A support of the renewable source energy utilization and conditions for the biogass station investment

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This paper describes possibilities of the renewable energy source projects funding and arises an importance of the analysis which should be the first step before investing in the generation of energy from renewable sources.

The issue of investing in biogas plants is related to particular conditions of the investor. The extent of the investment is never clear and always depends on the company equipment. Therefore, the quality evaluation of the project in the preparatory phase can protect the investor against a direct damage and disappointment.

Keywords*: supporting tools, renewable energy sources, biomass, investment, biogas station*

Introduction

A project routing in the field of renewable energy sources (RES) depends on the regional politics, application in the self-government, firms, services and the heat-producers which are often in a capital connection with the self-government. A trend is the implementation of support, legislative and financial proceedings at the level of government policy and self-government units, supported by an information campaign.

The realization of supporting measures is also connected with concrete conditions and possibilities of each country. Therefore, it is necessary to look for the utilization of RES in every member country with respecting of regional and environment comity.

Potential investors have a lot of supporting tools and programs. The question is how they can objectively use these tools due to technical processing difficulty and other influences.

Legislative conditions affecting the production of energy from RES in the territory of the Slovak republic

Every potential investor has to perform the following conditions of Regulatory Office for Network Industries before the start of the energy production from RES:

- to apply for the authorization of the energetics business,
- to apply for the authorization of the heat-energetics business,
- to apply for the authorization of the RES origin of electricity,
- to fill in the form of a compliance with reporting the obligations certificate.

Law nr. 112/2008 L.D. from 14th of February 2008 changes and appends the Law of Energetics and amendments of some laws nr. 656/2004 L.D. Lines of §5 sections 4 and 5 were changed. Therefore, the authorization is not required for:

- production and supply of electricity by devices with the installed power up to 1 MW,
- production and supply of energy from RES by devices with the installed power up to 1 MW in case of the production and supply of energy for small hydroelectric power plants, wind chargers, solar devices, devices for the geothermal energy utilization, devices for the biogas utilization and devices for the biomass utilization,
- production and supply of gas derived from biomass,

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- production and supply of gas derived from biogas,
- vehicles CNG sale,
- oil transport from the extraction to the processing place,
- liquefied hydrocarbon sale in pressure vessels up to 100 liters,
- liquefied hydrocarbon for the vehicles sale,
- transport of liquefied hydrocarbon in pressure vessels.

A confirmation of compliance with reporting obligations, issued by the Regulatory Office for Network Industries, is a proof of authorization to run a business. Other permits, without which it is not possible to a build construction, are required as a standard for all other types of buildings under the Construction Law [1].

In the case of non-compliance with the legislation threatens to double punishment. The first are high financial penalties. From a marketing point of view, however, be much worse punishment negatively may affect the reputation of the company and its credibility [8].

Declared support types in Law 309/2009 D.L. about the support of RES in the territory of the Slovak republic

- electricity pricing by the Regulatory Office for Network Industries
- guaranty of this price for 15 years
- support for devices not supplying electricity to the grid
- mandatory electricity taking (bioenergy preferred from conventional energy types)
- preferential attachment and obligation to extend the distribution system
- support of the biomethane production

***Tab.** 1. Declared forms of the bioenergy production support under Law nr. 309/2009 D.L.*

Energy production device	Device performance [MW]	Priority connection to a regional distribution network	Priority access to the system, transmission, distribution and supply	Electricity taking at the price of electricity losses	Surcharge		Responsibility for the deviation
					Duration	Electricity quantity	
RES	(0-1)	yes	unlimited	unlimited	15 years	unlimited * 1)	unlimited
VU-KVET						* 2)	
RES	<1-4)	yes	unlimited	15 years	15 years	unlimited	15 years
VU-KVET						* 2)	
RES	<4-10)	yes	unlimited	15 years	15 years	unlimited * 1)	no
VU-KVET						* 2)	
wind charger	<4-15)	yes	unlimited	15 years	15 years	bez obmedzenia	no
RES	<10/15- 125)	yes	unlimited	15 years	15 years	* 1,3	no
VU-KVET						*4)	
VU-KVET with RES more than 20% in the fuel	<125-200)	yes	unlimited	15 years	15 years	* 4)	no

Source: Own processing according to Law nr. 309/2009

Comments to the chart:

VU - KVET - high-efficiency cogeneration of electricity and heat

1. It is only valid for biomass, if the electricity is produced by the cogeneration and the biomass meets the required quality (forthcoming decree RONI).

2. electricity produced by the highly efficient cogeneration (forthcoming decree the Ministry of Economy).

3. electricity produced multiplied by a correction factor:
   - 15 MW / power of the device in MW´´ for wind powerhouses,
   - 10 MW / power of the devices in MW´´ for other devices,

4. electricity produced by the high-performance cogeneration multiplied by a correction factor
   - 1 for devices with a share of heat for technological purposes more than 40 %;
   - 10 MW / power of the device in MW´´ for other devices

The amount of purchase prices for the electricity produced by renewable energy sources and electricity produced by the highly efficient cogeneration of electricity and heat is regulated by Decree No. 7/2009 of the Office for Network Industries SR [6].

