Let’s boost bioenergy on farms!

An overview of the impact of BioEnergy Farm and the opportunities for businesses
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Author: M.F.B. van der Werf

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CCS B.V.
Welle 36
7411 CC Deventer
Tel: +31 570 - 667000
Fax: +31 570 - 667001
E-mail: info@cocos.nl
Website: www.cocos.nl

For more information about this report and the BioEnergy Farm project;
please contact Dr. Ir René Cornelissen

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**Summary**

**BioEnergy Farm is about** boosting bioenergy, generated on farms. The chosen method is based on a proven successful Dutch approach and is transferred to other European countries (during the IEE supported period, these were Poland, Italy, Germany, Belgium and Estonia).

The chosen **method** is the following:

First, farmers are informed about the potential of bioenergy on the BioEnergy Farm portal. Not only by text but also by quick scans that calculate the feasibility of the production of bioenergy and the growing of biomass.

The second step is to assist farmers with an expert scan. In this case, a trained expert uses an offline tool together with the farmer to determine more precisely how profitable a bioenergy project can be. It also presents the opportunity to “play” with the parameters.

The third step is to assist interested farmers with the drafting of a business plan that is needed to get the project financed.

The project thusfar resulted in many products which remain available (for free):

- BioEnergy portal (guaranteed for 2 years)
- Informative documents (o.a. best examples, market description)
- Tools and scans (7 in total) for calculating feasibility; available for free, adaptable
  - Anaerobic digestion quick scan and expert tool
  - Wood combustion quick scan and expert tool
  - Online feasibility calculation tools for growing biomass
- Implementation guide and financing guide
- Business plan template

**Interested in joining the project? Get in touch!**
1. Introduction

1.1. Quick overview
The BioEnergy Farm project aimed to increase the amount of renewable energy, generated on farms in Italy, Poland, Estonia, Belgium, Germany and the Netherlands. At the start of the project, the ambitious final goal was set to increase the capacity of bioenergy with 40 MW, three years after the end of the project.

To reach this ambitious and clearly defined goal, a proven three-step method was used to assist farmers with their renewable energy project:

1. Individual farmers and land owners are motivated to assess the profitability of bio energy on their farm themselves with an easy online quickscan that gives reliable independent information. Additional information can be gained with quickscans on the field of (short rotation) forestry and energy crops.

2. Experts assist farmers and land owners with a more in depth expert scan (by the use of a profit calculator)

3. Experts will assist farmers and land owners with the writing of a businessplan which serves as a basis to get the project financed.

Now, three years later, the method has proven to be succesfull since the target (40MW) seems likely to be reached.

1.2. The facts
The BioEnergy Farm project was funded by the Intelligent Energy Europe project and ran from the 1st of June 2010 until the 30th of April 2013 (the first year was mainly spent on preparations). The most important targets that were set at the start and the achievements are:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Target</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visits to the BioEnergy Farm platform</td>
<td>30,000</td>
<td>35,935 (23,396 unique)</td>
</tr>
<tr>
<td>Users of the online scan</td>
<td>3,000</td>
<td>3,042</td>
</tr>
<tr>
<td>Expert scans performed</td>
<td>400</td>
<td>459</td>
</tr>
<tr>
<td>Farmers assisted with a businessplan</td>
<td>80 (80 MW)</td>
<td>83 (44 will be realized)</td>
</tr>
<tr>
<td>Plans which will be realised</td>
<td>40 (40 MW)</td>
<td>44 (50,7 MW)</td>
</tr>
<tr>
<td>Extra bioenergy production capacity installed</td>
<td>40 MW in 2016</td>
<td>18 MW in 2013</td>
</tr>
</tbody>
</table>

1.3. Why bio energy on the farm?
The European Union wants the market share of renewable energy to reach 20% in the year 2020. This ambitious goal can only be reached if all renewable energy sources are used. At present, the agricultural sector is having a difficult time. Production is limited by production quota, and the prices of most agricultural goods are low due to the economic crisis. These factors hamper the expansion of European agriculture and prompt European farmers to look for new sources of income. One of the most promising options is the generation of bio
energy and biofuels; serving both the agricultural community and the European energy policy.

Besides that, farms are places where biomass is already produced, gathered and processed. Some of the necessary machinery is already present and farmers/landowners know how to get their hands on biomass and how to determine its value. The farm is therefore a logical place to retrieve energy out of biomass.

1.4. The primary actors

Within the project, it is important to have a technical expert in each country to make sure that the information makes sense. This organisation is also needed to bring visits to farmers and make sure that the tools that are developed are properly configured since every country has its own quality of biomass, rules and regulations.

The dissemination is another crucial aspect for which we acquired other organisations in most countries to make sure that we can reach our targetgroup. The last partner was an IT firm to construct the BioEnergy Farm portal.

