The biggest problems and concerns affecting the uptake of the energy crop cultivation and use

Report based on the experiences offering the advisory service
I. The biggest problems and concerns in Austria ................................................................. 2
   A. Description of the advisory service: ............................................................................. 2
   B. Problems and concerns affecting the uptake of the energy crop cultivation and use .......... 3
   C. Possible solutions to these problems/concerns: ........................................................... 6

II. The biggest problems and concerns in Italy ................................................................. 8
   A. Description of the advisory service: ............................................................................. 8
   B. Problems and concerns affecting the uptake of the energy crop cultivation and use .......... 8
   C. Possible solutions to these problems/concerns: ........................................................... 8

III. The biggest problems and concerns in Spain ............................................................... 9
   A. Description: ................................................................................................................. 9
   B. Problems and concerns affecting the uptake of the energy crop cultivation and use .......... 11
   C. Possible solutions to these problems/concerns: ........................................................... 14

IV. The biggest problems and concerns in Finland ........................................................... 15
   A. Description: ................................................................................................................. 15
   B. Problems and concerns affecting the uptake of the energy crop cultivation and use .......... 16
   C. Possible solutions to these problems/concerns: ........................................................... 18

V. The biggest problems and concerns in Germany ........................................................... 20
   A. Description of the advisory service: ............................................................................. 20
   B. Problems and concerns affecting the uptake of the energy crop cultivation and use .......... 21
   C. Possible solutions to these problems/concerns: ........................................................... 25

VI. The biggest problems and concerns in Sweden ........................................................... 27
   A. Description of the advisory service: ............................................................................. 27
   B. Problems and concerns affecting the uptake of the energy crop cultivation and use .......... 27
   C. Possible solutions to these problems/concerns: ........................................................... 27

VII. Index of pictures ............................................................................................................ 28

VIII. Index of tables ................................................................................................................ 28

IX. Encrop partners: ............................................................................................................. 29
I. The biggest problems and concerns in Austria

A. Description of the advisory service:

We got support of our strategic parter EEE Güssing GmbH to offer the advisory service to persons and companies who are interested to invest in energy crop business. Our employee Renate Kleinhappl and afterwards Alexandra Kopitar offered the service at the place of the EEE Güssing.

The city of Güssing is famous for its energy self-sufficiency using Renewable Energies. So a lot of people who are interested and/or want to invest in energy crop projects are visit Güssing every year to get informed about the energy supply of the city of Güssing.

The steps for the Advisory Services are to get in contact with visitors groups who are planning to see running system of the Biogas plant in Strem using energy crops. The persons in the group are employees of communities, politicians, farmers, foresters and so on who have interest to invest money in such plants like Biogas plant in Strem. The most interesting questions of the farmers are about prizing of the used energy crops, logistic or transportation costs, the utilisation of the waste concerning the production process and at least about financial support programs. The visitor groups being from the whole counties of Austria and also of various regions from Germany and Hungary.

Moreover, BOKU also carried out detailed advisory services to 3 companies planning to build biogas plants. These were advisory talks about the feasibility of biogas projects using biological wastes and energy crops. Batch-Tests of substrates were made to analyse the methane potential of different substrates.

The following table shows a list of 13 detailed advisory services carried out within the ENCROP project. The short minutes of the meetings can be found in the attachments.

<table>
<thead>
<tr>
<th>Date and place</th>
<th>Topic</th>
<th>Persons, company</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15, 2009; EEE</td>
<td>Short rotation forestry; crops for biogas</td>
<td>2 farmers</td>
</tr>
<tr>
<td>November 2009; EEE</td>
<td>Short rotation forestry; crops for biogas</td>
<td>Delegation Slovakia (30 persons; major;..)</td>
</tr>
<tr>
<td>December 2009; EEE</td>
<td>Best practice example – biogas plant Strem</td>
<td>Delegation from Upper Austria</td>
</tr>
<tr>
<td>Januar 2010; EEE</td>
<td>Best practice example – biogas plant Strem</td>
<td>25 Students of University</td>
</tr>
<tr>
<td>February 10, 2010; BOKU</td>
<td>Biogas plant for the company “Manner”</td>
<td>Mr. Weiß; Manager of Manner</td>
</tr>
<tr>
<td>February 11, 2010; BOKU</td>
<td>Biogas plant for a diary; company “Käsemacher”</td>
<td>Mr. Perlega, quality Manager of the diary</td>
</tr>
<tr>
<td>February 25, 2010; BOKU</td>
<td>Biogas plant for the city of Krems</td>
<td>Mr. Berthiller; planner of energy plants</td>
</tr>
<tr>
<td>February 2010; EEE</td>
<td>Best practice example – biogas plant Strem</td>
<td>Delegation of BOKU (20 persons)</td>
</tr>
<tr>
<td>March 2010; EEE</td>
<td>Best practice example – biogas plant Strem</td>
<td>Austrian majors and agricultures</td>
</tr>
</tbody>
</table>
March 2010; EEE  |  Best practice example – biogas plant Strem  |  Majors and agricultures
April 2010; EEE  |  Best practice example – biogas plant Strem  |  Delegation from Germany (agricultures, majors,…)
April 2010; EEE  |  Best practice example – biogas plant Strem  |  Agricultures, majors
May 2010; EEE  |  Best practice example – biogas plant Strem  |  Consultants, students,…

Table 1: advisory services in Austria

Offering this advisory services and due to the experiences in the biogas branch the biggest problems and concerns affecting the uptake of the energy crop cultivation can be summarized as follows:

**B. Problems and concerns affecting the uptake of the energy crop cultivation and use**

**Political problems/concerns:**
– Green electricity law:

![Biogas Plants in Austria](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAoAAAAHhzb7V99yAAAA0lEQ...)

