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10. Sustainable investment decision making for Biogas plants in Hungary and the utility cost reduction measure

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This study attempts to biogas plants for combined power plus heat and bio methane production the decision making process. The second part will present the licensing process of biogas plants. I will take all aspects of investments into account. This will be the macro economical aspects like inflation for different products used for or complementary to biogenic processes in biogas production. Furthermore, the study will shows different investment calculations based on feed in tariffs, EU investment incentive schemes and the utility cost reduction masures by the Hungarian government. The third aspect for the investment decision will be the licensing process and the costs for the facility costs itself. This will calculated on a sample biogas plants which are a small and a middle size facilities. The study is complex, the investment decisions must be well based, as the plants are running over decades. The administration process of biogas plants is also a larger issue, as the legal background of renewable energy is about to change permanently in recent years. This aspect makes the study actual and the legal changes are absolutely necessary take into account.

Keywords: decision making process, investment biogas, bio-energy, biogas, renewable energy in Hungary, utility cost reduction

1. Introduction and Background

The social and political aspirations of a sustainable energy grew stronger in recent years. Due to the adverse environmental impacts of climate change and dwindling fossil fuels. "Renewable energy" is the buzzword - it will in future replace conventional energy sources. A special role plays the power generation from biomass, particularly illustrating the biogas production is a promising form of energy (Kaltschmitt–Hartmann 2001). Where the economic and environmental benefits of biogas production are evident: for planners, producers, installers and operators of biogas plants offers a wide range of activities. In particular, for agriculture open up new sources of income as "energy industry" or as producers of energy crops. Contributes to the production of biogas to conserve natural resources and a decentralized energy supply. The aim of this case study is the preparation of an investment decision between two mutually exclusive investment alternatives in terms of agricultural biogas plants. The Hungarian energy market is in the course of their accession to the European Union (EU) been fully liberalised. The major providers are government owned MVM and MOL, they have still a dominant influence on the market. From more characteristics of the Hungarian energy market are the distinct dependence on imports and the low energy efficiency in European comparison. Natural gas is in a proportion of about 43% (2009) of the total primary energy consumption of the most important energy source in Hungary. Renewable energy plays of primary energy supply not a significant role. According to a study WWF, the share of renewable energy in primary energy consumption in 2008 5.6%. The IEA and the MVM indicate a value of less than 5%. Structure of energy sources in electricity generation in the last years on averge 21.8% on gas (Statistical office: KSH).

The domestic production of primary energy sources in Hungary is continuing steadily. During 1990, she was 48.5% and in 2000 at 44.26%, the resulting Figures for 2003, in-house production of only 35.6%. This becomes particularly clear the increasing dependence on imported oil and natural gas: in 2003, the Import quota of natural gas at about 80 percent of oil and oil products at 86 % (Eurostat). This factors shows that the there is further a need of decentral and local energy generation in Hungary.

In the case study the farmer as an investor is faced with the decision to build a small 150 kW system for the exclusive fermentation of manure and solid manure from on-site dairy farm, or in a larger 500 kW system, which in addition to the renewable resource "corn silage" codigestion to invest. The decision in the sense of economic evaluation is to take place by means of selected monetary investment calculation method and a non-monetary cost-benefit analysis. Essential data of this study are based on the German Association for Technology and Construction in Agriculture (KTBL) publish laboratory values and test results.

In Hungary the dataset is not given in the deepth as in Germany, but the Central Statistic Office (KSH) publishing about the subject. These are found in practice with a lot of attention and include physical, technical and business information. Under an investment is the use of capital, ie, the longer-term bond funds understood in assets affected Becker (2009), Hoffmeister (2008). In case of biogas investment is especially the procurement of balance sheet assets (fixed assets as non-current assets as opposed to short-term working capital) with production of useful way. Formally, the investment can be defined as cash flow, the first begins with an issue and draws a future benefit or net income by itself (Blohm et al. 2006), Seicht 2001, Walz–Gramlich 2009). Also the types of investments in intangible investments (concessions, patents, licenses) capital investment (land, buildings, machinery) and financial investments (investments, securities) can be classified.