<table>
<thead>
<tr>
<th>Technical experts</th>
<th>Dissemination organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>NL    CCS, Cornelissen Consulting Services</td>
<td>NL Stimuland, non-profit organisation aimed at the development of the agricultural sector and rural area’s</td>
</tr>
<tr>
<td>PL    NAPE, National Energy Conservation Agency</td>
<td>IT CIA, a farmers association representing over 50,000 active farmers; 15,000 in piemonte region.</td>
</tr>
<tr>
<td>IT    DEIAFA, Dep. of agriculture, forestry and environmental engineering. University of Turin</td>
<td>DE GERBIO, association of bioenergy professionals</td>
</tr>
<tr>
<td>DE    IER, System analysis and renewable energies, institute for energy economics and the rational use of energy. University of Stuttgart</td>
<td>ES EFF, the estonian farmers federation is a union of farmers associations</td>
</tr>
<tr>
<td>BE    Biogas-E, a knowledge centre with regards to biogas in Flanders</td>
<td>IT organisation</td>
</tr>
<tr>
<td>ES    EULS, Estonian university of life sciences</td>
<td>NL Zet Solutions, an IT firm, founded by LTO, a farmers organisation and the Rabobank (founded by farmers)</td>
</tr>
</tbody>
</table>
2. Method

2.1. The project thusfar

The objective of this project was an increase in the use and production of bio energy and biofuels by farmers. To achieve this, it is necessary that farmers are given information on the possibilities and feasibility of bioenergy and the growing of biomass. For most European countries, there was no programme for supplying this information. BioEnergy Farm has created such a program, based upon an existing successful Dutch approach which is shown below (the numbers indicate the initial targets set for the BioEnergy Farm project, to be reached in the march 2013).

A portal was created to bring reliable and independent information on (the feasibility of) bioenergy and the growing of energy crops and (short rotation) forestry to farmers and landowners in Germany, the Netherlands, Belgium, Italy, Poland and Estonia. Even information on the feasibility of growing energy crops and (short rotation) forestry is presented. But information is not enough. A free quickscan offers information but no incentive. Therefore, users with interesting business cases are contacted and offered a free expert scan. A trained expert will visit the farmer and together, they will use a more advanced bioenergy calculator to assess the feasibility of the (potential) project.
During the project, 83 farmers were assisted even further with the creation of a **business plan**, needed to convince banks to finance the project; finally leading to a positive investment decision and a realized project.

### 2.2. From the user perspective

Individual farmers are able to do an online BioEnergy Scan to assess the profitability of bio energy or bio fuels for their farm. If the online scan predicts a positive profitability, the user can extend the search by the use of the online tools EnergyFarm, Short rotation forestry and Forestry4Energy (profitability of energy crops, short rotation forestry and regular forestry).

The next step is an expert scan with help of either the Anaerobic Digestion Profit Calculator and/or the Wood Combustion Profit Calculator. These tools can be used solely by the farmer (both tools can be downloaded and used free of charge) but the project aims at the assistance of a trained expert.

The expert scan comprises a more detailed calculation to determine the profitability and feasibility of Anaerobic Digestion and/or Wood Combustion for the individual farm.

If the profitability and feasibility seem interesting enough, experts can assist the entrepreneur with the drafting of a business plan. This plan will help the farmer to obtain funds and to make an investment decision.
In short:
1. Farmers\(^1\) are attracted to the BioEnergy Platform
2. Farmers visit the platform website
3. Farmers perform an online BioEnergy Scan
4. Farmers possibly extend their search with the EnergyFarm tool and/or the forestry scans
5. Expert performs an anaerobic digestion profit calculation and/or a wood-combustion profit calculation
6. Farmers visit best practices and specialised workshop
7. Expert support farmers, foresters and landowners in writing business plans and during implementation
8. The Farmers decide to invest and realize the plan.

### 2.3. Why would you want to cooperate?

Boosting the production of bioenergy on the farm can be beneficial for your organisation. For the partners of BioEnergy Farm, this benefit can be described as follows:

Consultants/experts: can generate more work by getting in touch with users of the online scan and assisting them in the implementation of bioenergy projects.

Branch organisations of farmers/landowners can boost the image of their members by giving attention to the potential of the production of bioenergy on their own farm/land.

### 2.4. Reaching out to farmers

To create the impact that was aimed for, communication was a serious key to success. During the IEE supported period, many communication methods were used. The effect differed from type to type.

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\(^1\) To make reading easier, in this case, farmers also represent landowners and foresters.
<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>internet platform</td>
<td>Presents information on bioenergy and biofuels, offers tools to calculate the feasibility of producing bioenergy production and growing biomass for energy, best examples, expert advice and local news on the subject. Visited by 23,000 unique visitors.</td>
<td>78% of respondents said they found some useful information on the BioEnergy Farm portal, 22% said they did not learn anything new from the portal.</td>
</tr>
<tr>
<td>links from partners' websites</td>
<td>electronic links to BioEnergy Platform placed on project partners' websites</td>
<td>2014 visits - referrals from partners' websites.</td>
</tr>
<tr>
<td>news items in agricultural newsletters</td>
<td>news items from the BioEnergy Platform added to agricultural email newsletters</td>
<td>increased number of visits to the portal after publications (visible in website statistics)</td>
</tr>
<tr>
<td>banners on websites popular with target group</td>
<td>banners with links to BioEnergy Platform placed on websites popular among farmers, foresters and landowners</td>
<td>108 referrals, together with 133 email referrals, generated ~5 000 visits (~13% of all visits)</td>
</tr>
<tr>
<td>advertorials/advertiments</td>
<td>advertorials and advertisements in agricultural magazines and periodicals. 17 advertisements were placed.</td>
<td>increased number of website visits in a given country after most of the publications.</td>
</tr>
<tr>
<td>press articles</td>
<td>articles in agricultural magazines and publications reaching all target groups 31 press articles were published.</td>
<td>increased number of website visits in a given country after most of the publications.</td>
</tr>
<tr>
<td>telephone contact with users of online scans</td>
<td>collecting feedback on the BioEnergy Platform, making arrangements for visits to chosen farms</td>
<td>Lead to the high number of expert scans and helped to make online scans and portal more user-friendly.</td>
</tr>
<tr>
<td>presentations at farmers' exhibitions</td>
<td>at least one presentation of the BioEnergy Platform at a major farmers’ exhibition in each participating country</td>
<td>Lead to a lot of contacts of farmers interested in expert scans, many scans were performed on the spot.</td>
</tr>
<tr>
<td>workshops for farmers</td>
<td>Informing farmers about bioenergy and biofuels production possibilities. 765 farmers attended the workshops.</td>
<td>They were effective in Poland, Estonia, the Netherlands, and Italy.</td>
</tr>
<tr>
<td>excursions for farmers</td>
<td>excursions for farmers, showing them good examples of bioenergy projects 381 farmers attended the excursions.</td>
<td>Popularity and effectiveness differed by country.</td>
</tr>
<tr>
<td>brochures</td>
<td>Country specific brochures about the project and its results were distributed. 3,000 were distributed.</td>
<td>received positive comments from farmers.</td>
</tr>
</tbody>
</table>
The cooperation between the National Energy Conservation Agency, an energy advisory, and the Mazovian Agricultural Advisory Centre developed beyond the framework of the initial agreement to support BioEnergy Farm project implementation.

