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BIOGAS - GLOBAL CHALLENGES, MARKETS AND COOPERATION OPPORTUNITIES

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ABSTRACT: The DiBiCoo project supports the European biogas/biomethane industry and the biogas development in developing and emerging countries by preparing markets for the export of sustainable biogas/biomethane technologies from Europe to developing and emerging countries. This is achieved by the development and application of innovative digital and non-digital support and matchmaking tools and actions, by knowledge transfer and capacity building as well as by the preparation of demo cases up to the prefeasibility stage. This will increase the share of renewable energies, both in Europe and in importing countries. The paper addresses the status of biogas in developing and emerging countries and the related research and development needs.
Keywords: biogas, biomethane, markets, international cooperation

1 INTRODUCTION

To meet the growing demand for heating, power and fuel, biogas has already proved its potential as a versatile energy carrier. Due to favourable regulations and energy policies, the number of biogas plants in operation in the European Union has increased to over 18,000 to reach an installed capacity of 10 GW as of 2016. Biomethane production has steadily increased to over 17,000 GWh per annum. It is estimated that biogas has the potential to contribute at least 1.5% of the EU's primary energy mix by 2020 (EBA, 2017).

Germany is the leading country with the highest number of biogas plants in Europe (~9,500 forecast 2018 according to EBA statistics), followed by Italy and France. Increasingly saturated markets and changing support schemes in key markets, such as Germany, significantly impacted the market for new biogas plants since 2011. The number of newly-built biogas plants per year in Germany dropped by almost 95% from 2011 to 2014. Since then, the German market for biogas plants has continued to stagnate. A recovery of the market in Germany, as well as in other European countries, can be expected and already happens e.g. through the "Greening the Gas" initiative in Austria, where biomethane from biogas and gasification will play a key role. In addition, European technology providers are increasingly looking at external markets for new investment opportunities.

However, also beyond Europe, decreasing electric energy incentives for biogas technologies are a challenge to the sector in many countries. There is a large amount of biomass excess and biowastes that could be transformed into heat, power and fuel. For example, countries like Ghana or Indonesia that have palm oil plantations and industries, would benefit from the biogas technology to treat wastes from the palm processing and to produce more electricity and fuel. Indonesia as the biggest oil palm producer country would benefit from the technology to reduce the waste from palm oil production. In addition to that, urban wastes are common problems in developing countries that can be reduced by using biogas technology. Therefore, adapted technologies are needed to increase revenues from energy services, waste treatment, digestate, and negative carbon emissions.

The DiBiCoo project supports the European biogas/biomethane industry by preparing markets for the export of sustainable biogas/biomethane technologies from Europe to developing and emerging markets.

This paper will explain how the DiBiCoo project plays a role for preparing such markets, for reducing organic waste and for increasing the biogas development in selected importing countries where the DiBiCoo project is applied.

2 THE DIBICOO PROJECT

The EU H2020 project DiBiCoo (Figure 1) supports the European biogas/biomethane industry by preparing markets for the export of sustainable biogas/biomethane technologies from Europe to developing and emerging markets. This is achieved by the development and application of innovative digital and non-digital support and matchmaking tools and actions, by knowledge transfer and capacity building as well as by the preparation of demo cases up to the investment stage. This will increase the share of renewable energies, both in Europe and in importing countries.

Figure 1: Logo of the DiBiCoo Project

More specifically, the DiBiCoo facilitates the diversification of the sales markets of the European industry and increases the deployment of biogas technologies in Latin America, Africa and Southeast Asia. The target countries (importing countries) are Argentina, Ethiopia, Ghana, Indonesia, and South Africa (Figure 2). For these markets, European technologies will need to be adapted to the local situations. The project addresses two main challenges in developing and emerging countries, namely the management and treatment of organic wastes, agricultural residues and the increased demand of renewable energy. DiBiCoo promotes technologies and concepts for the collection and treatment of organic wastes (e.g. bio-waste, food, feed and beverage processing waste, agricultural residues, catering waste) as well as biogas conversion technologies (anaerobic digestion and small-scale gasification) and its use (for upgrading, CHP, industrial processes, transport, etc.). In the target countries, demo cases will be developed with a systemic and life cycle approach in order to analyse opportunities and constraints. The project thus helps to mitigate GHG emissions by reducing emission from disposal of organic waste as well as by increasing the share of global renewable energy generation. DiBiCoo contributes to the security of energy supply and to the creation of rural workplaces.