Investment decisions have a significant impact on the success or failure of the company, because it usually has a high and long -term capital commitment (Blohm et al. 2006). Because of the associated long-term consequences and regular impact on other divisions, it requires intensive preparation in which the later consequences of the respective investment alternatives carefully evaluated possible werden (Kruschwitz 2000). The investment decision always implies an assessment of the profitability of an investment. Is directed to a single project investment, it is the absolute advantageousness. If at least two investment alternatives evaluated, the relative advantage is considered. If it appears that an investment alternative as relatively advantageous, it may nevertheless only be realized if also given their absolute favorability. The decision on the profitability of an investment alternative based on a certain (subjective) objective of the investor (Walz–Gramlich 2009). Unter objectives are understood as desirable to seeing future states that will occur as a result of certain behaviors (Kruschwitz 2000). To find out which of several investment alternatives, the best, the goals must be operationalized, i.e. it requires a clear definition of objectives in terms of a clear, understandable and differentiating description (Kruschwitz 2000). It has usually several goals, it makes sense to bundle target set (target systems), which consist of monetary and non-monetary goals. These will be described in more detail in the following chapter.

In many cases a single farmer, single individual investor or even a group of investors is not capable of financing the whole project by equity capital. Therefore, borrowed capital, EU subvention or subsidy is essential for the implementation of a biogas plant. Common financing methods are credits from private banks or state owned banks. Traditional loan financing is the most common way of receiving borrowed capital from banks. This form of financing is not just used for major investments, as they are regularly needed within biogas projects, but also covers many smaller private loans. The bank or state owned subsidy office checks the financial background of the borrower in order to decide on the reliability and risk of the engagement. Of particular interest for financial institutes are securities in case the project fails. Such securities may consist of estate, components of the biogas plant, private – and company asset, and all other assets that cover the loan sum. Furthermore, the prospects of success of the project are analysed. The prospect and decision making of biogas projects in Hungary will be deepen in the second section of this study. As example, in Germany the duration of loans for biogas projects as well as the number of grace years is strongly dependent on the prerequisites of each particular biogas project. However, regular loan and subsidy periods with fixed interest rates and feed in tariffs are about 15 years and typically one or two grace years are granted for the starting up phase for the loan.

2. Monetary objectives

Monetary targets have the advantage that they always can be quantified and can be simulated by means of static and dynamic investment calculations over non - monetary goals (Kruschwitz 2000). The most important monetary target is the long-term gain. It may in assets struts (Valuemaximizing) and income aspiration (removal maximization) are divided regularly. Assets pursuit aims at a maximum assets at the end of an operation period, which can be calculated using the net present value. Finally, the net present value brings the increase or decrease in financial assets at a given rate of return in terms of value relative to the beginning of the planning period (Blohm et al. 2006). Income struts aims to maximize the removal of each period, which can be quantified with the annuity. The annuity is a profit ratio that reflects the periodic success. As a further monetary goal the maximization of return can be set and it is measured on the basis of internal interest rate methods.

The following specific objectives for the investor farmer are to define:

- Capital value € 1 million at a discount rate of minimum 5 %;
- Income (annuity) of at least € 100,000 or 30.000.000 HUF a year;
- Profitability of at least 10 % and internal rate of return of at least 5 %.

The achievement of the non-monetary objectives is checked outside of the capital budgeting process by means of a cost-benefit analysis. Under non- monetary objectives utility values are understood to be quantified not based on incoming and outgoing payments and bring the subjective perception of the investor's specific demands on the virtue worthy investment alternative to expression (Seicht 2001). The investor pursues here the following non-monetary goals that are legal, environmental and technical nature:

- Warranty period for the plant of at least four years;
- Bureaucratic approval procedures;
- Advantageous properties of the digestate;
- Positive record;
- Process stability;
- High degree of automation.