As it turned out, the presentations about bioenergy production on farms given by BioEnergy Farm experts were very well received, so the experts were invited to more trainings for farmers and for agricultural advisors. Also, the fact that agricultural advisors had a chance to learn about biogas plants and visit existing installations was very useful, as Poland is still a developing bioenergy market and knowledge transfer to agricultural advisors plays a crucial role in popularizing agricultural biogas production. The interest in this kind of installations is growing, and along grows a demand for reliable information on available
3. Changes on the ground

3.1. Support

The direct support that was given to farmers and land-owners consisted of expert scans, assistance with business plans and coaching that was related to the development of the business case. However, during the project period, regulations and subsidy schemes changed as well. This had a large impact on the activities on the ground.

The support given during the IEE supported project period to the farmers was diversified and took place in the period between January 2010 and February 2013. The period of time spend to support farmers in developing and précising a bioenergy project on their farm varied among 2-26 months, with an average of 37 hours spend for each business plan (time spend, between 4-400 hours). Generally, support was given by direct communication with the farmers. Additionally assistance by phone was realized. Support was realized giving information about permits and emission regulations, investment subsidies and creation of business plans, performing scans, feasibility calculations and scenario analysis. Moreover, advice in type of installation, plant size and optimization (e.g. optimize biomass use to minimize costs etc.) was given and energy delivery options were compared. Furthermore specific information was given regarding e.g. pocket digestion and combustion of manure instead of wood, as well as location analysis and analysis of reference markets to get best deals for biomass purchasing were carried out.

3.2. Scans, indicators of local climate towards Bio-energy

3.2.1. Netherlands

During the BioEnergy Farm project more than 80 online scans were made with the Anaerobic Digestion Profit Calculator (ADPC) and the Wood Combustion Profit Calculator (WCPC) by the Dutch Bio-Energy experts. The biogas business cases for which a scan was made were in the range from small scale micro-digesters with an installed electrical capacity of 50 kW to large scale industrial digesters with an installed capacity of 5 MW. These large plants can digest over 100,000 tonnes of biomass per year. The outcome of the scans varied strongly and was strongly dependent on the scale of the installation and the year (due to changes
in the subsidy regulation and demands with respect to permits)

**Biogas**

During the project period of the BioEnergy Farm project, the Dutch market for biogas plants changed in different aspects. An important aspect is the available subsidy. For biogas plants the SDE subsidy is essential to achieve a financially solid business plan. In the last years, the SDE scheme changed several times in structure and grants. At the moment, there is no room anymore for large-scale biogas installations producing electricity or bio-methane. Only biogas installations which deliver heat only have enough chance in receiving enough subsidy for a positive business case, which reduces the number of interesting locations dramatically.

Another important aspect are the biomass costs. The annual benchmark co-digestion of the Rabobank shows that the cost of raw materials increased with a few euro cents per kWh electricity produced in the recent years. Since the operating costs of a biogas installation consist for a large part out of the purchase of biomass, this price increase had a major impact on the financial feasibility of biogas plants which use co-products. During the BioEnergy Farm project it turned out that the public opinion regarding large scale biogas installations became more negative in the last years. An important issue in countries like the Netherlands, Germany, Belgium etc. is the food vs. feed discussion. Also the farmers complain because the market prices of crops like corn increased in the last years.

The online biogas scans showed that most farmers are only interested in small/ micro scale digesters which only use the manure of their own farm. The same opinions were heard during the workshops and excursions organised for the farmers during the project. The main reasons for this interest are the high financial risks of large biogas installations which became visible because a lot a biogas installations in the Netherlands went bankrupt in the last years.

Within the BioEnergy Farm project many scans for micro-digester are made. These scans show that micro-fermentation is only profitable when the farm produces enough manure on its own and there is SDE subsidy available. Again, the likelihood of receiving adequate funding for the production of electricity and injecting bio-methane is too small, so farmers need to find heat customers in their neighbourhood. The investment costs for micro-scale biogas installations are relatively high so also an investment subsidy is necessary to achieve a profitable business case. Additional income can be found in the small-scale manure processing. Farmer that produce more manure than they can dispose on their own land can
than avoid costs for manure disposal to other farmers. When some of these incomes coincide a positive business case can be found.

