

Final report

General information

1. Project details

Project title	Demonstration af samensileret roetop og halm til biogasproduktion
File no.	64018-0138
Name of the funding scheme	EUDP
Project managing company / institution	Danish Technological Institute
CVR number (central business register)	56976116
Project partners	Jens Krogh, Vrejlev Bioenergi, Dansk Fagcenter for Biogas
Submission date	20 June 2023

2. Summary

Describe the objectives of the project, the obtained results and how they will be utilized in the future.

The short description should be in two versions:

- *English version*

The project demonstrates different methods of the use of co-silaged sugar beet leaves and straw for biogas production. Sugar beet leaves and straw are both considered waste biomasses according to both the Danish sustainability criteria for biogas production and the R&D strategy for biogas. As it is up to 3 mil tons of straw and 1 mil tons of sugar beet leaves are not utilized for energy production but left unutilized in the fields each year. However, it represents a tremendous resource for biogas production, as approx. 500.000 ton oil equivalents of energy could be produced from it in the form of biomethane. A recent R&D project conducted by DTI-AgroTech "Flexible CHP from Biogas Based on Waste Biomass from Agriculture"¹⁾ proved that co-ensiled sugar beet leaves and straw is an excellent substrate for biogas production found in lab- and pilot scale experiments. Next step is this project, which contains a full-scale test and demonstration, in which different methods of producing the silage will be tested and demonstrated, experience documented and efficiently communicated

- *Danish version*

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3. Project objectives

- *What was the objective of the project?*

The purpose of the project is to demonstrate and test different methods for handling and using co-silage beet and straw for full-scale biogas production. It is also the purpose to document the experience with regard to handling and biogas production. Finally, the aim is to demonstrate whether the synergies found in a previous project can be demonstrated in full scale, to document the economy of the value chain and to effectively disseminate the results to the target group.

- *Which energy technology has been developed and demonstrated?*

Co-ensiling of sugar beet leaves and straw for biogas production.

4. Project implementation

- *How did the project evolve?*

The activities in the project were affected by a number of unforeseen incidents. Firstly, one of the original partners in the project decided not to continue his plans of incorporation sugar beets in the feedstock ration for his dairy cows. This was in fact due to his location in a hilly and stoney neighbourhood, which gave unexpected challenges to the harvest of both sugar beets and the leaves. This partner left the project and a new was found, who already cultivated sugar beets for his biogas plant, namely Vrejlev Bioenergy. Secondly, the very wet autumn in 2019, made it difficult to harvest the beet leaves, which was given up by Jens Krogh in 2019, though he had made all his preparations. In 2020 the harvest was perfect. It was the plan to have an open house arrangement in Vrejlev at harvest time in 2020, but the very day of the event the whole region was locked down due to corona. This part of the dissemination had thus been cancelled. Nevertheless the demonstration effect proved its value, as in Lolland Nordic Sugar, Nysted Biogas and a group of farmers made their own trials of coensiling beet leaves and straw. One farmer there invested in a new sugar beet harvester which is able also to collect sugar beet leaves.

- *Describe the risks associated with conducting the project.*

Main risk was the weather conditions in autumn, which did to some extent affect the flow of the project.

- *Did the project implementation develop as foreseen and according to milestones agreed upon?*

Only the open house event was cancelled due to corona.

- *Did the project experience problems not expected?*

It was not expected that one partner wanted to leave the project.

5. Project results

- *Was the original objective of the project obtained? If not, explain which obstacles that caused it and which changes that were made to project plan to mitigate the obstacles.*

Yes, the project was mainly a demonstration project. The fact that new initiatives were launched in the Island of Lolland inspired by the project is a major success

- *Describe the obtained technological results. Did the project produce results not expected?*

Yes, two methods of producing the silage was demonstrated. Both were successful

- *Describe the obtained commercial results. Did the project produce results not expected?*

The project was mainly a demonstration project, whereas results from it should be utilised by commercial players in the biogas sector in DK and elsewhere. Nature Energy plan two new plants in the south east region of DK and Nordic Sugar at least one to secure biomethane for their sugar production. The technology in question will most likely be significant part of the biomass supply for these plants.

- *Target group and added value for users: Who should the solutions/technologies be sold to (target group)? Describe for each solutions/technology if several.*

The technology will be applied by farmers with own biogas plants and farmers who can sell the silage to larger biogas plants. According to the techno-economic analysis the technology is indeed competitive compared to energy crops

- *Where and how have the project results been disseminated? Specify which conferences, journals, etc. where the project has been disseminated.*

The final scientific report is now uploaded to DTI website:

[Roetop og halm til biogasproduktion - Teknologisk Institut](#)

On this website also a project video and the final leaflet is found. In addition articles are submitted to Landbrugsavisen Kvæg, Sukkerroenyt, Maskinstationen og Landbrugslederen and Bioenergimagasinet.

The project was presented at EUBCE 2019 in Lisbon. Next TI-AgroTech newsletter will contain information of the project with links to the website.

The web site link is sent to the following group (organisations of sugar beet growers, straw growers, agricultural machinery service and Biogas Danmark) who can link to it in their next newsletter.

6. Utilisation of project results

- *Describe how the obtained technological results will be utilised in the future and by whom.*

By farmers and biogas plants to secure biomass supply

- *Describe how the obtained commercial results will be utilised in the future and by whom the results will be commercialised.*
- By farmers and biogas plants to secure biomass supply
- *Did the project so far lead to increased turnover, exports, employment and additional private investments? Do the project partners expect that the project results in increased turnover, exports, employment and additional private investments?*

Not among project partners. But one farmer on Lolland, who invested in a new sugar beet harvester also invested in a conveyor to collect beet leaves, so he is ready for the future. In general, the technology will contribute to growth in the biogas sector by providing a whole new type of biomass for biogas production.

- *Describe the competitive situation in the market you expect to enter.*

Many biomass types have to be paid for. This silage can just be collected and utilised, and not require extra agricultural land for the production, which is a very important parameter, and it is thus considered a waste biomass.

- *Are there competing solutions on the market? Specify who the main competitors are and describe their solutions.*

Not really. Other waste biomass resources can be harvested and utilised, but at present there is far more manure available than waste resources, so there is a long way before the demand for solid biomass for biogas production will decrease.

- *Describe entry or sales barriers and how these are expected to be overcome.*

This is not relevant for this project, as it is mainly a demonstration project

- *How does the project results contribute to realise energy policy objectives?*

The technology will provide a substantial biomass supply for several biogas plants in Lolland, Falster, Southern Sealand, Møn and perhaps Langeland. As the rate of energy crops allowed for biogas production is reduced in years to come, production of sugar beets for livestock forage and use of leaves for biogas production will definitely increase.

7. Project conclusion and perspective

- *State the conclusions made in the project.*

Silage made of sugar beet leaves and straw is an excellent substrate for biogas production. It consists of a mix of two biomass types both considered waste biomass and therefore not categorised as energy crops.

Production of the silages is economically viable, as low-quality straw can be utilised for low costs.

- *What are the next steps for the developed technology?*

In Lolland/ Falster several initiatives for new large biogas plants are under way. As both sugar beet leaves and straw is ample in this area, no doubt they will play a major role in the biomass supply for these plants.

- *Put into perspective how the project results may influence future development*

Most likely in 3 years 3 or 4 new large plants are in operation in the mentioned area. Most likely the biomass supply will consist of livestock manure and silage of straw and sugar beet leaves. In addition, periodical waste supply from sugar production also.

8. Appendices

- Add link to relevant documents, publications, home pages etc.
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- 1) [Roetop og halm til biogasproduktion - Teknologisk Institut](#)