As already indicated, biogas is particularly distinguished by its variety of uses. It is designed to support preparation and injection into natural gas networks not only as fuel and natural gas substitute, but CHP can also be used to generate electricity and heat generation using combined heat and power in cogeneration plants. The obtained electrical and thermal energy can be fed into supply networks and self-consumed. Typical areas of use for the biogas-generated thermal energy are in farms feeding into a district heating network to heat residential and commercial buildings as well as stables and animal breeding places and the hot water supply Kaltschmitt–Hartmann (2001). In Hungary, a large potential of biomass for energy production is given. It is important to distinguish between the potential of the forestry sector and the biomass potential from agriculture. In general, the potential assessment should be evaluated very carefully. While the wood potential is largely exhausted, the biogas potential is only about 10%. Hungarian agriculture provides good opportunities to increase the biogas sector. 57% of the country occupy agricultural land. Each year 14 to 15 million m³ manure to fall in livestock farming as well as 300,000 tonnes of slaughter waste that can be recycled and disposed of in biogas plants. To the agricultural waste sludge coming from the municipal sewage disposal. This is to be expected in the future with a larger volume. Agriculture can use brownfield sites for the cultivation of energy crops such as rapeseed or sunflower. For this sequence using the farmers can again take EU subsidies. The highest methane content in the biogas obtained the substance group of proteins with 71% Fats provide a gas with a methane content of approximately 68%. The worst performers from carbohydrates, with only 50% methane content (Eder–Schulz 2006).

3. Planning of Biogas project decisions

In general there are many objectives to cover by the decision making for a large investment like a biogas plant. They are the energy prices in short and long term, Industry structure: Share of renewable energies and policy objectives, economic arguments pro and cons, Feed-in tariff, Green Certificate Mechanism revenue, Agricultural Potential, Biomass potential, Income from sales of electricity and heat, Approval procedures for Biogas plants, Subsidy schemes, Partners, Concluding long-term supply contracts. Based on a German KTBL calculation, we set our starting point is an existing agricultural operation from the definied sample farmer investor which has (sole proprietorship) with 320 cattle for the dairy farm. The obtained in the dairy cattle manure (slurry and solid manure) to be fermented in each case in a still to be constructed agricultural biogas plant. The biogas produced in the plant is to be converted in each case by means of combined heat and power in a connected CHP heat and electricity. The electricity will be each entirely fed into the power grid. For the use of waste heat utilization is a concept which provides to heat the houses and farm buildings with a total floor space of 1,000 m2. The digestate is to be sold as a high quality fertilizer to agricultural customers. The investor faces the following investment alternatives:

1. Alternative: The first investment alternative only manure and solid manure is fermented from the cattle. In this respect, a small biogas plant will be built with an installed electrical capacity of 150 kW.
2. Alternative: In the second investment alternative the establishment of a much larger 500 kW biogas plant is being considered. The background is the idea that the co-fermentation of renewable raw's because of their higher biogas and methane yield is often more economical than the exclusive fermentation of manure. In view of these investment alternatives, it is now exactly match the dimensions of the major system components on the proposed substrate volume and its gas yield. Only by a full utilization of all system components can be ensured later the efficiency of the systems. To determine the annual manure and manure volume of livestock on the farm in standardized livestock units (LU) is converted (Anspach 2010). After the conversion of the key KTBL result from 320 cattle of different ages. The livestock unit has an annual manure seizure of 20 tons and an annual Mista case of 11 t to be expected (KTBL 2009). In the second alternative also 7,000 tons of silage maize to be purchased from a neighboring farmer and used for co-fermentation.