*picture 1: development of the biogas plants in Austria*

The implementation of the green electricity law in 2002, with favourable buyback rates for biogas electricity fed into the grid, has led to a market boom in the construction of agricultural biogas plants. The number of approved biogas plants significantly increased from 9 in December 2002 to 325 in December 2005.
After 2005 the approval of new biogas plants stagnated in Austria. The reason for this was a new green electricity law introduced in 2006. The government limited the support for new biogas plants to 5.1 Mio. € per year and the period for the guaranteed feed-in tariff was reduced.

The picture above shows the stagnation of the development of the Austrian biogas branch. In 2010 once again a new electricity law was introduced. The feed-in tariffs are now a bit higher (between 13 and 18.5 cent/kWh) and this tariffs are guaranteed for 15 years (instead for 10 – 12 years). Moreover there is a new gas upgrading bonus of 2 cent/kWh and the CHP bonus of 2 cent/kWh.

Austrian representatives of renewable energy organisations say that the new tariffs are “too high to die and too low to make a living”.

The following years will show, if this new tariffs are favourable to invest into new biogas plants. However, the current atmosphere in the biogas branch is not that positive. A lot of investors and plant operators wish buyback rates like the German EEG law.

**Financial problems/concerns:**

In Austria approximately 77 % of biogas plant operators use energy crops as substrate. The most important energy crops are maize silage, maize corn, corn silage and corn like rye or oat.

The picture above shows the highly fluctuating energy crop prices of the last years. In 2008 the prices increased significantly and as a consequence a lot of biogas plant operators in Austria were faced with ruin. To avoid bankruptcy of several plant owners a surcharge of 4 cent/kWh was guaranteed for produced electricity in 2008. However, the energy crop prices decreased again to the level of the year 2006.

The basic dilemma which plant operators are pointing out is the fixed feed-in tariff compared with the highly fluctuating energy crop prices. Energy crops are the biggest part of the operating costs and it is difficult to make a profit within the period of fixed feed-in tariffs (12 to 15 years).
A survey in 2008 has shown that 48% of the Austrian biogas plant operators are making financial losses. Only 3% are making profits that are higher than 10% of their turnover.

**Technical problems/concerns:**

The second biggest part of running costs is for the technical equipment. On the one hand the investment costs for example for stirring units, gas engine or pumps are very high. On the other hand the plant operators did not assume the high running costs for maintenance of the technical equipment.

Within the advisory service we found out that there are several plant components which make problems. One technical problem for example are the stirring units for stirring the digesters. Although thousands of biogas plants have been built in Europe the last years the stirring units are not state of technology so far. They are not perfectly adapted to the different energy crops and conditions in the anaerobic digesters. The stirrers often break or don’t mix the digesters sufficiently.

Beside the technical problems microbiological problems can occur during line operation. Plant operators sometimes feed too much energy crops into the digesters. As a consequence volatile fatty acids can accumulate and can reach a toxic concentration for the bacteria. So parameters like pH value or volatile fatty acids (VFA) have to be monitored regularly. Otherwise microbiological problems can cause a total breakdown of the gas production. In the worst case a time intensive and cost intensive restart of the biogas plant is needed.

**Other problems/concerns:**

- Lack of knowledge

One of the most important problems we have noticed during the advisory service is the lack of knowledge of persons who want to invest money in energy crop projects (biogas plants) and also of persons who are already running a biogas plant.

The results of the survey in 2008 show following results:

- 48% of all plant operators had problems with surface layers in their digesters
- 1/3 of the plant operators do not know how much Biogas they produce per hour
- 4 out of 10 do not know how much heat their plant produces
- Nearly 40% use the second digester as additional main digester
- 21% store the energy crops without a plastic foil
- 40% store the digestate in an open container

This lack of knowledge can consequently result in a lower turnover and financial losses.

- Image of the biogas branch

Although biogas is a renewable energy source the image in the population is not always a good one. A lot of people prefer renewable energies but they do not want to have a biogas plant in their neighbourhood. Biogas plant operators often have problems with their neighbours because of odour emissions or increased traffic.

Moreover the use of energy crops like maize or other corn is controversy because of the competition with the food production.
C. Possible solutions to these problems/concerns:

— Amendment of the green electricity law

As mentioned above the Austrian biogas branch is not satisfied with the green electricity law. Everyone is looking to Germany and wants to adapt/copy the EEG law.

The big difference to the German EEG is that in Austria the budget for green electricity is capped. The bio energy projects are supported according to the “first come, first serve” system. There is no capped budget for renewable energies in Germans.

Moreover other European countries often have higher feed-in tariffs guaranteed for longer periods. A “rule of thumb” says that in Germany a biogas plant has to reach 6,000 full load hours producing electricity to make profits. In Austria you need more than 8,000 full load hours. An adoption to the German EEG will make Austrian biogas plants more profitable.

On the other hand the lower buyback rates in Austria require a more efficient and optimized method of operation to make profits. So this is a motivation to optimize the required technologies and to invest in R&D to get out the maximum energy out of the utilized energy crop.

— Promoting biogas as fuel/Feed in tariffs for bio methane

The amendment of the green electricity law (2010) supports the biogas upgrading with 2 cent/kWh. The new law for fed-in tariffs goes in the correct direction and the following year will show if this bonus is favourable to in vest in biogas upgrading for feeding into the natural gas pipelines or for bio methane fuel stations.

Feeding the bio methane into the natural gas grids opens new markets for the biogas branch. Biogas can be used as fuel; gas engines can be placed independent from the location of the biogas plant to use the produced heat more efficient or biogas can be used in conventional gas heating systems (or mixture with natural gas).

In the province of Upper Austria the subsidized housing is dependent on the usage of renewable energies. To get the subsidy you can choose for example a mixture of natural gas and biogas (80 % natural gas + 20 % bio methane) for heating and hot water. Such regulations create new markets for biogas beside the conventional electricity production. However, a feeding-in tariff for bio methane is required to compensate the higher production costs.

— Alternative energy crops

An option to avoid too high and fluctuating substrate costs is the increased usage of alternative energy crops which are not traded at the commodity market and do not compete with the food industry.