Core activities of the DiBiCoo project is the active involvement of European technology providers through the European and national biogas associations, the collaboration with the target countries, the elaboration of a digital support tool, the implementation of capacity building measures and the identification of suitable project opportunities in the target countries.

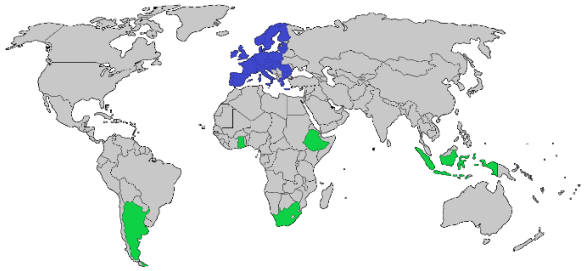

Figure 2: World map with the DiBiCoo exporting (blue) and importing (green) countries

3 BIOGAS IN EMERGING AND DEVELOPING MARKETS

Typically applied biogas systems in many parts of the developing world are very different to the ones in developed regions. Household scale biogas plants with no operational control are established to meet a very different set of needs than industrial plants do. For billions in the developing world, who use solid biomass for cooking and heating, biogas plants represent a transition to more modern fuel with social benefits often being the main motivation for biogas developments. Governments without the financial resources to provide the incentives to establish an industrial biogas market may choose to promote household scale digesters to rural communities to achieve what is perhaps a more socially beneficial end than is achieved on an industrial level. (Gue, 2020)

However, household scale biogas plants are not considered within the DiBiCoo project. That is not to say that there are not enormous benefits to be achieved by well-constructed domestic biogas schemes, which are expected to move 200 million people away from traditional biomass in the next 10 years (IEA, 2020). Though there is an argument to be made for the two modes of biogas production as competing technologies. Due to the fact that they operate on different scales and in different areas of a country's economy they are considered as two technologies with no intersection, each serving their own uniquely beneficial service. The remainder of this section will exclusively introduce industrial scale biogas systems in developing regions but does not aim to overlook the merits of household scale plants. (Gue, 2020)

Developing nations tend to have certain common characteristics that on one hand paint a bright picture for industrial biogas sector growth, but on the other hand present severe challenges that have hindered potential growth in the past. Factors such as large agricultural sectors with high feedstock potentials, fast growing economies and a high demand for electricity put developing regions in prime position for biogas market growth. However, there are a myriad of obstacles that stand in the way of realising this potential. Weak or non-existent policy support schemes and specific biogas targets, lack of funding mechanisms, less favourable political support or economic climates and lack of research present major barriers for these regions (Patinvoh & Taherzadeh; 2019). (Gue, 2020)

A very small portion of industrial biogas capacity exists in developing regions as a result of the aforementioned obstacles. Projections by IEA (2020) see developing countries in Asia leading the growth of global biogas generation under existing policies. Factors such as low-cost feedstocks, increasingly supportive policies and relatively high natural gas prices underpin this potential growth. This projection also sees developing regions increase the share of biogas used for power and heat in industrial biogas plants rather than for cooking on a domestic scale. Energy crops are generally not considered by developing countries as they move forward with biogas sector development. Industrial, agricultural and municipal waste streams take feedstock priority, seeking to benefit from the waste-management ability of biogas systems (IEA, 2020). Developing nation governments stand on firm ground when developing biogas policies having learnt from the successes and failures of more developed sectors providing apt communication between developed and undeveloped regions occurs. (Gue, 2020)