The price of electricity produced from renewable energy sources is determined as a fixed price in euros per 1 MWh:

Combustion process
- landfill gas or gas from sewage € 96.36 / MWh,
- biogas produced by the anaerobic fermentation technology with a total power of the device up to 1 MW included € 148.72 / MWh,
- biogas produced by the anaerobic fermentation technology with a total power of the device over 1 MW included € 131.45 / MWh ,
- thermochemical gasification in a gasification generator € 159,85 / MWh.

Possible ways of funding projects aimed at the use of RES in the Slovak Republic.

The Slovak Republic supports investment in RES in 3 forms: the general state aid, the structural funds 2007 -2013, the National Programs and the Funds with an investment assistance which do not exceed 60 % of eligible investment costs. In the case of middle businesses it is possible to increase the financial aid by another 10 %, in the case of small businesses up to 20 % [3].

The national Strategic Reference Framework is a basic strategic document of the Slovak Republic for the use of European Union funds in the years 2007 -2013 and also sets priorities, which will be financed, while the strategic objective is to increase significantly to the year 2013 the competitive performance and production rate of regions and the Slovak economy an the employment while respecting the sustainable development. In addition, there is still a National strategic plan for the rural development.

The National Strategic Framework provides the following operational programs:
- Operational Program ENVIROMENT, it is financed jointly by the European Regional Development Fund and the Cohesion Fund, while it contains a separate priority axis for each of these funds and a separated liability for each fund.
- Operational Program Competitiveness and Economic Growth. It represents a basic document spelled out the direction and support for the innovation development, industry, tourism and other selected services using the growth potential of regions with a focus on meeting the global - strategic objective of the NR SR in the 2007-2013 programming period.

Investments for setting up the biogas station and return of the investment

Until 2009, Slovakia has not laid down by law any rules for the energy market, what discouraged investors from the investment. Law No. 309/2009 about the support of RES is valid from 1.1.2010.

Regarding the concrete implementation of investments to the biogas station, it is important to consider the following factors and conditions in each case:
- appropriate soil and climatic conditions for growing the biomass for energy purposes intended;
- sufficient area of land suitable for the cultivation of energy plants
- sufficient energy potential of soils,
- conservation of biodiversity of plant production,
- equity - the right settlement of land for the construction of the biogas plant,

- ensuring adequate funds for necessary investments,
- choosing the right power of the biogas station based on the potential of agricultural residues and the biomass in the immediate vicinity,
- unlimited ability to supply raw materials for the food industry,
- to ensure a stable supply of biomass from the distance 100-150km by the constant prices of the biomass,
- sufficient premises for storing the biomass, regarding the investment into the biogass station, taking into consideration a homogenizing container and separator due to the sustaining an appropriate substrate adjusting before its application into the fermentation container,
- to sustain stabile biological, thermal and chemical surrounding in the fermenter with regard to attain a maximal biogas producing with a highest volume of methane,
- to sustain a stable check of the biogas station by a skilled worker, there is also a needed to provide the BPS management,
- constant quality evaluation of the substrate and the surroundings in the fermenter,
- sufficient gasometer volume to ensure continual a biogas supply into the co-generational unit [7].

By the implementation of the biogas station it is needed to account for the following expenses: building and equipment depreciation**,** insurance, its own heat and electricity consuption of the biogas station + maintainance, analysis, certificates – lab analysis of the input substrate, biogas, substatum used as the charge into the biogas station (for defining characteristics of the plant biomass source it is advisable to consider the following parameters influencing its quality**:** the dry mass volume, figure PH, temperature, organic substances, the volume of nitrogen and its form, the volume of sulphur and hydrosulphide, heavy metals, the physical characteristics of the substrate, toxic substances), the employees needed for providing the management and maintainance of the biogas station, water and so on [8].

Based upon the previous experience, the charges for the preparation of a biogas station can be divided in the following way:

40 % fermenters and other technological containers, premises for story, their age and manipulation
20 % co-generational part (gasometer, co-generational unit)
17 % heating (heat reservoir , heating equipment)
13 % equipment for the manipulation (pipes, pumps and so on)

The economic return of the investment into the biogas station depends on the financial conditions of the chosen technology and its following maintainance. The maintainance economy of such a station is influenced by the input costs (whether there´s need to purchase it or just the opposite, there´s money coming from the garbage placement into the biogas station), as well as by the costs of the **"digestat"** placement and mainly by the prices of the electrical energy and heat energy on the market.

The construction of the biogas station is economically effective in case if a stable raw materials supply is secured and if it´s possible to secure the electrical energy and heat [4].

The opportunity to use the affluence of heat: heat supply for other purchasers (villages, towns and companies), drying technologies (wood, fruit, vegetable), tempered warehouses, fish breeding in warm water, growing thermophilic plants (green-houses, plastic green-houses).

To use fermentation garbage as an organic fertilizer for the following reasons:

reduced smell, the decrease of green-house gases emissions, reduced pathogen volume, seed quality of the weed, crops will use the nutrition to the full, substratum is stable from the bilogical point of view.