Such alternatives to maize are for example sorghum, vetch, mustard, beet and grass. Approximately 40 % of all Austrian biogas plants already use grass silage as substrate. But the amounts of used grass silage are comparatively low.

In the following years in Austria will be a significant surplus of grass biomass in the alpine regions. These areas do not compete with the food industry. The methane potential of this biomass ranges between 365 and 615 million m$^3$ per year. This is equivalent to thermal power of 336 to 564 MWth or 140 to 240 MWel. The current installed electric power of all Austrian biogas plants is 75 MWel. So there is the potential to double or triple the biogas capacity.
However, it is a technical challenge to use higher percentages of grass silage in the digester and moreover it is expensive to harvest grass (3 cuttings a year).

– R&D

As mentioned beforehand there are several steps/areas from the cultivation of energy crops to the production of biogas and usage of biogas where processes can be optimized. For example to use more grass as substrate the harvesting technologies have to be optimized and the technologies handling the substrate in the plant/digesters (stirring technologies...) have to be adapted to grass. Nowadays the technologies are adapted to the substrate maize silage which can be handled comparatively easy.

Another field of research and development is the usage of more lignocellulosic energy crops which can be pre-treated to make the cellulose better available for the bacteria.....

Biogas plant operators and investors ask for more applied research to optimize the biogas production.

– More training for plant operators

The direct and easiest way to avoid problems and to make it easier to use energy crops is the training of plant operator and persons who want to invest in energy crop projects. They have to know the most important facts about biogas plant technologies, microbiological process monitoring and project management. Biogas plant operators should have a technical, biological and economical background. A good training for plant operators is the basic for an economical and ecological successful biogas project.
II. The biggest problems and concerns in Italy

A. Description of the advisory service:

B. problems and concerns affecting the uptake of the energy crop cultivation and use

Political problems/concerns:

Financial problems/concerns:

Technical problems/concerns:

C. Possible solutions to these problems/concerns:
III. The biggest problems and concerns in Spain

A. Description:

The aim of this report is summarizing the biggest problems and concerns that affect to the production and use of energy crops, based on the gained experience by offering “advisory services”.

The “advisory services” were offered to people and organizations interested for investing in energy crops, mainly to the groups referred in WP4.1 (Center Group, South Group).

The following table includes advisory services offered for promoting the cultivation and use of energy crops, and the services tipology (feasibility study, technical advice, contract drafting, legislative advice)
<table>
<thead>
<tr>
<th>Advisory service</th>
<th>Description</th>
<th>Kind of service</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4.3(1.a)</td>
<td>Pre-feasibility study for selection 30 kW biomass boilers multi-fire using energy crops for 100 new houses (3,000 kW in total) in Madrid and Castilla La Mancha.</td>
<td>Feasibility study</td>
</tr>
<tr>
<td>D4.3(1.b)</td>
<td>Pre-feasibility study of a 300 kW biomass heating boiler for a modern hotel.</td>
<td>Feasibility study</td>
</tr>
<tr>
<td>D4.3(2)</td>
<td>Study for selection of machinery oriented to poplar production in short rotation (2-3 years) and medium rotation (5 years), based on exploring the poplar machinery market and discussions with manufacturers, experts and distributors.</td>
<td>Technical advice</td>
</tr>
<tr>
<td>D4.3(3)</td>
<td>Drafting of 4 different contract models: c1) Before the energy plant construction; c2) A biomass plant administered by a private company; c3) An energy services company “ESCO” offering global service to the consumers for heating and DHW; c4) A maintenance contract for biomass plants.</td>
<td>Contract drafting</td>
</tr>
<tr>
<td>D4.3(4)</td>
<td>Technical advice about the quality characteristics of wooden and herbaceous biomass (including poplar and salix) for potential further use in an electrical combustion plant.</td>
<td>Technical advice</td>
</tr>
<tr>
<td>D4.3(5)</td>
<td>Analysis of the current normative for electrical generation and cogeneration using forest biomass and energy crops, as a tool for economical evaluation of projects that will generate energy.</td>
<td>Financing advice</td>
</tr>
<tr>
<td>D4.3(6)</td>
<td>Pre-feasibility study of a CHP Plant, fed with energy crops and forest wastes (0.6 MWe and 5.6 MWth). This study determines the economic and technical conditions for getting a profitable result.</td>
<td>Feasibility study</td>
</tr>
<tr>
<td>D4.3(7)</td>
<td>Study about the installation of a biomass boiler (1300 kW) in a ceramic industry, replacing the old natural gas boiler currently used.</td>
<td>Business plans</td>
</tr>
<tr>
<td>D4.3(8)</td>
<td>Study of a partial replacement of heating necessities, using a biomass boiler (500 kW) including energy crops in a chemical industry.</td>
<td>Business plans</td>
</tr>
<tr>
<td></td>
<td>Advisory Service offer preparation (meeting with South Group)</td>
<td>Advisory service identification</td>
</tr>
<tr>
<td></td>
<td>Advisory Service offer preparation (meeting with Centre Group)</td>
<td>Advisory service identification</td>
</tr>
</tbody>
</table>

Table 2: Advisory services in Spain
B. Problems and concerns affecting the uptake of the energy crop cultivation and use

Political and legislative problems/concerns:

a.1) From the R&D (Research & Demonstration) point of view investors require to researches detailed information about poplar clones and hybrids, efforts in public and private activities oriented to increase the yield of crop (tn/ha.year), harvest processes, and logistic solutions for the whole chain. These efforts must be concentrated in: efficiency for utilisation of scarce resources (such as water), optimised production regarding spacing/rotation, selection and monitoring of technologies adapted to harvesting and associated logistics, economic energy and environmental equilibria. All these actions require a great support from the public institutions.

a.2) From legislative point of view, RD661/2007 gives bonus for electricity production using biomass. These bonuses are different depending on the type of biomass (forest residues, industry residues, energy crops), the size of the Plant, and the age of it. However, there are not subsidies for establishment and production of energy crops.