4. Financing of Biogas plants

Interest in the construction of biogas plants have before the one the suppliers of input material. Therefore, they can also act as investors of the project. Hungarian banks yet gained no special expertise in the field of financing of renewable energy projects. At most, the OTP Bank identifies himself as a specialist in this area, but comes only as a partner in major projects in question. The OTP is based on its own information on the time and know-how can use the experience of the DZ Bank Group. It comes as a partner for small projects in question is represented by the savings cooperative banks heavily on location fundamental problem in the search for investors, however, is the political uncertainty of the grant of the feed in tariff. A fully secure financial planning can therefore be in the long run not so deterred many investors. Project financing in general is intended to finance a very particular investment which is repaid by its own cash flow. The financing bank makes its decision on the loan in the first place on the estimated cash flow of the project. In contrast to conventional loan financing, the financier usually has little or no access to private or company capital. In case of financing a biogas project, the financier’s investment is secured by the estimated cash flow of the plant selling electricity, the plant components and by the property of the plant site. Prerequisite to achieve project financing is the formation of a dedicated biogas project company. Project financing provides considerably higher risks for financiers than conventional financing, since the loan can only be repaid when the project is operational. Therefore, banks are interested in minimizing potential risks. All aspects of the project are analysed very carefully. This leads to increased administrative work for both parties. The investor has to prepare all project documentation in high detail. This procedure can be considerably time consuming. Advantages and disadvantages of project financing structure:

+ The investor is not liable with private asset in case of project failure.
+ The financial institute helps identifying and allocating potential week points of the project.
+ It does not matter, how many people join the project company. Thus, a consortium of farmers can jointly operate a biogas plant.
+ Capacity for further loans is not constrained, as private estate is not charged.
− High administrative complexity.
− A project company has to be founded.
− Not every bank provides the option of project financing.
− Interest rates might be higher.

Acquiring leasing partners is a frequently applied method for gathering equity capital for a biogas project. Leasing is characterised by the distinction of plant constructor (leasing company) and plant operator (lessee). The leasing company constructs and finances the plant by company capital or equity capital from leasing partners. Afterwards the company leaves the plant to the lessee who has to take the risks of operation. The lessee keeps all revenues from the operation of the biogas plant but has to pay leasing rates to the leasing company. After the contract expired, the lessee can either buy the plant corresponding to its residual value, or the leasing company has to remove it.

Advantages and disadvantages:

+ Leasing partners provide expertise in biogas plant implementation and operation.
+ External investors have the opportunity to join the leasing company.
+ Farmers with low equity capital have the opportunity to operate a biogas plant.
− The leasing company does not have direct influence on the operation of the plant. Thus, success or failure of the project lies in "someone else's hand" (lessee).
− After the contract expired, the biogas plant might have a considerable residual value, which makes removal uneconomic for the leasing company.

5. Decision making process, main drivers

Due to the opening of the Hungarian energy market, the Hungarian energy prices reflect realistic market prices. According to the price index for energy costs of the Austrian Energy Agency (EVA), energy prices for households and industry in the period 1995 to 2001 have increased substantially (for households by 130% to 150% for the industry). After the price of electricity from 1985 to 2008 more than doubled, is for industrial power users now have a slight decrease in electricity prices expected, while the price of homes will continue to rise.

After the input in the form of substrate amounts and the dimensioning of the biogas plant alternatives are fixed, now, a quantitative yield and subsequent investigation proceeds held in terms of the output. This is in electrical energy (electricity), and – as a by-or co-products – in thermal energy (heat) and digestate, Anspach (2010). A meaningful utilization of the end products is also essential for economic production of biogas. The current revenues are made up of the feed-in remuneration for the electricity produced from the cost saving for the used amount of heat and of the achievable selling prices for the heat produced. In order to later be able to determine the produced electricity and heat, the first biogas and methane yield in the fermentation must be known. This is substrate specific, depends on the respective organic dry mass fractions of the substrates and can be calculated according to the KTBL. In the following we take the methane yield for the 150 kW plant in the amount of 303 724 Nm3 and for the 500 kW system results in the amount of 1,049,854 Nm3. 1 m3 of methane has a heating value (gross energy value) of 10 kWh. Hence the approximated gross annual amount of energy (kWh) in the amount of 3,037,238 kWh and 10,498,538 kWh.

Regarding the EU policy objectives the Hungarian government has to increase the share of renewable energies in the total energy production by 2010 to increase to 5%. Long term, the EU funds will reach 12%. This goal is, among other things, by the requirements of EU directives in the field of renewable energy (Directive 77/2002), the environment and security of supply. As the reserves of its own fossil fuels are estimated to be very low, which is as yet little used bioenergy potential should be better exploited. In this way, the increasingly pronounced dependence on imports is reduced. Furthermore, the development of bioenergy in the interests of the Hungarian government, since the cooperation with suppliers biomass as agricultural and forestry enterprises maintain employment in rural areas or created.