**Wood**

Within the project BioEnergyFarm eight wood combustion scans were made in the Netherlands. These scans are made for firewood, wood pellets and wood chips fired boilers. For a number of living houses it was checked whether a fire wood boiler is financially profitable. Due to the relatively low gas consumption (about 5000 cubic meters per year max) for domestic heating, the payback period is relatively high. However, when own wood is used, there are financial benefits.

For some farmers and other interested people the feasibility of wood pellet and wood chip fired boilers was determined. These boilers are equipped with an automatic feeding system. For a location within the city pellets are preferred, because they can be stored in a closed silo. The storage of wood chips more space is needed and the open storage can lead to odour problems. A pellet fired boiler is cheaper than a wood chips fired boiler. In all cases, it appears that, when the gas consumption is constant and large enough (> 30,000 cubic meters / year), wood combustion is financially profitable. This means that a wood boiler is feasible for residential complexes, swimming pools and broiler farmers. However, the financial benefit depends very much on the wood price developments. In Germany, where the wood market is further developed compared to the Netherlands, for example, the prices are already much higher than in the Netherlands. In the Netherlands farmer pay between 30 to 50 euros per ton of fresh wood chips and pay around 180 euros per ton of pellets, current prices in Germany are respectively 80 and 250 euros per tonne.

3.2.2. Estonia

In total, 40 offline scans were made (cost-benefit analysis) with the Bioenergy Farm Tools in Estonia in 2012. 30 scans were made by using the Offline Anaerobic Digestion Profit Calculator (offline scan for biogas production) and 10 scans were made by using Offline Wood Combustion Profit Calculator (offline scan for wood combustion).

The cost-benefit analyses of biogas production were done mainly in livestock farms, of which the larger amount was dairy cattle farms. Also some pig-breeding and cattle farms were analysed. In addition the biogas production cost-benefit analyses were performed also for
grain production cooperation, for a enterprise of plant processing company and for a horticultural enterprise. Most of the wood combustion cost-benefit analyses were carried out for grain producers, but also one vegetable producing and one fruit producing farm were involved.

Currently in some farms the investments for bioenergy production are already made time and some farms are in the phase of technical blueprinting of the bioenergy unit. The rest of the farms, for which the offline scans were performed, are still in the stage of conceptual design.

For biogas production the most cost-effective were the projects, where cattle manure with at least 30% of grass mass in addition was available. The annual volume of substrate for running the digester was essential.

The projects of biogas production are more cost-effective, if the complex approach is used. For example, in one scanned project a greenhouse is planned to be built next to cattle barn. In this greenhouse there is possible to use the extra heat from electricity production from biogas. By using such a solution there is possible to get quite short payback period.

In conclusion, the offline scans gave an estimation that the production of electricity and heat from biogas is foremost profitable in case when the annual volume of substrate is more than 30 000 tonnes of substrate (manure and grass mass). As a rule, the projects with annual substrate volume less than 10 000 tones have too long payback time or are not profitable at all. A short payback time can be predicted only for the farms with very large amount of cattle, which have an access to large grassland area. Simultaneously there should be a certain requirement for most of the extra heat produced together with electricity from biogas.

In wood combustion projects for example was feasible the case where the diesel boiler for cereal drying was replaced with the wood chips boiler. In this case mainly switching from fossil fuels to wood biomass causes the cost-effectiveness. The investments costs are relatively small and ensure the quick cost-effectiveness.

3.2.3. Poland

The experience gained in the course of BioEnergy Farm project implementation proved that a decision concerning an investment in a biogas plant depends on a number of factors. There is no universal "success recipe." Also, the lack of publically available and reliable information on the technical possibilities and prospects for exploitation of a biogas plant in a given localization turns out to be a major obstacle in the way of development of agricultural biogas production. So to foster more dynamic development of this type of renewable energy production, farmers should be encouraged to perform preliminary technical and economic
analyzes for biogas, which can be compared with the cost-effectiveness of the current farm profile.

In the first half of the year 2012, 81 biogas scans were performed by Polish experts in the framework of the BioEnergy Farm project. The farms whose cases were analysed are located in the Pomeranian and Mazovian Voivodships, because the Pomeranian and the Mazovian Agricultural Advisory Centres cooperated with the National Energy Conservation Agency during the course of project implementation.

Most Polish biogas plants produce heat. This results from the fact that biogas installations in wastewater treatment plants and by landfills are usually located nearby urban areas with an already existing district heating network. A large portion of heat is also produced by biogas plants by wastewater treatment plants that require large amounts of heat for their own operation.

The experience gained so far leads to a conclusion that larger scale biogas plants (more than ~300-400 kW electric power) and those based on substrates produced on the same farm, such as manure and residues, are generally more profitable. The most common agricultural land use scheme in our country is characterized by large distances between cultivated fields and potential buyers of heat from a biogas plant. For this reason the cost of the heat transporting network, or some alternative solution to deliver the heat to the recipient, is usually a significant element in the investment costs balance. It should be mentioned that a big portion of the analysed investments reached the threshold of operational profitability only in case of heat sale being possible (and hence the possibility of acquiring certificates for energy produced in cogeneration - so called "yellow certificates"). Also the avoidance of heat costs can be treated here as heat sale, when there is a considerable heat demand at the farm (ex. greenhouse, drying processes, etc.) Biogas treatment eliminating CO2 to produce biomethane and deliver it to the grid turned out to be unprofitable in all cases. The analysis of information collected in the course of project implementation shows that operating costs not directly related to biomass acquisition are a major factor influencing the investment profitability.