On the other hand, thermal plants that use coal (heating) must be replaced with gas/gasoil/biomass technologies since year 2012, so this is a good opportunity to promote the agrobiomass thermal sector.

Financial problems/concerns:

b.1) Contract supply agreements between farmer-energy producer are high time-consuming, farmers are not satisfied with the prices offered by the electrical plant, because the farmers request 80 €/ton with 20% Hbh at Plant site and the electrical plant offers 60-65 €/t. Anyway, the farmers want the big electrical companies to supporting them in the acquisition of new machines for the energy crops production, because the investment to acquire these machines is too high for a single farmer.

b.2) Installation of poplar energy crop, requires a great investment at the initial stage. Rural Banks already offer financing lines for traditional crops: greenhouses, olives, asparagus, irrigation implantation, equipments for traditional agriculture or cattle farming. The guarantees are different depending the devolution period: personal guarantee if the period < 8 years; or mortgage if the period is > 8 years. There are not financing lines for the energy crops production (eg. poplar), but the responsables are openminded to study the further possibilities in a parallel way with the traditional crops: mortgages for purchasing the land, campaign mortgages, plants purchasing.

b.3) To get economic funds using the “CO₂ Credits – CER” and “voluntary agreements - VER” could be analysed.

The countries which had adhered to Kyoto protocol, must reduce their emissions respect the 1990 ones (Spain case). There are several mechanisms: JI (Joint Implementation between industrialized
countries), CDM (clean development mechanism between industrialized countries – country development).

CER credits (CDM) are created in the countries included in Annex II (e.g. Brazil) when a project includes CO₂ emissions decreased (coal electrical plant → combined cycle) and these CERs are bought in the countries included in Annex I (e.g. Spain) where the emissions are higher than the agreed level.

CER and VER can be created in projects where energy crops are produced and that crops are used as primary energy in boilers that previously used coal instead energy crops. This will produce additional income both for the energy plant and for the farmer.

**Technical problems/concerns:**

c.1) Main questions presented from South Group farmers are related to:

- Which poplar clones are the more convenient in one particular geographical area?

- According to the implantation cost and the productivity, which will be the yield (t/ha.year) of the plot during the plantation life cycle (15-20 years) before replantation?

- Which will be the more feasible logistic chain? Based on chips or bundles?

- Which is the more convenient machinery and how much is it?

- For saving costs, can the farmers form a group and share the machinery?

The crop is seasonal, but the electrical plant consumes biomass during the whole year. It is necessary storing for a long time, where is storage more convenient?, how do you storage the biomass?, which will be the storage cost? This operation will require big areas, that will be subtracted from crop zones.

*Opportunity costs, when poplar yield-costs are compared with other alternative crops yield-costs (eg. maize).*

c.2) The Center Group farmers wants to develop the poplar crop with low inputs: low costs and high yield to get a profitable crop without subsidies, in a sustainable way.
Soil preparation (subsoil in order that land get a soft texture in the surface and the root can grow correctly), tops preparation (storages at 4ºC and with appropriated humidity), plantation of tops (different options from 10,000 p/ha rotation 2 years, to 25,000 p/ha and annual harvest), irrigation and fertilization will be controlled reducing the costs, eliminating bad weeds (the gramineas are inconvenient, because they affect to the poplar roots) using motocultor + weeding machine, harvest whole tree (without chipping), storage 3-4 months in order to reduce the humidity up to 20% Hbh, chipping in origin and sending to the plant according to the demand (quantity, quality).

When the application is thermal and the poplar chip presents a good quality (H=20%Hbh) it will be possible to get up to 90 €/t. It is necessary studying the long time prefeasibility, comparing the biomass boiler with other options.

c.3) Some agricultural sectors need innovation, opening to new business. The tobacco sector in “de la Vera” zone (Extremadura) showed some problems: crisis sector, bad-dimensioned small companies, a lot of small drying places, each one was different from the others, so the result consisted on different tobacco qualities and high cost.

The adopted solution consisted on: each farmer (120 farmers) produces the tobacco and harvests it independently, but the remain processes (filling containers, charging drying place, drying, selection, packaging, storage, purchase) are externalised and carried out by a cooperative organisation. The new drying space (secadero) receives the heat from 4 boilers x 1,5 x 10^6 kcal/h and 2 boilers x 1,25 x 10^6 kcal/h, so 9,87 MW, that are filled by olive stone 3 x 10^6 tons (H = 15%, PCI = 4,3 MWh/t), cost of biomass 90 €/t. The savings are about 65% in the fuel cost, and 15% in production cost.

Another option would be burning almond shell and poplar chips (H = 15%, PCI = 4,15 MWh/t). This will increase the poplar demand, which additionally will produce new incomes for tobacco farmers.

One of the biggest problems is initial investment of a biomass boiler, higher than a gasoil or natural gas one. So, it is necessary studying the savings in a long time (5-10 years). Then, the biomass boiler competes with natural gas and gasoil, and additionally the price of biomass per ton is constant.

Other agricultural sectors (ie. tomato, sugar cane) could present some sectorial problems (ie. no competitive, offer-demand desequilibrated), a possible solution could include the installation of poplar energy crop in the agricultural area previously dedicated to other crops.
### C. Possible solutions to these problems/concerns:

<table>
<thead>
<tr>
<th>Problems / concerns</th>
<th>Possible solutions</th>
<th>Advisory service contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few information about more appropriate poplar clones by geographical area</td>
<td>Information, studies and research</td>
<td>Presentations in meetings with South and Center Groups</td>
</tr>
<tr>
<td>Need of efforts oriented to increase the productivity, harvest and logistic</td>
<td>Organization, machinery information</td>
<td>D4.3(2)</td>
</tr>
<tr>
<td>Necessities for farmer-electrical plant agreements about biomass/energy crop prices</td>
<td>Contract information including agreements about price/quality</td>
<td>D4.3(3)</td>
</tr>
<tr>
<td>Difficulty in selecting energy crops machinery</td>
<td>Studies, sharing the machinery</td>
<td>D4.3(2)</td>
</tr>
<tr>
<td>Great investment in the initial stage, how to get economic funds</td>
<td>Financing lines by the Rural Banks, CO2 credits (CER) and Voluntary agreements (VER)</td>
<td>Presentations in meetings with South and Center Groups</td>
</tr>
<tr>
<td>Few information about the yield during the crop life cycle</td>
<td>Information, studies and research</td>
<td>Presentations in meetings with South and Center Groups</td>
</tr>
<tr>
<td>Conditions of storage during the whole life-cycle (location, process, cost)</td>
<td>Information, studies and research</td>
<td>Presentations in National Seminar</td>
</tr>
<tr>
<td>Poplar quality characteristics in comparison to other crops</td>
<td>Advice, information</td>
<td>D4.3(4)</td>
</tr>
<tr>
<td>Poplar production with low inputs</td>
<td>Control for irrigation and fertilization</td>
<td>Presentations in meetings with Center Groups</td>
</tr>
<tr>
<td>Sectoral crisis, opportunity to adopt energy crop projects</td>
<td>Advice, information sharing</td>
<td>Presentations in meetings with South and Center Groups</td>
</tr>
<tr>
<td>Subsidies for using energy crops</td>
<td>Legislative studies</td>
<td>D4.3(5)</td>
</tr>
<tr>
<td>It is necessary making comparative studies about agro biomass – boiler with other options (natural gas, gasoil) for improving the knowledge and stimulating the demand</td>
<td>Advice, information</td>
<td>D4.3(1.a), D4.3(1.b), D4.3(6), D4.3(7), D4.3(8)</td>
</tr>
</tbody>
</table>

Table 3: possible solutions to the problems/concerns
IV. The biggest problems and concerns in Finland

A. Description:

The aim of this report is summarizing the biggest problems and concerns that affect the production and use of energy crops, based on the gained experience by offering the advisory services under the WP4.3.

Benet (Bioenergy Network) Ltd. was subcontracted to carry out offering advisory services in Finland. The offered services consisted of feasibility studies, business concept plans, technical and economic advice (covering the whole production chain), contract drafting, financing and subsidy advice, as well as advice on networking and seeking customers.

The target group for the services were people and organizations interested in investing in energy crops and their processing, upgrading and energy production possibilities. Also, some individuals and organisations that already were in the energy crop business were offered advice on how to develop their activities and solve problems (mostly techno-economic).

Since the reed canary grass (RCG) is the mainly cultivated energy crop in Finland, most of the advice cases concentrated on it. Other, less used crop types were: willow, hemp, and rape seeds and their straws.

The number of advised target groups so far is as follows:
- farmer/producer/entrepreneurs 16
- harvesting contractors 1
- energy plant owners/managers 6
B. Problems and concerns affecting the uptake of the energy crop cultivation and use

Political and legislative problems/concerns:

In Finland, the legislation affecting energy crops is related mostly to 1) the agricultural subsidy policies and 2) general energy and climate policy.

1) The agricultural subsidy policies affect heavily on energy crop cultivation, as subsidies enable economically viable energy crop production and use. Thus problems can arise from the rules that have to be fulfilled in order to be eligible for the subsidies. A good example of this kind of problem is that because of the crop rotation requirements, organically farmed RCG is not eligible for subsidies and thus not economically possible.

In addition, the agricultural subsidy legislation is somewhat complicated and thus advisory services to farmer and entrepreneurs are needed. Also the administration of subsidies is quite heavy, and different interpretations may occur.

2) Energy and climate policy has also a great effect on the use of energy crops. Again, the concerns here are related to different kinds of subsidies and legislation, such as the energy investment subsidies and emission trading.

The investment subsidies are decided by local authorities, and they may have different interpretations of legislation, which can cause uncertainty and reduce investments. This is especially the concern with newer technology (e.g. biogas and crop biomass gasification), where local authorities have little experience and little directions from the ministry responsible for the subsidies.

In large energy plants covered by the emission trading, the differing levels of emission allowance costs over time make it harder to assess the profitability of investments related to energy crop production and use.

As a summary, most of the political and legislative concerns in Finland are related to the subsidies and other political steering instruments, which are needed to make energy crop production and use economically viable. In the future, the feed-in tariffs and taxation schemes will also affect the use of energy crops.
Financial problems/concerns:

Energy crop production and use needs investments, which causes financial concerns and future risks. Also, as stated earlier, energy crop production and use in Finland relies heavily on the subsidies. This is a clearly the biggest financial problem, and future changes in subsidy policies may pose a risk for farming. Also the changing price relations between energy crops and other agricultural products are one concern for the producers, as other products may become more profitable over the time thus posing an opportunity cost.

The financial problems for farmers are in many cases related to either subsidies or contracts for selling their crops. The crops can be sold directly to the energy plant or to biomass fuel supply companies. Some contract models between crop producers and buyers may cause problems especially for the farmers. For example, sometimes energy plants have not been able to use the contracted amount of RCG and the bales are left on the side of the road for months - this posing a problem that the farmers won’t receive their money before the bales are collected.

Many crop producers clearly need advice on the financial issues regarding the subsidies, economic feasibility and contract models - which seem to be their main concerns.

As regards the user side, e.g. energy production and energy companies, the following financial problems were identified. When the energy production is outside emission trading, energy plants have very little incentives to use energy crops because RCG is much more expensive fuel (c. 20 €/MWh), than e.g. peat (12 €/MWh); the high price is largely due to the emission trading, since it boosts the price and demand of biomass fuels compared to e.g. peat (which carries the highest CO2 cost in emission trading). Furthermore, when producing electricity with forest chips, there is a subsidy of 6.90 € per MWh electricity produced - which accounts for 2 - 2.5 € per MWh forest fuels used. This doesn’t apply for RCG, which obviously decreases the profitability its use for CHP plants.

Yet, the emission allowance price is expected to rise in the near future (after 2012) and also the wood fuel price is constantly climbing up as the markets react to the increased demand. These drivers will support use of RCG at least in the larger plants covered by the emission trading.