Biomass biogas plants or to offer to the wind energy as compared to the advantage of uniformly to generate power. This leads, for example, compared to wind power at lower power and control costs. From distributed generation and degradation of energy in turn accounts for high net development or maintenance costs, and transport losses in the network. In rural areas especially, the biogas plant can also be used to process agricultural waste such as manure or municipal sewage sludge and reduce the cost of disposal. Overall, it is desirable both from the political side as well as from a purely economic point of view, a further expansion of bioenergy in Hungary.

For German suppliers of modern technology offers therefore a larger market. The Economic and Transport Ministry drafts the policy and regulatory environment in Hungary and settled in this manner determine the long-term energy strategy. The essential task of the Ministry the annual determination of energy prices (electricity and gas). The Hungarian Energy Office, the Hungarian Energy Office performs the function of a regulator in the Hungarian energy market. Under the supervision of the Authority are the electricity and gas sector, monitoring the quality of public services, the granting of licenses and the provision of consumer protection. On behalf of the Ministry of Economy and Transport Authority designs the working principles for the design of national energy policy. The Hungarian Energy Centre (Energia Központ Kht.) (see contact list), the Hungarian Energy Centre (Energia Központ Kht) coordinates national and international support measures for the introduction of renewable energy sources and to increase energy efficiency. Among since EU accession also includes the funds from the EU Cohesion Fund. In addition to providing information regarding subsidy leads the energy center of a national energy statistics and publishes information brochures on general energy issues. Electricity Act (Act CX of 2001).

The regulations for the supply of electricity from renewable sources is defined in the Electricity Act (Act CX of 2001 on electricity completed with the Governmental Decree 180/2002 (VIII. 23.) on the enforcement of it). Under this law, the supply grid operator MVM Ltd., obliges electricity from renewable sources, independent power producers, which is produced by plants with a capacity of 0.1 MW to decrease. If the system is not connected to the transmission network of MVM Ltd., the compensation granted by the regional distribution system operators Édász, Demasz, DEDASZ, Titász, ELMU and EMASZ). The purchase price is determined in accordance with Decree 56/2002 (XII. 29.) GKM by the Ministry of Economy. The price is adjusted annually by the inflation rate. In 2003 was at 24 HUF / kWh (about 9.26 EURct) for electricity for peak loads and 15 HUF / kWh (about 5.78 EURct) for electricity to cover basic loads. This gives an average payment of 17.41 HUF / kWh (6.6 EURct). This scheme retains initially to 31 December 2010 its validity.

A major criticism of this scheme is the lack of predictability and the uniform grant of compensation, regardless of the renewable energy source. In addition, the amount of compensation deemed insufficient. Besides the guaranteed feed-in price, there is a Green Certificate system in Hungary. According to the statutory scheme, a certificate system for renewably generated electricity is introduced. HEO certified producer of green electricity this can for each produced unit power output a corresponding certificate. Electricity consumers are bound to end u p a year to seize a determined percentage of their electricity consumption with such Green Certificates. This can directly relate the power producers or buy on a set up market. For the producers of renewable electricity is obtained through the sale of allowances a source of revenues. The calculation of the by-products as quantitative output size is important in that the fermented substrate amounts can be sold as high-quality, nutrient-rich fertilizer to agricultural customers. The nutrients do not go through the fermentation that is lost, but are rather highly concentrated as digestate and odour in flowable form. The digestate can extent a conventional and polluting fertilizers (Eder–Schulz 2006). The value of the digestate fertilizer depends not only on the amounts of its nutrient content (N, P, K) and the current nutrient prices. Also taken into account minor treatment costs a fertilizer proceeds of 2.00 € / m3 can be recognized.