Taking into account the cost of equipment maintenance, amortization and operational cost of the loan in case of smaller agricultural biogas plants (up to ~100kW) most often resulted in a negative balance in the economic analysis. The investment cost mostly depends on the cost of the digester and the cogeneration unit. In case the heat recipient is located at a distance, the cost of constructing a heating network becomes significant.
Summing up, both the exploitation and the investment costs are to a large extent dependent on the specific characteristics of a given case. Therefore, it cannot be concluded that investing in biogas plants in Poland is either profitable or not profitable at the moment. The only noticeable trend is that the average profitability of the investment depends on the size of the biogas plant, which showed an increasing tendency with the increase of the scale of equipment (the largest case analysed was 437 kW el and the smallest 43 kW el.). It should be underlined however, that the legal environment of small installations will fundamentally change in the nearest future (Act on RES) and certainly will have an impact on their cost-effectiveness. According to the official announcements, the new Act will promote small-scale installation through introducing fixed energy purchase prices and simplifying procedures for energy trading and acquiring permits. Cases where the scan result was clearly positive most often fulfilled one of the following conditions: availability of substrates produced at the spot (big farms), small distances from the field and heat recipients (ex. production facility), possibility of utilising a lot of the heat, access to the power grid, large and constant power demand by the farm itself (or a production facility). Currently, on the biogas market the investments are being withheld, waiting for the final version of the Act on RES and its implementation. It should be noticed that the new legal environment and subsidy rules will have a major influence on the profitability of investments and exploitation of RES installations.

### 3.2.4. Belgium

The Flemish Biogas sector has grown in capacity from 2010 to 2012 with 22MWe. This is significantly less than the two year period before, in which a growth could be noticed by 32MWe. Does this mean that the full market potential has been reached? Not yet according to the Flemisch Energy Agency. Their preliminary prognosis gives an average yearly added capacity of 4MWe till 2020, hence a clear diminishing of growth speed. Changes to the Energy Decree in 2012 are experienced as very negative for the sector. The times of plenty are over. Innovation, creativity and pioneering are key factors to success in the future.

How the project BioEnergy Farm has contributed to sectorial progress is difficult to put into exact numbers. The outcome and amount of scans and business plans can be an indicator for present and future investments. In general one can conclude that there is enough interest in anaerobic fermentation (and wood combustion too), but that significant investments are postponed mostly by an indecisive support climate. Response on the project met the set targets of 80 profitability scans and 20 business plans. Biogas-E will still use the tools to aid farmers and

![Groene stroom Lievens, an anaerobic digestion installation with an CHP engine of 1.1 MWe](image)
anyone who wishes.

General stakeholder consultation and sector survey indicates consistently that changes during the last three years in policies regarding RES entail great uncertainty. The project BioEnergy Farm ran during a period where the investment climate was negative and according to Biogas-E the output of the project would be a lot higher above the targets in a "normal" situation.

Of the 80 scans performed, there were 69 biogas scans and 11 wood scans. Eight of the 69 cases for biogas were not profitable, because they had a payback time longer than 10 years. Figure 1 illustrates the theoretical capacities for biogas CHP’s feasible in the studied companies. This figure is rather illustrative. Drawing conclusions about the entire industry seems premature, because the scans were made on farms owned by intrinsically interested farmers. However, we notice an mean potential of about the 15kWe and a median of 10.5 kWe at the surveyed companies. The fact that many companies in the scans have a capacity of around the 10kWe has to do with the use of a running back counter. This means that these companies do not sell cheap electricity to just buy it back at a more expensive price when they need it.

The BioEnergy Farm project has especially revealed that investments in large installations will greatly decrease on one hand, but that the market for small-scale fermentation applications still has an optimistic market potential on the other hand. For the current major exploitations may be expected that they will need to reinvent themselves in the coming years. This can be done by more efficient processes control, investments in performance enhancing techniques (eg Organic Rankine machine) or by moving away from electricity and heat production and instead looking for biomethane applications.

most progress is made in small-scale fermentation. Philippe Jans, who was trained as an expert successfully started his own company called Biolectric SA, which currently has 45 small plants built. Given that a plant costs € 95,000, this means an investment of 4.2 million euro has been made in the biogas sector. Of past scans are already two are realized and there is a good chance that a dozen projects will follow within two years.

3.2.5. ITALY

During the project 132 scans were carried out in Italy with the off-line tool with the Anaerobic Digestion Profit Calculator (ADPC) and two were carried out with the off-line wood combustion tool WCPC. In this document you can find a summary of the results of scans performed during the project, allowing you to better understand the circumstances in which Bioenergy can be more or less profitable and why. The positive outcome of the scans is related to Italian incentives and regulations

The scans for biogas production were made for digesters with an installed capacity of less than 100 kWe to digesters with an installed capacity up to 1 MW. In Italy the type of contribution allowed to get the best economic return for installations that are around ore
below one MWe. The average capacity of the plants that have made a scan was of 590 kWe, for a total of 77.99 MWe.

Of scans performed 14 had a payback less than 6 years (listed as profitable by the tool) and 21 gave positive outcomes a result close to economic viability (payback of 6-7 years). For these 14 plants (those with positive outcome) the business plan was made. In most cases, companies are located in Northern Italy. Are also present a number of companies in Central Italy and some are located in Southern Italy.