Technical problems/concerns:

For the RCG users, the main technical problems are related with fuel handling and combustion effects in the boiler. First, RCG needs own crushing and handling systems which mean extra investments. Furthermore, boiler fouling and corrosion may occur as RCG has quite high chlorine and alkaline levels - however this can be fixed with adding peat to the fuel mix. Also, to avoid problems RCG must be harvested in spring when the crop is dryer and ash, chlorine and alkaline contents are lower. These problems and extra investments could be offset if RCG would be more competitively priced.
Another concern is that RCG is not yet a market fuel, as volumes and trade is less developed than e.g. peat or even wood fuels. This reflects to the price and availability. Most energy plants find it easier if the fuel supplier crushes RCG and mixes it with e.g. peat - this way there is no need for separate RCG handling and crushing systems and also the combustion process can be handled better. In the energy plant point of view, this indeed would be the best way to increase the uptake of RCG.

For the energy crop producers, the main concerns stand out usually when starting the cultivation of energy crops. Especially the soil suitability is one of the first questions, which will limit the potential of producing energy crops. In many cases, the cultivation procedures and methods are handled quite well (at least for the RCG), as the ProAgria rural advisory centres work actively to spread the best practises. The mowing and harvesting rises more questions, such as: whether to use conditioner with mowing, what method to use (bale or loose harvest), and whether to invest in machinery or where to get contractors to mow and harvest and how much will it cost.

Some producers have needed technical advice on the possibility of processing (usually briquetting), however most RCG farmers sell their crops as bales to a fuel supply company or straight to the energy plant.

As mention earlier, sometimes energy plants have not been able to use the contracted amount of RCG and the bales are left on the side of the road for months. Along with the financial problem for the producer, there is the technical issue that the quality of fuel can lower if the bales lie in the side of field/road for a long time (months).

C. Possible solutions to these problems/concerns:

a) Political problems/concerns

This set of solutions is related to policy development needs, such as more clear and flexible agricultural subsidy rules and more consistency and better knowledge for local administration on energy subsidies. As for new legislation, the use of energy crops could be supported with feed-in tariffs and taxation schemes. Generally, the policy and subsidies should clearly support RCG and other energy crop market development towards larger volumes and a clear and steady price, creating stability for both producers and users.

b) Financial problems/concerns

There are little possibilities for energy crops such as RCG to become economically viable fuel option without subsidies - except large taxation or price changes that would drastically change the price relations between energy crops, peat, wood fuels and fossil fuels. Thus keeping a steady subsidy and taxation policy to minimize the financial risks from policy changes for energy crop producers and users is vital - as also stated in the previous point.
For producers, contract models that minimize the risks of the crops not being bought or collected by the energy plants or fuel supply companies should be promoted. Also advisory services on the financial issues and risks are important.

For users, the financial problems are mostly related to fuel price relations and their implications on the profitability of energy production investments. Thus the above mentioned subsidy and taxation policy solutions are strongly linked to these concerns.

c) Technical problems/concerns

The user side technical problems can be avoided with boiler and plant designs that are suitable for the energy crop fuel qualities (high chlorine and alkaline levels). Also good availability of fuel mixes including peat, wood, and energy crops is a good solution for the technical problems on the energy plants. Most energy plants find it easier if the fuel supplier crushes RCG and mixes it with e.g. peat - this way there is no need for separate RCG handling and crushing systems and also the combustion process can be handled better. In the energy plant point of view, this indeed would be a good way to increase the uptake of RCG in several plants. Another issue is that as RCG and other energy crops are quite new fuel type, there are very few energy plants designed for their use, thus creating problems and extra costs when introducing RCG in the fuel mix. If the availability and position of energy crops as a market fuel is strengthened, this could lead to a situation where their use is better considered already when designing new plants and boilers.

The major producer side solutions would be good advice and planning when starting energy crop production, and a good availability of reasonable priced contractors for mowing and harvesting - or - forming groups of RCG farmers who would jointly invest in the needed equipment. Also more and better equipment for processing to higher fuels, e.g. briquetting, would increase the uptake of energy crops. This way, also the smaller plants could utilise the crops more easily.
V. The biggest problems and concerns in Germany

A. Description of the advisory service:

GERBIO has been doing advisory services such as feasibility studies, on-site meetings, business plans, contract drafting, schoolings, conferences, seminars (...) for many years. As a result, GERBIO has been gaining a lot of consulting experiences in the biogas and energy crop industries so far.

As independent and non-profit making association, GERBIO promotes and distributes the sustainable generation and use of energy made out of organic mass. Our principal goal is to organize the entire cycle of production and usage of bio-energy, starting with the production of organic biomass and bio-energy, up to the recycling of residual materials, within the framework of economically, ecologically, and socially acceptable and effective means. We do this through professional conferences, training courses, consulting, and the active design and use of networks.

During the ENROP project, GERBIO offered a few feasibility studies to advice about the sustainable utilization of energy crops. GERBIO discovered no new facts or problems but together with GERBIO’s long time experiences from other advisory services, one could see some of the biggest concerns affecting the uptake of the energy crop cultivation and use. Many problems have been already solved in the past 20 years. Biogas from energy crops is nowadays widely used in Germany.

The main target group for the services were people and organizations interested in investing in energy crops and biogas production. Most promising has been the contact to farmers during the organisation of ENROP events in Germany. In addition, some individuals and organisations were offered advice services.
B. Problems and concerns affecting the uptake of the energy crop cultivation and use

Political problems/concerns:

To start with a general problem, as in many industries, manufacturers like to sell more products and machines than clients really need. This appears initially helpful for the uptake of the energy crop cultivation and use, but in the end, also buyers of biogas installations get frequently larger plants than originally planned or required.

Some manufacturers certainly try to maximise their profits by selling bigger plants with the German feed in law as a marketing instrument. It appears for many people like a licence to print money, since it offers a secure income and the income rise with the installed electrical power. The more electrical capacity one installs the more income by the national feed in law will be generated. But manufacturers often overuse this concept by finding gaps in the feed in law.