In the agricultural sector, personnel costs are to be brought to approach as wages and non-wage labor costs, ie variable costs. While the system support comprises essentially routine work such as operating checks, maintenance and fault fixes, as well as office work in terms of data collection and organization, the substrate binds Management working hours for the feeding of the plant and for the processing, storage and dosage of the substrates used (Koch 2009). In principle, the time required for the operation of a fermentation plant of the operational concept, size and the substrates used depends. In general, in agricultural biogas plants – as opposed to waste fermentation plants that require multiple full-time employees – one to five hours a day sufficient are. In the literature, the view is uniformly represented that with increasing size of the system also increases the level of automation, which is a decrease of care burden result (Eder–Schulz 2006). In the literature, the view is uniformly represented that with increasing size of the system also increases the level of automation, which is a decrease of care burden result. Due to the high technical requirements to work in a biogas plant, a high claim should be placed on the qualifications and reliability of the staff, which would appear justifiable an hourly rate including all non-wage costs of 5 € / h (Koch 2010). In the larger biogas plant, a higher workload than the smaller plant is assumed, because in addition here 's renewable resources are differentiate, so that require a higher daily time spent on the substrate management. The cattle manure and cattle solid manure represents a waste product of the company's own dairy cattle and the biogas plant is free of charge. In the second Investment alternative is bought to in silage maize for biogas production. Maize is particularly beneficial in growing and very undemanding in terms of the soil. Depending on the specific cultivation costs (seed, fertilizer, labor and machinery costs for fertilizer spreading, mowing, chopping and transport) fall for 1 ha of silage maize € 1,072. At an average yield level of 44 t / ha corresponds to a price per tonne inclusive of 5% profit and risk surcharge of € 25.50 / t (Röder 2005) in Germany. Hungarian cost structure is highly dependent on the location.

6. Investment decision under uncertainty

Investment decisions are always based on the forecast of future values (recoverable proceeds to be paid expenses), which are always subject to uncertainty because of their unpredictability. Uncertainty means that the value of the target (eg, the net present value) clearly and unambiguously is not predictable, but be that several future values considered possible. If the uncertainty is not included in the investment calculus, wrong decisions, changes in feed-in-tariff system or gas and power prices, but also the selection of investment alternative can be the result (Mensch 2002). Uncertainty can be divided into uncertainty and risk. If there are no probabilities for the predictions are determined, a decision is available under uncertainty, but are the probabilities for forecast values known and used in decision-making, as is spoken of decisions under risk (Hoffmeister 2008). In order to incorporate the uncertainty in the investment decisions are in the investment accounting practice three methods to choose from: the correction method and risk analysis. The correction method is cope with simple methods the investment risk by putting all calculated and estimated values (input and output sizes) are provided with a surcharge or discount (Kruschwitz 2000). This method is very popular in practice because it is relatively easy to handle. A critical examination of this method, however, reached the conclusion that it is unsuitable for sound risky investment decisions. The reason lies in the arbitrariness of the flat and surcharges that are not derived analytically and that the security calculi often double in the bill incorporated (eg by increasing the calculation rate while reducing the intake values, Kruschwitz 2000). Because of its methodological weaknesses, the correction method is only useful for smaller scale projects, for which a high planning effort is not worthwhile. Therefore, the correction method is for this case study are not mainly considered. Used but it was in the 1.5 % inflation surcharge on payments made under the provisions of the periodic series of payments.

