web-page visit statistics. For new RES platform the owner should register on the Google Analytics, and perform its essential configuration:

- create new account;
- create new property;
- add service account to property access management configuration.

# 3   Project code and configuration

Following chapters describe code structure and some changes needed to adopt it for the new RES platform.

Source code is available at:

**https://github.com/dibicoo-project/digital-matchmaking-platform**

## 3.1   Code structure

Overall, the platform has two distinct entities: user interface (*front-end*) and server side application (*back-end*). In addition, the source code contains various configuration files used to deploy the platform to the Google Cloud or used by the continuous integration tool.

## 3.2   Front-end

The user interface of the platform is built using Angular 11 framework and follows its structure. The application consists of following modules:

- **static** - includes various static pages of the platform, such as landing page, privacy and legal statements, contacts and other;
- **knowledge-base** - dedicated for literature sources and factsheets shown on the platform;
- **public** - includes all publicly available pages, such as list of companies, details of the particular company, etc;
- **user** - includes pages dedicated to the user's private pages, such as list of drafts, editing wizards, notifications;
- **admin** - includes pages related to administrator's functionality, such as category management, company profile review, etc;
- **auth** - module dedicated to request authentication and authorization via Auth0;
- **domain** - includes various components and services used in other modules, such as services for data exchange with the back-end, pop-up dialogs, type definitions, etc.

## 3.3   Back-end

The server side of the platform is built based on Express and Inversify frameworks. The application code is structured using following concepts:

- **controllers** are used to map and handle HTTP requests;
- **services** implement business logic and are called by controllers;
- **repositories** provide access to the persistent data storage (Cloud Datastore) for the services;
- **domain** object definitions used for typing.

Corresponding classes are logically grouped into number of folders:

- **analytics** - fetching page visit statistics from Google Analytics service;
- **applications** - business opportunities related functionality;
- **attachments** - functionality related to uploading various attachments to Cloud Storage;
- **auth0-users** - resolving usernames to full names via Auth0 API;
- **categories** - functionality related to the management of the categories;
- **common** - components used by other services, such as environment variables, geocoding, etc;
- **contacts** - account-wide access to contact items;
- **countries** - database of countries and their details;
- **cron** - endpoints for scheduled tasks;
- **emails** - components for sending emails via MailJet service;
- **enterprises** - company profiles related functionality;
- **matchmaking** - functionality related to matchmaking between company profiles and business opportunities;
- **notifications** - platform notifications related functionality;
- **security** - request authentication and authorization components;
- **utils** - various utilities used in other components;
- **validation** - request validation via defined JSON schemas.

## 3.4  Build, Test and Deploy

For development purposes it is usually useful to run the whole platform locally. Following commands might be useful to start it:

- `back-end$ npm run db`

To start local datastore emulator (port 8001)

- `back-end$ npm run dev`

To start back-end server (port 8088)

- `front-end$ npm start`

To start front-end (port 4200)

Majority of platform functionality is covered by unit and integration tests.

- `back-end$ npm run test:watch`
- `front-end$ npm run test:watch`

Production files are build as follows:

- `back-end$ npm run build`
- `front-end$ npm run build`

and can be deployed to Google Cloud using utility as follows:

- `back-end$ gcloud app deploy --version=<version-name> .`
- `front-end$ gcloud app deploy --version=<version-name> .`

More technical details on the commands are available in the corresponding `package .json` files.

# 4    Essential changes

For the new RES platform, the list of essential changes includes (but is not limited to) aspects described in the next chapters.

## 4.1    Environment setup

Various configuration files and environment variables should be changed in order to point the new RES platform to the correct Google Cloud project and related services (as described in the infrastructure section).

The deployment operator should configure his own credentials for the Google Cloud utilities to be able to deploy the platform.

## 4.2    Branding

The new RES platform branding includes changes to the platform title, logo, colours and texts. Majority of visual features available for end users are located in the `front-end` part of the platform. Landing and other informative pages belong to the static module and can be changed directly inside HTML files. The platform's colour palette and typography styles are defined within `_dibicoo-theme.scss file`.

