



## Partnership

### Lead partner:

- Savonia University of Applied Sciences, Finland

### Partners:

- Ostfalia University of Applied Sciences, Germany (WP4 leader)
- Marshal Office of Lower Silesia, Poland
- Klaipeda University, Lithuania
- Mälardalen University, Sweden
- Estonian Regional and Local Development Agency, Estonia
- University of Eastern Finland, Finland

Key technology provider and expert of microbiology and the bioprocess for Pilot A investment and testing:

- Finnoflag Oy, Finland

Service provider for the Polish tests and the related activities:

- Wroclaw University of Technology

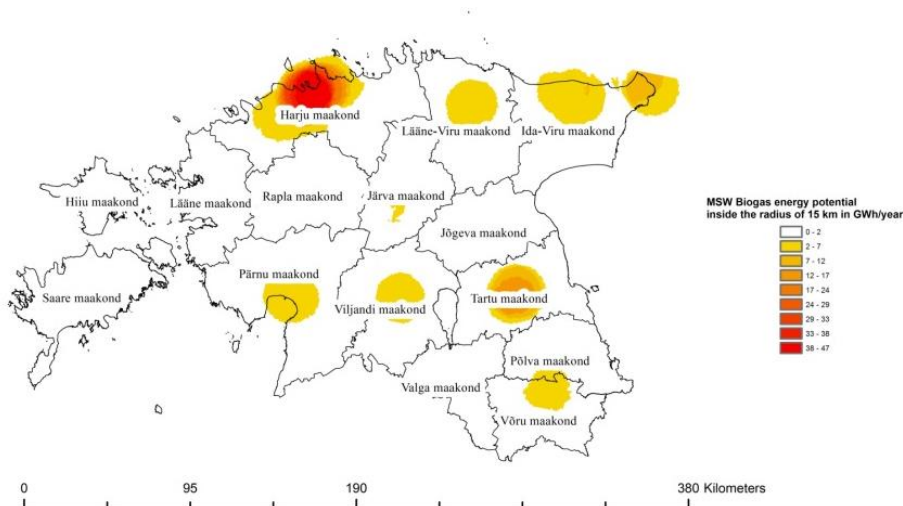
## Feedstock potential, supply chain and sustainability assessment around ABOVE Pilot B

Regional modeling was used to evaluate how feedstocks for dry digestion system (Pilot B) could be utilized in Estonian target area. Feedstock mass flows, impacts on labor and GHG savings were assessed. Feedstocks under of interest were household biowaste and dry manure fractions.

Manure biogas energy potential is concentrated on large dairy cow and pig farms. In the future, it is obvious that waste-to-energy solutions should be found in co-operation with these large units.

Significance of biological utilization of household biowaste should not also be forgotten. Thus, geographical biogas energy potential of household waste was introduced (Figure 1.). Even though the largest potential is around Tallinn region, modeling considered feedstock collection from whole Estonian area. Possible biogas CHP plant locations were optimized which considered feedstock transportation, biogas heat and electricity production as well as heat delivery to the end users. Regional modeling results were represented to investors in the investor event in 16.-17.12.2013.

Tuomas Huopana  
University of Eastern Finland



Household biowaste (Municipal Solid Waste biogas) energy potential shows the distribution of population.





## Associated partners

Six testing sites in five countries:

- Farm of Rima Dauksiene, Lithuania
- Savon Sellu Oy, Finland
- OÜ Kaarli Farm, Estonia
- ZGO Gać Ltd, Poland
- Vafab Miljö AB, Sweden
- Hagby Gårdsfågel AB, Sweden

Other associated partners:

- Telemark University, Norway
- North Savo Centre for Economic Development, Transport and the Environment, Finland
- Jätekuikko Oy, Finland
- Berndt Schalin Board Advisors Oy, Finland

## Pilot plant B in Estonia –general overview

Pilot plant B is a semi-industrial mobile pilot plant capable of regular and dry digestion and serves as an important educational and awareness raising tool for biogas. Pilot B was operated in Estonia since October 2013 till April 2014. During this period, Estonian partner ERKAS operated the plant.