The scans were performed on farms that mainly raise crops, with some livestock (cattle and pig in rare cases), with surfaces ranging from 20 ha to 100 ha. In the case of livestock farms the interest has been generated by the possibility to use the manure to produce energy and lower its odor, and then still use it as a fertilizer. In many of the positive scans, the feedstock was represented also by maize silage or forage. This feedstock can provide the best performance for the production of biogas, especially for biogas plants with 1 MWe of installed capacity, where it is difficult to find nearby the manure needed to run the plant. Due the flat feed-in tariff of 0, 28 €/kWhe up to 1 MWe power, all the plants nearby this power got the lowest payback time.

The Italian contribution has thus made unprofitable plants of medium-small size, resulting in non-interest by farmers for the implementation. The installation of a denitrification downstream of the biodigester resulted was often impractical because of the high costs and the relatively small size of the plant.

Another problem has been the availability of biomass: farmers are in a position to choose between the sowing of land for the purpose of livestock or feed the digester. Due to the reduced availability of surfaces the livestock prevails.

For these reasons, plants under construction up to Dec 31, 2013 are owned by companies, cooperatives, corporations that can provide the great amount of biomass needed. In Italy the incentive system does not reward the production of heat, and in the scans for biogas thermal energy is substantially dispersed or in most cases only used for heating the digester. In addition, the district heating networks are expensive and rarely in the neighborhood of the biogas are plants there structures (government agencies, hospitals, swimming pools ...) large enough to absorb and use the heat.

Considering the regulations in force in Italy up to 31 of December 2012, it was not convenient to use biomass to produce heat. Up to then, there were any scans made with the Wood Combustion Profit Calculator.
Since 1 January 2013, tank to a new law, the situation improve. The DM of 28 December 2012 - Stimulation of production of thermal energy from renewable sources and energy efficiency measures – provide some contribution under the name of “Thermal account”. Aimed at small biomass boilers with power less than 1 MW (incentive up to 40% of the costs incurred, paid in 2-4 years). The incentives can reduce about one year the payback of system (contribution of about € 80,000 for boiler of 500 kth, which could cost about 250-300 k€). Two scan have been made with an average power of 500 kW\textsubscript{th}, for a total of 1 MW\textsubscript{th}. Both scan gave positive outcomes.

3.2.6. Germany

GERBIO made 40 offline scans. The Biogas-Program Anaerobic Digestion Profit Calculator (offline scan for biogas production) was used in 38 scans. Unluckily, none of scans has been processed with the Wood Combustion Profit Calculator (WCPC), the offline scan for wood combustion. Two scans were made applying the GERBIO own-developed tool to calculate the Wood Combustion Profit. There is a difference between the GERBIO tool and the WCPC. Unfortunately the two projects are very small and none of them use totally the heat produced. The two projects were difficult to represent commercially. Both of them where adapted to the conditions of the EEG 2009. During the project’s life span fell at the end of 2011, the change in the statutory eligibility requirements. The new law EEG 2012, which is now a little more than a year valid, establishes for pyrolysis gas a less energy compensation.

As here in Germany it was hard from the beginning to find the experts, we start implementing a little bit late the offline scans. In the performed biogas scans selected cases were considered, which have between 30-50% animal manure (slurry and solid manure).

According to the new EEG (Renewable Energy Law) of 2012 biogas plants must now demonstrate a mass fraction of animal substrates of at least 60% or a meaningful degree of utilization of the CHP generated heat at least 60% (inclusive 25% for the digester heating system) get a legal guaranteed compensation claim.
3.3. Business plans, Getting serious

It is interesting to see that the reason for bioenergy entrepreneurs to start with a project is usually a combination of the availability of subsidies, the availability of biomass and the opportunity to add a source of income and become more independent in terms of energy. (multiple answers were possible)

Out of 83 business plans and n=268 motivation answers given

From the business plans that were drafted during the project (and as a result of the project), it becomes clear that there is a great interest in biogas plants in all project partner countries while wood combustion plants are lack of interest. It is interesting to see that there is both interest for small and large scale installations as is shown below (for anaerobic digestion installations):
However, preferences for the installed capacity differ from country to country as becomes clear from the figure below:

The support that was provided within the BioEnergy Farm project resulted in 83 business plans for bioenergy projects. More than half of them resulted in a positive investment decision. The most important reasons not to proceed with the project were difficulties with permits and the feasibility of the installation which is usually strongly dependent on the local subsidy regulation.
In the table below, an overview is given of the reasons of entrepreneurs to invest in the project or to stop the development.