Literature sources and factsheets are organised as a collection of links to the PDFs or other documents (see example in `knowledge-base` components). These documents can be self-hosted on the Cloud Storage or referenced as external documents.

## 4.3    Categories

Categories are the essential part of the RES platform used to organize various entities and perform matchmaking between them (see Figure 3). Platform owners should define hierarchical structures according to specific RES needs and covered business fields.

*Figure 3. DiBiCoo categories*

## 4.4 Specific features

There are a number of features implemented specifically for the BMP platform. These features can be adopted for the new RES platform or replaced with custom functionality. A few examples are as follows:

- specific details available when creating business opportunity via wizard;
- markers visible on the global map;
- guided tour on certain pages;
- notification templates, and others.

# 5 Sustainable development and further thoughts

For better and sustainable development of the RES platform it is advised to follow these recommendations:

- use a dedicated code repository;
- implement unit and integration tests for the critical functionality of the platform;
- set up continuous integration and deployment tools (CI/CD);
- perform code review between development team members;
- setup automated backups of the database and other information.

# 6 Outreach to other RES

During the DiBiCoo project life-time European project partners (GIZ, EBA, AEA, WIP) promoted the developed Matchmaking and Gasification Matchmaking Platform to other institutions and associations. For general promotion of the platform according to T4.7, information about the platform and its functions was sent out especially to biogas stakeholders.

Additionally, and within the framework of task T4.5, project partners approached specifically the European renewable energy associations and informed about the open-source character

of the Biogas and Gasification Matchmaking Platform and its adaptability to other RE sectors. The platform and its adaptability to other RE sectors has also been promoted in the scope of T5.7 to multiplier organizations with similar interest in transfer of biogas technologies such as business associations, trade chambers, development agencies and renewable energy associations in a variety of other countries according to T5.6.

In respect to T4.5 an overall of 48 organizations were contacted by end of march.

DiBiCoo project partner WIP reached organizations for solar PV, solar thermal and Bioenergy in Europe. Such organizations as ETIP Bioenergy, ETIP RHC, ETIP PV, EUREC, Euroheat and Power, EHPA and EUBA were contacted.

DiBiCoo project partner AEA reached out to organizations in Austria and Europe. Such organizations as PV Austria, Bundesverband Erneuerbare Energie (AT), Austria Solar, AEE Intec, save energy Austria, European Wind Association, International Energy Agency, International Renewable Energy Agency, European Renewable Energy Council, International Centre for Hydrogen Energy Technologies, World Council for Renewable Energy, COP Secretariat were contacted.

DiBiCoo project partner EBA reached out to organizations in Europe connected to heating, bioenergy and biomass. Such organizations as EUREC, Solar Power Europe, EuroHeat, EHI, Bioenergy Europe, Eurochambres, European Biomass Association (AEBIOM), EREF, EUBIA were contacted.

DiBiCoo project partner GIZ informed organizations in Europe, trade chambers in Latin America, Asia, Africa and several development agencies (Austrian, Belgian, French, Norwegian, Swedish, Netherlands). Such organizations as ETIP SNET, STIP DG, STIP Wind, European hub for research & innovation in district heating & cooling. GIZ also contacted different media and magazines in the field of biogas and renewable energies (Agora Energiewende, biogaspartner, Zukunft Gas, gwf-gas, energiezukunft) to inform them about the platform and its adaptability to other renewable energy sectors. At this stage, the information has already been picked up by two media on their websites. Furthermore, GIZ spread the information internally to Energy Cluster Networks, relevant Sector Networks and suitable GIZ projects around the globe in the field of renewable energy.


The process of contacting the organisation was organised in a way, that GIZ collected the list of potential contacts from EBA, AEA and WIP. Once all partners filled in their contacts the external contacting was started. For the effective communication two external email templates were prepared with most relevant information about the adaptability of the platform. The process of contacting of organisations was based on two factors:

1. the organizations have not been contacted yet at all with information about the matchmaking platform within the scope of T4.7, T5.6 or T5.7
2. the organizations have been contacted already and have been informed about the platform but have not yet gotten the information about the possibility to adapt the tool to other RES.