To achieve most realistic test scenario Pilot B was located at Kaarli Farm, a dairy farm of ca 1500 cows that is a fine example of all the similar farms in central region of Estonia. Second reason was that Kaarli Farm is located within the vicinity of several other possible sources for biogas production (beside agricultural waste also professional food industry). Third reason was a closeness of another e.g. reference biogas plant and a waste management plant that can become a future partner for potential investor into biogas in that region. Therefore for its period Pilot B operation in Estonia was a big and important awareness raising tool that took a huge leap forward future potential biogas plants for several companies.

Liquid manure was used as a testing substance in Estonian testing for Pilot B, and the plant was operated first in high temperature and later in mesophilic (40 °C) regime. In high temperature operating regime the production of biogas was 930 l per 1 T liquid manure, but in mesophilic regime – 11520 l biogas per 1 T liquid manure. The produced biogas contained 57,2 % CH<sub>4</sub> in average. General average output of 1 T of the raw material was 6.6 m<sup>3</sup> CH<sub>4</sub>. During the period several tests were made using Pilot B, input (manure) and output (digestate) was analyzed in laboratories – in Institute of Agricultural Research and in Tallinn University of Technology.

According to these tests, the content of dry matter was in average 7.6 %, so the volume of biogas was 152 m<sup>3</sup> per 1 T dry matter (these results didn't vary from results of Pilot B operations).

Jaan Lõõnik and Reljo Saarepera  
ERKAS  
Estonia



Local farmer with biogas plants as partner for cooperation





**Pilot B in Estonia**

Preparatory workshops were held in Estonia in October and December 2013

**Pilot B workshops in Estonia**

First Estonian ABOVE workshop took place on Monday, October 28<sup>th</sup>. The day began with the site visit to the pilot plant and Kaarli farm followed by the visit to the nearby working biogas plant followed by round table discussion. Representatives of ERKAS, as project partner and Kaarli Farm, as hosts of pilot plant had active discussion with expert from Tallinn Technical University, Peep Pitk, B.Sc., M.Sc. and representatives of the ministry of environment. In his presentation Mr. Pitk gave practical advice on operation of pilot plant and how to carry out viable tests in Estonia that will meet the expectations of the project stakeholders.

December 16-17, 2013 partners and leading stakeholders gathered for the first international Pilot B meeting in Estonia to discuss the initial progress of piloting as well as prospective for the business case in Estonia.

Presentations from Estonian experts lead in the day followed by a practical

discussion amongst project partners and round table with the local stakeholders to define the expectations, technical realities and socio-economic situation for the successful business case.

The main substrate that was considered was cow manure, due to the high potential of that substrate in Estonia. The transportation of the manure would be too expensive and the feed-in tariffs are rather low, therefore the biogas plants should be placed near to the farms, which are suitable as location.

So it has been considered if it is worth investing in a biogas plant provided that the anaerobic digestion is fully integrated as a part of the milk production residues treatment and not as a separate production business. The process has to be optimally adapted to the farm and the use of the digestate has to be assured.

Andreas Behnsen  
*Ostfalia University of Applied Sciences*



The Pilot B at Kaarli Farm





### Pilot B in Estonia

Investor event in Rakvere, Estonia was held in March 2014

Report about the Estonian Pilot B tests can be downloaded from the ABOWE web-site.

### Investor event in Rakvere

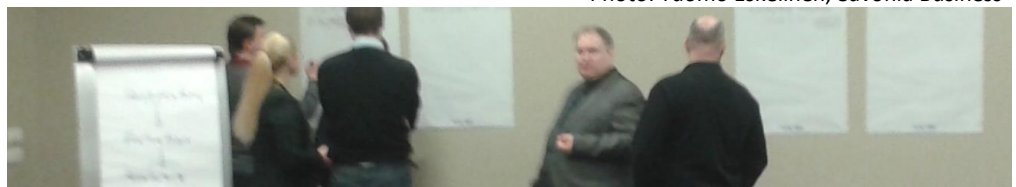
Project activities and results were presented on March 26, 2014 during the Estonian Investor Event in Rakvere. Local farmers and other interested entrepreneurs were invited to the event. At the beginning Prof. Ahrens gave an overview of the Pilot B together with Priit Freienthal, M.Sc and then everybody had a chance to express their opinion of biogas production and consuming issues.