The implementation of ecological technology enables not only the environmental protection but also the energy supply improvement as well as the potential to increase the employment rate in particular regions [2].

A simplified model:

Task - calculation of a period in which the investment into a biogas station will be returned

The pure contemporary value (NPV) of all expenses and gains related to the project is the basic criteria for the investor´s decision.

The given calculation is only approximate and therefore depends on various things. The following formula can be used for the calculation of the period (D) in which the investment will be returned:

$$D = \frac{I}{P - V}\left[YEARS\right]$$

I –general investment
P – yearly gains
V –annual expenses

Unit	Electric power [kW]	Heat rate [kW]	Heat consumption [Nm3/h] +
Cento T180 SP BIO	175	223	71,5

The output is influenced by a correct methane volume in the biogas and by an ideal pressure and temperature. These conditions are applied for the simplification of the task. The stated life-span of such an equipment is 15 years.

The payback period is strongly affected by the value of the energy so acquired. The price of biogas or biomass would of course prolong the payback period and that is why it is suitable to build the station in aplace where you can achieve best conditions (for example cheapest primary commodities for the biomass or biogas production). It is also favourable to use ecological disposal fees. The value of thermal energy is a value which shows neither in the CF of the project nor in the NPV calculation.

Calculation of the investment payback in BPS excluding the thermal energy value

Currency	EUR
Amount of investment [EUR]	1 000 000
Maximum amount of state grant	
OPPI (KaHR) [%]	60 %
OPE [%]	60 %
Grant	
OPPI (KaHR) [EUR]	600 000
OPE [EUR]	600 000
Total investment costs	
With the grant of OPPI (KaHR) [EUR]	400 000
With the grant of OPE [EUR]	400 000
Assessment of annual operating costs	120 000
Assessment of annual yields [EUR]	149 910
Eco premium [EUR/kWh]	-
Guaranteed price [EUR /kWh]	0,14872
Annual production	
Electricity [kWh/year]	1 008 000
Heat [kWh/ year]	1 204 200
Total investment costs [EUR]	400 000
Average annual benefits [EUR]	149 910
Annual average costs [EUR]	120 000
Amortization period /years/	13,37

The value of thermal energy can be used for heating or water heating as a positive externality. On one hand it can save the investors` costs but, on the other hand, it cannot be included in the project yields. If the value of so produced heat is set at ca. 0,0226 EUR/kWh, presupposing that the working time and effectiveness remains the same, the payback period will be reduced.

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With the grant of OPPI (KaHR) [EUR]	400 000
With the grant of OPE [EUR]	400 000
Assessment of annual operating costs	120 000
Assessment of annual yields [EUR]	173 994
Eco premium [EUR/kWh]	
Guaranteed price [EUR /kWh]	0,14872
Annual production	
Electricity [kWh/year]	1 008 000
Heat [kWh/ year]	1 204 200
Total capital expenditures [EUR]	400 000
Average annual benefits [EUR]	173 994
Average annual costs [EUR]	120 000
Amortization period /years/	7,41

This calculation does not reflect real conditions; it is just an example of a mutual comparison of defined parameters within variable factors.

The payback period is strongly dependent on variable input values, including the economic (electricity purchase value) and the environmental (volume of water in biomass affecting the output of generator ones), and in some cases on factors decreasing the input production costs.

Conclusion

Nowadays, the alternative use of biogas is considered. It is assumed that in the scope of near future there will be biogas propelled microturbines available, even biogas charged fuel cells. If biogas is cleaned more thoroughly, it can be used in fuel cells. It is technologically possible to isolate almost pure methane and CO_2 from biogas and then to utilise these gases. Compressed biogas is used for the vehicle propulsion. Methane can be distributed into households as natural gas. Pure CO_2 is used in the food processing industry or it is also used as industrial gas.

All the above mentioned facts imply that the construction of biogas station itself will not lose its value.

In the present, there is a great tendency toward the development of technologies focused on the improvement of environment and also on the decrease of energetic consumption of technologies. Very often the exploitation of reusable energy resources is not financially advantageous. It is necessary to focus our attention on ecological aspects in order to realise that ecological can also mean economical. It is also needed to create a zone of complex exploitation of reusable energy resources and energy saving technologies which reuse every energy source and so that they can help to create an economically prospering project.

The creation of the ecologically, energetically and economically friendly zone requires not just the specific environment but mainly the total valorisation of specific environment. In present days a huge variety of technologies capable of supplying power in its many forms is known and that is why it is important to create a suitable combination of energetic resources and technologies able to use the energy in its specific form. When choosing an appropriate resource of energy and a device consuming this energy it is necessary to consider specific conditions of given area and to choose traditional options, which are connected to the local industry or produced goods which have sufficient sales in the given area.

Many areas are suitable for a complex exploitation of facilities used for the production and creation of ecologic energy. The implementation of eco-friendly technologies can bring better possibilities of environment protection and the improvement of energy supply. It will also increase the employment rate in backward regions and can stimulate an advancement of the economical situation.

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