<table>
<thead>
<tr>
<th>Country</th>
<th>Projects that will be realised</th>
<th>Reasons for the farmer to invest (Project is going to be realized)</th>
<th>Projects that will not be realised</th>
<th>Reasons for the farmer not to invest (Project is not going to be realized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>5</td>
<td>x Implement a heating grid in the community. x Subsidy is available. x Raise fields ernings. x Increase income.</td>
<td>2</td>
<td>x Too big logistical challenge for substrate delivery. x Issues with permits (building).</td>
</tr>
<tr>
<td>NL</td>
<td>9</td>
<td>x Energy independence. x Subsidy is available. x Second income next to farm. x Needed to enlarge farm (manure). x Sustainable farm with low emissions. x Financial benefits because of own substrates.</td>
<td>6</td>
<td>x Risk of not getting subsidy. x Issues with permits. x High land prices.</td>
</tr>
<tr>
<td>BE</td>
<td>15</td>
<td>x Subsidy and support frame available. x Innovation and repowering of old plant.</td>
<td>5</td>
<td>x payback period too long.</td>
</tr>
<tr>
<td>IT</td>
<td>11</td>
<td>x Subsidy is available. x Lower environmental emissions. x Biomass used is produced by the farm.</td>
<td>4</td>
<td>x High costs for the installation. x Biomass too expensive or risky.</td>
</tr>
<tr>
<td>PL</td>
<td>0</td>
<td></td>
<td>20</td>
<td>x High initial investment. x Subsidy system does not provide stable conditions for smaller producers.</td>
</tr>
<tr>
<td>ES</td>
<td>4</td>
<td>x The possibility to use silage grass. x Reduce costs of residue handling. x Subsidy is available. x Use of bioenergy for heating is more profitable.</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>44</td>
<td></td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>
A success story from Belgium

During the project one of the expert trainees Philippe Jans was already testing small scale options for the Belgian dairy farms.

His experiences with the tool and the information and experience gained by participating in the project has partially led to the success of the current company Biolectric.

Already more then 45 small scale digesters are contracted at the moment (see http://www.biolectric.be/node/56). During the performance of the 80 scans some 40 new candidates were screened for a biolectric installation. Already 3 have a biolectric and some 10-15 more to come.
During the project, many products were created that will continue to prove their value. Let’s have a look at the products that are available right now and use them for your advantage. Let’s cooperate and create more impact together!

- **The BioEnergy Farm Platform** contains valuable information on bioenergy for farmers and landowners and presents all scans and downloadable tools and documents that are presented below. Of course, available in all project languages¹ and easy to extend to other countries (which is true for all products mentioned below).

- **The online Biogas Scan.** Continuously improved during the last three years. Requesting only a minimum amount of user input and available in all project languages. It is easy to add extra countries and languages (if you are interested, please get in touch!). All investments are automatically generated and a clear idea of the pay-back time is presented to the user.

- **The online Wood Combustion Scan.** Less used but also fit for duty. At the moment, new funds are found to improve the scan and rigorous improvements are underway which will make the scan easier to use. Available in all project languages and easy to adapt to other countries and languages.

- **The Biomass4Energy scan** allows farmers to completely define the production cost of energy crops. All costs involved with the production of energy crops are included. Even aspects like fuel consumption, cost of herbicides and cost of irrigation are included. Tractors and other equipment can be selected from an extensive database to make the use of the tool as user friendly as possible.

- **The short rotation forestry tool** is a special version of the Biomass4Energy scan, focused on the economic and technical aspects of short rotation forestry.

- **The Forestry4Energy scan** is a special version of the Biomass4Energy scan, focused on the economic and technical aspects of regular forestry.

- **The Offline Anaerobic Digestion Profit Calculator** is the expert tool with which you can calculate the feasibility of your anaerobic digestion project. Including automated investment costs, energy consumption, maintenance costs, report function and much more; all fully adjustable by experts and free to download, install and use. Use your

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¹ The project languages are: English, French, German, Polish, Italian, Estonian and Dutch.
own adjusted subsidy regulations, define which biomass to use and how to deliver your energy. Featuring a 20 years cashflow overview and the calculation of the internal rate of return.

- **Offline Wood Combustion Profit Calculator** is the expert tool with which you can calculate the feasibility of your wood combustion project. Including automated investment costs, maintenance costs, report function and much more; all fully adjustable by experts and free to download, install and use. Use your own adjusted subsidy regulations, define which biomass to use and how to deliver your energy. Featuring a 20 years cashflow overview and the calculation of the internal rate of return.

- **A document with best examples**; especially on the technologies of biogas fermentisation, biogas upgrading, co-generation, the increase of biomass production from agricultural land and the production of second generation crops.

- **A market description** in the form of a presentation market description with the latest trends and technology on anaerobic digestion and wood combustion

- **An implementation guide** for bioenergy entrepreneurs that gives an overview on the main steps that the farmers have to follow to make their project becoming real, profitable and lasting. Following the five main steps of project implementation are listed, documented and depicted. Each part includes a general description of the step, presents the main aspects which have to be dealt with and the output of the step.

- **The financing guide** gives an overview on the different existing financing options for biogas plants and wood-combustion plants and should be used by farmers and forest owners and generally by people that are not specialized in financing concerns. The focus of this booklet is set on financing options with exception made of funding options.

- **A business plan template** makes the drafting of a business plan less time consuming. In combination with the 20 year cashflow overview that can be automatically generated with the expert offline profit calculators, a minimum amount of time remains.
Of the 136 scans and 15 business plans made by the trainees during the project, 11 plants were made with a total of 5.7 MW electric power installed with additional 7.2 MW of thermal power produced.

Paschi Società Agricola Semplice, one of the installations that is already realised. The plant started its operation in the middle of November 2012.

The installation features Jenbacker CHP engines that can operate from 320 to 998 kW. Substrate mix: 36 t/day of corn silo, 40 t/day of manure and slurry from cows meat production (1500 heads) of the livestock next to the plant.

Lesson learnt: quality of biomass comes first. Fresh manure and slurry loaded daily, high quality corn silo. Future plans: they are installing a district heating network to serve neighbors (a small industry, houses)
5. Lessons learned

During the project, several lessons were learned. To help future replicators to implement the project in an optimal way, this chapter will discuss the lessons learned.