The main problem for farmers is, that the share of useful elements e.g. nitrogen in the total mass of potential organic fertilizer decreases, when making manure into digestate through biogas production and that causes additional costs for the farmers when they use digestate instead of manure to fertilize their fields. Of course the content of microbic elements could be bigger, if to change the technology of collection of manure in the farm but that would again not benefit the biogas production and would demand additional investments.

As today mostly manure is washed out of farm floors that already significantly reduces the potential of manure as a fertilizer as it gets mixed with big amount of water.

Also in the case of Kaarli Farm that beside dairy farm has also big fields, they are interested, if it is possible to dewater the digestate in order to save money from transportation and if it would be cost efficient. The latter together with economically viable solution for using biogas for heating cow-farms, instead of liquid fuels would make biogas interesting for the farmers' community.

Photo: Tuomo Eskelinen, Savonia Business



As part of the Investor event, business model items were collected in an brainstorming idea generation session.





## Pilot B in Lithuania

The Lithuanian investment memo has been completed and can be downloaded from the ABOWE web-site.

## Pilot B studies continued in Lithuania

In the third period of ABOWE project Lithuanian and German teams prepared a biogas feasibility study for Sveksna city in Lithuania. The study covered calculations of energy consumption of city state organization's needs for heat and power, and also for Sveksna's street lighting. Energy consumption was counted for area of 3000 inhabitants. The draft results of Sveksna energy feasibility study have been presented to Sveksna municipality authority. Due to the limited amount of target area biodegradable waste, this small scale biogas plant (50-70 KW) development project is profitable after 10-12 years of exploitation.

Another biodegradable waste fermentation equipment could be planned to be built for bigger area such as Silute district. The biogas feasibility study covering needs of a whole district is under preparation. The working capacity of the biogas plant could be 300 kW and it is the example of big scale plant project.

The Silute district infrastructure including arable land, pastures, livestock farms with counted amount of manure produced as well as power and heat district consumption have been taken into consideration.

During the third period of the ABOWE project the biogas residues (digestates) testing has been done. The cattle manure was used as main substrate. The results (presented in the table) correspond to the Lithuanian legal base rates. In accordance with Lithuanian Environmental Protection Normative Document (LAND 20-2005) the results of digestate analysis showed digestates' applicability for agriculture's purposes. Accredited analysis methods have been applied.

Olga Anne  
Klaipeda University  
Lithuania

Parameters	Value
<i>Salmonella sp</i>	0
K, mg/kg	43854.0
P, mg/kg	6825,0
N, mg/kg	61343.6
Cr, mg/kg	16,8
Cu, mg/kg	24,9
Ni, mg/kg	14,35
Zn, mg/kg	70,65
Cd, mg/kg	0,22
Pb, mg/kg	3,45
Hg, mg/kg	0,27
Dry material, %	9,1





## Pilot B in Sweden

Investor event in Mälardalen, Sweden was held in June 2014

## Pilot B in Sweden

The dry digester will be operated at VAFAB for six months, from March to September. Vafab works with sustainable and environmentally sound handling of waste, and is owned by the municipalities in Västmanland County. The population of the region is about 300,000, and there are more than 10,000 businesses that generate waste.

The substrate that is being tested is the fine fraction of the residual waste. The fine fraction is obtained by crushing and screening the residual waste (size <40 mm). The residual waste is currently being incinerated but contains organic matter with a high biogas potential that decreases the heating value during incineration.

This waste is complex, containing a mix of hard and soft plastic, paper, metal, glass, and a varying amount of organic material. The purpose of the testing is to determine if it is technically and economically viable to produce biogas from this waste. The biogas potential of the domestic waste will be investigated. Various variables related to loading and retention time will be

tested to find the most optimal process, for this challenging but potentially valuable waste stream.

While carrying out the technical tests, key stakeholders in the waste sector in Västmanland County is being informed about the project and results from the piloting.

The 13th of June key stakeholders were invited to a half-day workshop where the dry digester was discussed and demonstrated. The purpose of the meeting was to inform stakeholders and to discuss how dry digestion can be a solution to current and future waste management needs in the region and beyond.

In preparation for this event the project team contacted stakeholders and conducted an informal interview to learn more about challenges and opportunities in the waste sector in Västmanland County.

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*Mälardalen Högskola*



Arrival of Pilot B at VAFAB