4 RESEARCH AND DEVELOPMENT NEEDS OF BIOGAS TECHNOLOGIES IN THE DIBICOO TARGET COUNTRIES

With the aim to apply European biogas technologies in the DiBiCoo target countries, technologies and business models need to be adapted to the country specific situations. As the status of technology application and thus market maturity in the target countries is very different in comparison to the one in central Europe, a dedicated study was performed in the DiBiCoo project by Gue (2020) on the identification of research needs in the target countries. In this study, a distinction was made on the organisational and technical research commitments. Figure 3 displays some important features of technical and organisational research in the biogas project development lifecycle. In the early stages of technology development, technical

research is the main research activity, proving an innovation at a conceptual level in small-scale. The rise in organisational commitment comes when technical research institutions start to collaborate within their academic and industrial network to explore the commercial viability by cross validating and testing technologies with competing concepts and designs.

Next, the technical research commitment increases due to the combined research efforts of industrial and academic research institutions. Afterwards, the curves converge and cross when technological adaptation is complete, and commercialisation begins. At high Technology Readiness Levels (TRL) most research is conducted in the organisational space due to the technical dimension of a project being demonstrated and validated in earlier levels and the high degree of organisational complexity involved at this stage.

The DiBiCoo project is supporting measures to overcome the "Valley of Death" in the target countries, which is the critical phase between research and successful innovation.

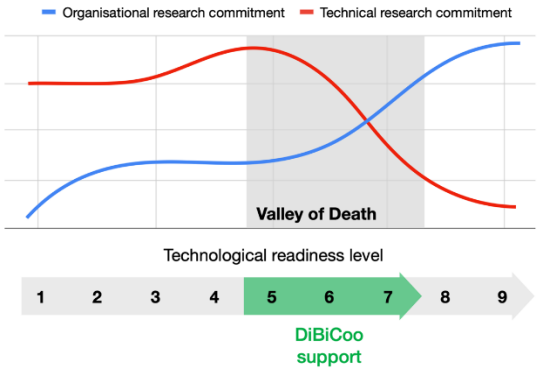

Figure 3: The contribution of technical and organisation research at different stages of the technological readiness pipeline. (Gue 2020)

5 CONCLUSIONS

The DiBiCoo project supports the market uptake and the application of European biogas technologies in developing and emerging countries. About 1/3 of the DiBiCoo project is completed. As the framework conditions in the target countries are very different to Europe, an analysis of the research needs was conducted by Gue (2020) in the first phase of the DiBiCoo project. The results are currently being considered in the ongoing project activities of DiBiCoo. Currently, the set-up of the digital support tool is further developed in order to facilitate exchange between experts and technology providers from Europe and from the target countries utilizing virtual formats. Furthermore, demo cases in the target countries are currently being selected for the implementation of pre-feasibility studies.

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7 NOTES

(1) Adapted from National Academies of Sciences, Engineering, and Medicine, (2016). Technical research commitment curve derived from De Rose et al. (2017) and valley of death placement defined by Upadhyayula et al. (2018)

8 REFERENCES

[1] DiBiCoo (2020) DiBiCoo – Digital Global Biogas Cooperation. http://dibicoo.org/ [14.07.2020]

[2] EBA (2017) Biogas & Biomethane. - Workshop on the Supply Potentials and Renewable Gases for TYNDP https://www.entsog.eu/sites/default/files/entsog-migration/publications/Events/2017/tyndp/EBA_Biogas%20and%20biomethane-final.pdf [14.07.2020]

[3] Gue O. (2020) Global diffusion of biogas technology Research needs to fast track the renewable transition of developing economies. – DiBiCoo project report.

[4] International Energy Agency. (2020a). Outlook for biogas and biomethane: Prospects for or-ganic growth. Retrieved 2 April 2020, from https://www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth [14.07.2020]

[5] Patinvoh, R. J., & Taherzadeh, M. J. (2019). Challenges of biogas implementation in develop-ing countries. Current Opinion in Environmental Science & Health.