5.1. Communication to the target group

The most effective ways to reach potential interested farmers were:

- Farmers’ exhibitions. The offline profit calculators made it possible that farmers where not only informed about bioenergy but also assisted on the spot by an expert. By using the calculator together, a first connection and good first impression is made. It is an interesting way to get in touch since agricultural experts/consultants are often already present at fairs and exhibitions. To make an expert scan on the spot saves time and creates a good impression right from the start.

- Workshops are an excellent way to get in touch with farmers. Workshops share the advantage mentioned above; the attendants can be assisted on the spot or can be shown a demonstration of the calculation of the tool which makes a good impression.

- Excursions are very interesting for making the first contact and the aspect of “seeing is believing” is crucial for further advancements in the implementation of a project.

- Calling. When farmers use the online scan and the situation looks promising: call and assess if the potential is high enough to invest by means of an expert scan. The criteria that defines if a case is promising or not depends greatly on the country (subsidy regulations) but apart from that, the scale of the installation, availability of biomass and options to deliver the energy are crucial.

5.2. Implementation support

The implementation of bioenergy projects usually takes a lot of time. The different products created within the project (implementation guide, overview of project financing, business plan template and examples of businessplans) reduce the amount of time needed.

Nevertheless, this phase requires an investment in hours of both the entrepreneur and a bioenergy expert. Since the risk for entrepreneurs in the implementation phase is usually still very high due to uncertainties with regard to subsidies, permits and financing, it is hard for the entrepreneur to finance this phase.

Therefore, it is of crucial importance that the experts assist the entrepreneurs to find additional financial support for this phase as well. In many regions, governments subsidize the development of renewable energy projects.

5.3. Expert training

The level of the experts that were trained during the project differed strongly. Some experts had no background knowledge of renewable energy at all on beforehand, some others
already were biogas experts (Germany) and were primarily interested in the tools that were developed during the project. It became clear that 10 days of training is too little to change a general agricultural expert into a bioenergy expert that could handle the profit calculators developed within the project. Furthermore, many experts did not speak English which resulted in a crucial role for the translators that were present at the international training events. A third very important aspect is that it is not possible to “force” an expert working for an organisation that is not a partner in the project to perform scans and assist with business plans in line with the project.

Therefore, we advise to:
- Train experts from the participating organisations
- select trainees that already have some knowledge on bioenergy (or develop a far more intense and longer training course)
- only include international training events if the participants can understand English (or budget for more translation services).

### 5.4. Tools

Several tools were developed. The most crucial were the online scans and the offline profit calculators. During the project we noticed that the interface of the online scans were needed. On beforehand, we knew that updates would be necessary, but our thoughts were about updating values and subsidy regulations. However, during the project, we noticed that our online tools were too difficult for our target group and we decided to simplify the interface several times. Furthermore, the changes in subsidy regulations had larger consequences than expected because during a large period, almost finished projects use the existing subsidy regulations while newer projects already want to use the new calculations. Since the changes do usually not only include a change in values but require a change in the calculation method, it is not possible to include all subsidy regulations and keep them up-to-date all the time. Our solution has been to implement general subsidy regulations. They include general calculations and settings with which can be used by all countries to define their current subsidy regulation. In a separate subsidy file, an expert can define which subsidy calculations must be used (feed in tariff? Only subsidy? Subsidise only electricity? Heat as well? Etc etc). This way, maximal flexibility is available and an expert is always able to use the latest subsidy regulations.

### 5.5. Conclusion

So, what is the BioEnergy Farm project offering to new regions?

We have a large range of easy-to-use tools; reports to assist with the implementation and advise on how to get your target group into action. So, benefit from our effort and open up your market for bioenergy!

**So how do I participate?**

1. **Get in touch with us!** (check the contact details under Imprint)
2. **Train your RES consultants on the use of the tools**
3. **Translate the tools/scans and portal**
4. **Get into action!**
6. Want to know more?

Visit www.BioEnergyFarm.eu or get in touch with us!

The Netherlands  
Cornelissen Consulting Services  
René Conelissen (coordinator)  
+31 (0)570 667000 / Cornelissen@cocos.nl  
Welle 36, 7411 CC, Deventer  
www.cocos.nl

Poland  
Narodowa Agencja Poszanowania Energii S.A.  
Andrzej Rajkiewicz  
+48 22 50 54 654 / arajkiewicz@nape.pl  
ul. Świętokrzyska 20, 00-002 Warszawa  
www.nape.pl

Italy  
DEIAFA - University of Turin  
Remigio Berruto  
+39 (011) 6708596 / remigio.berruto@unito.it  
Via Leonardo da Vinci 44; I - 10095 Grugliasco  
http://www.deiafa.unito.it

Belgium  
Biogas-E  
Jonathan de Mey  
+32 (0)56 241 263 / jonathan.de.mey@howest.be  
Graaf Karel de Goedelaan 34; 8500 Kortrijk; Belgium  
http://www.biogas-e.be/

Germany  
GERBIO  
Michael Köttner  
+49 (0)795 4926203 / m.koettner@biogas-zentrum.de  
Am Feuersee 8, 74592 Kirchberg/Jagst, Germany  
http://www.gerbio.eu/

Estonia  
Estonian University of Life Sciences  
Katrin Heinsoo  
+372 7477172 / katrin@zbi.ee  
Kreutzwaldi 1, 51014 Tartu, Estonia  
https://www.emu.ee/