On the one hand, the secure compensation fee guaranteed by the EEG law promotes actually quite successfully renewable energies and acts like a stimulation program for the rural economy. On the other hand, the EEG scheme even makes many investors to believe that they could easily build and run a biogas plant. GERBIO’s experiences show that biogas is quite a challenging business.

![Graph showing installed electrical capacity (red line) and number of biogas plants (yellow columns)](image)

*picture 4: installed electrical capacity (red line) + number of biogas plants (yellow columns)*
The recent development with stable compensation fees for electricity from biogas leads to the expected effect that the operators could gain a higher income in comparison to selling traditional goods on the agricultural market for less and less money. Especially agricultural buyers are open for the thought of gaining more income by doing less work on the fields and by building larger plants. The EEG has been misused even sometimes. As a result of searching for gaps in the EEG, the law is getting much more complicated every four years.

Future investors even fear possible extra large cuts in the compensation fee like it just happened in the German photo-voltaic industry. Fehler! Verweisquelle konnte nicht gefunden werden. shows the context of installed electrical power (red line) and number of biogas plants (yellow columns) in Germany. Especially since 2004, one can see the trend to larger plants in comparison to smaller plants in the beginning. GERBIO refers this development of bigger dimensioned plants not only to the technological progress, but also to maximise the profits of the manufacturers.

![Cultivation of renewable resources in Germany](image)

**picture 5: area under cultivation in Germany**

However, the usage of substrates like energy crops is constantly rising with the climbing number of large plants. Although GERBIO supports the overall economic effect that more and more energy is produced by biomass, the rising use of agro-biomass could be also disadvantage in single cases. E.g. some farmers have to cultivate much more than one was used to deal with. That means that the plant operators have to extend their agricultural areas or depend on external suppliers.

Farmers are not any longer producers of agricultural products, they act nowadays more and more as energy crop suppliers and make themselves dependent on long-term contracts. 6000 farmers act as suppliers in Germany, saving the future of rural farms. Further, farmers could even work more than...
before and in this way not profit from compensation fees. This development is changing agricultural structures.

Further problems are caused due to the rising demand for energy crops. Missing public acceptance is most importantly to name. Many people still believe that biogas plants leads to new competing situations for cultivation areas or maize monocultures in some special regions nowadays. In contrast, agricultural statistics show only a small proportion of today’s maize plantation in transformation regions for agriculture products. The cultivation of maize for livestock feeding accounts up to 50 per cent on agricultural areas in those regions.

Finally, it is difficult to run a biogas plant entirely by one substrate from energy crops. If one does not use further residual material like manure, the biogas process can easily stop due to a missing buffer capacity for acids. The silage from energy crops has a high pH value and acidify by the absence of micronutrients.

Financial and Technical problems/concerns:

From GERBIO’s point of view, technical problems/concerns are linked to financial difficulties and vice versa. Many technical and financial troubles in the biogas and energy crop industries result by refusing and even avoiding profound preliminary information by neutral experts. GERBIO can confirm that many future biogas plant operators as well as energy crop suppliers do not search in deep "advisory services" from independent experts before buying from a manufacturer.

Agricultural investors believe and hope to save costs by going directly to a manufacturer in the first place to buy a biogas installation. In many cases, the next best company is being chosen. Additional independent information is taken only into account, when the bank or financial investors insist on schooling, biogas trainings or independent feasibility studies. GERBIO experienced that just the minority of farmers is seeking and investing in profound information before building a plant.
As a consequence of this, it is often the case that biogas plant operators without a profound schooling and pre-informational training are discovering higher costs and facing unexpected problems by misusing the biogas installation. GERBIO notices in such cases, that during building and running a plant more problems accrue finally. However, more accidents as well as break downs than the average could happen.

GERBIO takes the view that not the farmers but mostly the manufacturers benefit from this situation. Our association sees again and again that components of biogas plants have much shorter life time than originally claimed by the producer. In the end, this leads to higher maintenances costs and is economically less efficient.

It happens quite often that input substrates like energy crops are not really efficiently used and energetic losses are taken into account until less biogas is being produced considerably. Such losses could happen during harvesting, transporting or storing. Due to bad logistic, many larger plants run out of substrates and have costly to carry energy crops with a low dry matter over long distances. If the energy crops are not correct ensilaged, energetic losses are inevitable.

It might happen that the costs afterwards are three times higher than during the construction. Some plant operators report that they even would not have built the biogas plant, if they had known the difficulties before.
C. Possible solutions to these problems/concerns:

More profound information, clarification or training can solve certainly the problems and concerns explained above. There is an enormous need for independent and in deep advisory services to avoid complicated maintenance and higher costs during and after installing a biogas plant.

GERBIO has been experienced that a lot of people does not know much when it comes to biogas production and energy crop cultivation. For those who are working in the biogas industry this kind of ignorance is naive and very costly at a later date.

Avoidable mistakes should not be repeated over and over again. They happen furthermore although countless consulting services for biogas are offered. One could receive plenty of information for free, because many public financed biogas services exist. But gaining important insider tips and independent facts cost either some money or some time.

To have much more economically and ecologically efficient biogas plants in the future, GERBIO claim to extend the in deep information, training and knowledge among users and operators. In that context, a lot of situations could be much more easily solved. But, there must be a broader acceptance to adopt information about biogas in general and even more there must be the wish for consulting independent experts before and during the operation of a biogas plant.

This could be simply done by supporting and offering more detailed training courses, study tours, operator’s meetings, talks or advice services from independent biogas experts. However, it is much more difficult to change the farmer’s minds on paying for information that they could seemingly get for free by consulting directly a manufacturer for biogas plants. One particular solution might be on the one hand, to require schoolings and certifications for operators by independent biogas institutions. But on the other hand, this could make the regulations for biogas installations like the German national feed in law (EEG) even more complicated.