Any responses on the information sent out via e-mail will be taken up by the partners AEA, EBA, GIZ and WIP in the upcoming weeks and will be forwarded to LLU for technical feedback if necessary.

## e-mail template 1:

Dear X,

the EU-funded Horizon 2020 project DiBiCoo (Digital global Biogas Cooperation) connects 13 organisations from Europe, Argentina, Ethiopia, Ghana, Indonesia and South Africa. It facilitates collaboration between European biogas industries and stakeholders from emerging and developing markets.

With the release of a digital and freely available **Biogas and Gasification Matchmaking Platform** (https://biogasplatform.eu) DiBiCoo has reached a milestone in promoting affordable and clean energy technologies not only in Europe, but also in emerging and developing countries. Another benefit: **The platform is not limited to the biogas sector. It is open-source and can be adapted to other RE sectors, that can benefit from this tool!** We are happy to share more information about the functionality and benefits of the platform:

The business-to-business platform serves to establish sustainable international business relationships and offers three main components:

❖ **Company Profiles:** This section helps to easily identify suitable business partners around the world working in the sector. Companies or organisations from the sector can create a company profile and advertise their products and services for free. By using filters to finetune your company search you will constantly receive updates if new companies match them. A global map shows you in what countries and regions companies are active. The company explorer allows you to browse through the continuously growing company database and learn about the technologies and services they offer. The platform has already 179 registered companies!

❖ **Business Opportunities:** It was never that convenient to find suitable business opportunities. Whether quickly finding a business partner for a project realisation or offering a service under fair market conditions – companies can easily post their needs, projects ideas or service requests on the online marketplace in the section 'business opportunities' to expand their own business and successfully build a business cooperation in the biogas sector.

❖ **Knowledge Base:** The 'knowledge base' section completes your know-how on the biogas sector with valuable factsheets, reports, and in-depths studies.

Although the platform was initially designed for the biogas sector, the open-source character of the platform has the advantage that it can be adapted to other renewable energy technologies such as solar, wind, hydropower, or geothermal energy. The source code is freely available along with a technical manual. **DiBiCoo is offering technical guidance on how to adapt the matchmaking platform to your specific RE sector.** If you are interested in establishing such a matchmaking platform for your RE sector, please get in touch with the DiBiCoo project.

For more information visit:
Biogas and Gasification Matchmaking Platform (biogasplatform.eu) & dibicoo.org

With best regards,

X

### e-mail template 2 (addendum):

Dear X,

I have contacted you a while ago to inform you about the release of DiBiCoo's digital and freely available Biogas and Gasification Matchmaking Platform (https://biogasplatform.eu).

Hopefully you've already had some time to have a look at the platform and maybe you're interested in building such a platform for the RE sector you're working in.

A great benefit of DiBiCoo's Matchmaking Platform: **It is not limited to the biogas sector.** The open-source character of the platform can be adapted to other renewable energy technologies such as solar, wind, hydropower, or geothermal energy. The source code is freely available along with a technical manual. **DiBiCoo is offering technical guidance on how to adapt the matchmaking platform to your specific RE sector.**

If you are interested in establishing such a matchmaking platform for your RE sector, please get in touch with the DiBiCoo project.

We'd kindly ask you to actively spread the word on this new platform within your networks and to encourage stakeholders, companies and organizations from other RE sectors to have a look at the platform and contact DiBiCoo, in case they could benefit from it.

For more information visit:
Biogas and Gasification Matchmaking Platform (biogasplatform.eu) & dibicoo.org

Best regards,

X

# The DiBiCoo Consortium

## COORDINATOR

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

## PARTNERS FROM EXPORTING COUNTRIES

WIP RENEWABLE ENERGIES

AUSTRIAN ENERGY AGENCY

EBA European Biogas Association

kompost & biogas verband

Fachverband BIOGAS

Latvia University of Life Sciences and Technologies

## PARTNERS FROM IMPORTING COUNTRIES

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GreenCape

rdi Resilience Development Initiative

SEES INSTITUTE FOR SUSTAINABLE ENERGY AND ENVIRONMENTAL SOLUTIONS

**Project website:** www.dibicoo.org

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