Risk analysis is a process by which hazards are and their causes Detected and are to be detected qualitatively and quantitatively their risks. The essential basic principle of risk analysis is to derive a probability analysis the output size of investment appraisal (eg net present value) and secure information about the relevant input variables (Hoffmeister 2008). First, the relevant uncertain input variables of investment appraisal must be selected. Subsequently, various environmental conditions must be defined and are generally assigned to them subjective probability assumptions for their entry (values between 0 (does not occur) and 1 (surefooted a), Hoffmeister 2008). Taking into account stochastic dependencies between the uncertain input variables then the probability distributions for the output size can be determined (Kruschwitz 2000). This can be done by simulative analysis method. However, these processes are so complex and diverse that it is beyond the scope of this work. The decision on the preferability of an investment alternative depends in each case on the particular risk attitude of the investor (Hoffmeister 2008). The selection of the input variables are regarded as uncertain investment expenditure, discount rate, useful life of the investment, sales volume, sales prices, expenditure fixed and variable costs and purchase prices available (Blohm et al. 2006). Investment expenditure discount rate, length of use should be considered in the biogas plant as a relatively safe levels. Sales volumes in the operation of a biogas plant electrical energy (electricity), thermal energy (heat) and the digestate (fertilizer). The amounts of energy (electricity and heat quantities) produced can be very accurately predicted and calculated according to the biogas and methane yields and the efficiencies of the cogeneration system. Also, the current paragraphs can be considered as not safe, because on the one hand, the renewable law requires the network operators to prioritize purchase of electricity produced and on the other hand, a rate is every year changeable and also dependent from the current power and gas prices which can be changed by the government even twice a year. The heat produced is a de facto a saving of other resources. It is a substituted fossil fuel oil, which would otherwise have purchased. Because the slightest substitution value has already been set (approx. 0.55 € per litre) and it is a purchase price which decreases as inflation and demand-driven rather increases, the more can be expected from a secure expectation here. Although the amount produced can be in the digestate also accurately predict and calculate, unlike the current or in the heat here is both the achievable sales volume as well as the selling price be uncertain. Finally, it can not be predicted whether the digestate ever find a purchaser and, if so, at what price. On the expenditure side the principle uncertainties was countered by an inflation premium has been mainstreamed by 1.5% in the analysis. Particular attention should however be paid to the substrate costs for the procurement of Silomaises. The raw material is subject to this experience, strong price fluctuations. On the revenue side of the series of payments is the paragraph of the digestate and on the expenditure side, the substrate costs are considered to be unsafe. Below are selected as uncertain input variables individually varied and the sensitivity of the net present value are examined for these fluctuations.

7. Summary and outline

Biogas projects can be financed by many different options. Each financing model has particular advantages and disadvantages for the investor and the financing bodies. It is very important for a successful implementation and operation to select the correct financing option for the regarding project. It has to be assessed very carefully, which costs occurs and which revenues can be expected from the operation of the biogas plant previously to the implementation of the project. This case study has a decision to invest in an agricultural biogas plant to the object. Examines this was the preferability of one of two mutually exclusive investment alternatives: establishment of a pure liquid manure fermentation plant with an installed electrical capacity of 150 kW as the first alternative or construction of a industry size 500 kW system, in addition silage maize to be fermented. The operation of an agricultural biogas plant has been demonstrated. The decision on the advantages - both in absolute and in relative terms - was made on the basis of specific investor objectives through appropriate investment appraisal method. As a suitable calculation methods were static and dynamic investment calculations and for the non-monetary goals, a cost-benefit analysis in consideration for financial goals. In preparation for the investment calculations dedicated earnings, revenue and cost investigations were necessary. As a result, the investment calculations, the second 500 kW biogas plant alternative was found to co-fermentation of silage maize as relative and absolute preferable, only she was able, the required monetary investors objectives, namely:

- capital value of € 1 million at a discount rate of 5 %;
- income (annuity) of at least € 100,000 a year;
- profitability of at least 10 %;
- internal rate of return of at least 5 % to meet.

A control performed by sensitivity analysis, investment decision under uncertainty led to a different result. Thus, the investment decision can be seen in the construction of the smaller biogas plant as a long-term economically viable perspective, especially when the legislative rules are under changes. Intervention in the energy sector would not mind if the government measures of efficiency, rationalization and reducing energy dependence would result. In contrast, the overhead reduction affecting the sector and other charges („Robin Hood” tax, utility tax) may point in the opposite direction: investment reduction, cut backs, cutting costs. The economic point of view it is already too raises social issues. The need for a solidarity based on ground support system for the technology developement and agriculture would probably be justified. The need for a long run program for the renewable energy is essential, otherwise the decision making process will run to absolute clear answer, not to invest in vague conjecture and approximations. In the future - especially if the government is serious about the additional overhead reduction of 10 percent, so in overall 20 or even 30 percent cut would result common disorders in investments or even a provider exodus in the market. Meanwhile, the energy efficiency and agricultural development is not moving forward.

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