The EEG has been a good promoter for renewable energies. This concept is successfully transferred into other countries and should be further optimised. However, manufacturers use a shorter life time of plant components to make some profit from the compensation fees. If the components have to last longer as required in practice, the plants will become too expensive for investors and the compensation fee has to rise significantly. But a higher compensation fee is not easily political achievable. Anyhow in the long term, produced electricity from energy crops through biogas has to compete on the free market and can not have official guaranty provided by the EEG for ever.

One could summarise, that making profit from biogas requires optimal pretreatment, hydrolyse, logistic and storage. Without a well-thought-out production chain with those elements considered, energy and also money are wasted inevitable. The energy content of biomass substrates has to reach the digester without any large loss. Further, the technical components must work; especially stirring units or transport screws have to be looked at.
Another central and common problem for the stable biological process is a buffer capacity for acids. Many farmers want to produce as much as energy from biogas as possible and overfeed their plants with acid energy crops without having or even controlling the buffer capacity. Therefore, GERBIO recommend using residual materials like manure wherever applicable to avoid stopping the biogas process.

Beyond that, the cultivation of energy crops has to be optimised. Other crops as up to now could be used in the future. There are field tests with sugar-beets, miscanthus and other plants ongoing to reduce maize monocultures in some regions. But since the number of biogas plants mostly depends on the quality of the agricultural area, maize could even be a further option for the cultivation in some other regions.
VI. The biggest problems and concerns in Sweden

A. Description of the advisory service:
This is a summary of advisory services provided by SLU BTK and experiences in researching as well as promotion energy crop cultivation and use.
Our advisory services include mostly feasibility studies and technical advices

B. problems and concerns affecting the uptake of the energy crop cultivation and use

Political problems/concerns:
Taxes and incentives for reed canary grass are not supportive to farmers.
Education and research programs for increasing the knowledge has not been effective

Financial problems/concerns:
Prices of raw material (biomass) is low.

Technical problems/concerns:
Harvest loss is high
Compressing of raw material and handling techniques is unsatisfactory.
Combustion technologies for ash-rich fuel need to be developed.

C. Possible solutions to these problems/concerns:
VII. Index of pictures

picture 1: development of the biogas plants in Austria ................................................................. 3
picture 2: fluctuating energy crop prices ......................................................................................... 4
picture 3: cycle of production and usage of biomass ..................................................................... 20
picture 4: installed electrical capacity (red line) + number of biogas plants (yellow columns) ... 21
picture 5: area under cultivation in Germany .................................................................................. 22
picture 6: trainings for biogas plant operators .................................................................................. 24

VIII. Index of tables

table 1: advisory services in Austria .................................................................................................. 3
table 2: advisory services in Spain ..................................................................................................... 10
table 3: possible solutions to the problems/concerns .................................................................... 14
IX. Encrop partners:

Jyväskylä Innovation Ltd  
Ms. Tytti Laitinen, coordinator  
P.O. Box 27 (Piippukatu 11)  
40101 Jyväskylä, Finland  
tytti.laitinen@jklinnovation.fi  
www.jklinnovation.fi

ETA Renewable Energies  
Mr. Maurizio Cocchi  
Piazza Savonarola 10  
50132 Florence, Italy  
maurizio.cocchi@etaflorence.it  
www.etaflorence.it

German Society for sustainable Biogas and Bioenergy Utilization  
Mr. Dominik Dörrie  
Am Feuersee 8  
74592 Kirchberg / Jagst, Germany  
d.doerrie@biogas-zentrum.de  
www.fnbb.org

ESCAN - ESCAN, S.A.  
Mr. Margarita Salve  
Avda. El Ferrol, 14-B3,  
28029 Madrid, Spain  
escan@escansa.com  
www.escansa.com
Swedish University of Agricultural Sciences
Unit of Biomass Technology and Chemistry
Mr. Shaojun Xiong
P.O.Box 4097
90403 Umeå, Sweden
shaojun.xiong@btk.slu.se

BOKU - University of Natural Resources and Applied Life Sciences, Vienna
IFA-Tulln
Mr. Wolfgang Gabauer
Konrad Lorenz Str. 20
A-3430 Tulln, Austria
wolfgang.gabauer@boku.ac.at
www.ifa-tulln.ac.at

AEBIOM - European Biomass Association
Mr. Peter Rechberger
Croix du Sud 2 bte 11
1348 Louvain-la-Neuve, Belgium
rechberger@aebiom.org
www.aebiom.org

MTT - Agrifood Research Finland
Mr. Timo Lötjönen
Tutkimusasemantie 15
FI-92400 Ruukki, Finland
timo.lotjonen@mtt.fi
www.mtt.fi
<table>
<thead>
<tr>
<th>Partic N°</th>
<th>Participant name</th>
<th>Country</th>
<th>Partic N°</th>
<th>Participant name</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JI - Jyväskylä Innovation Ltd, co-ordinator</td>
<td>Finland</td>
<td>5</td>
<td>BTK SLU - Swedish University of Agricultural Sciences; Unit of Biomass Technology and Chemistry</td>
<td>Sweden</td>
</tr>
<tr>
<td>2</td>
<td>ETA – Energia, Transporti, Agricoltura srl</td>
<td>Italy</td>
<td>6</td>
<td>BOKU - Universität für Bodenkultur Wien</td>
<td>Austria</td>
</tr>
<tr>
<td>3</td>
<td>GERBIO - German Society for sustainable Biogas and Bioenergy Utilization</td>
<td>Germany</td>
<td>7</td>
<td>AEBIOM - European Biomass Association</td>
<td>Belgium</td>
</tr>
<tr>
<td>4</td>
<td>ESCAN - ESCAN, S.A.</td>
<td>Spain</td>
<td>8</td>
<td>MTT - Agrifood Research Finland</td>
<td>Sweden</td>
</tr>
</tbody>
</table>

Universität für Bodenkultur Wien
Department für Agrarbiotechnologie
IFA-Tulln
Institut für Umweltbiotechnologie
www.ifa-tulln.ac.at
Austria, Tulln 2010