EFFECTS OF THE INNOVATIONAL DEVELOPMENT OF ENERGY SOURCES BASED ON THE USAGE OF DOMESTIC WASTE

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Annotation: *Given that the topic of the invention of new technologies for the usage of alternative energy sources is following an ascending rate of constant innovative solutions, the problem with the detection of all iconomical and ecological side effects also needs to be brought to attention. Similar is the problem with the usage of renewable energy sources based on domestic waste which is also developing in that direction. This is why the initensive factors for the progress of this process are changing their dimensions and are going to be closely related with both the effective usage and improvement of the technologies, and the raising of the overall efficiency, taking into account the benefits of solving social, ecological, household and other problems. Also similar is the problem with the domestic waste used as raw material for renewable energy sources. The subject of observation of this present article is the development of this process based on innovation and the raising of its efficiency, also taking into account the side effects related to the ecology, solid and domestic waste. Measurement indicators for these effects with unified dimentional unit (leva) are suggested and an approach for measurement of their manifestation is formulated.*
Key words: RENEWABLE ENERGY SOURCES, DOMESTIC WASTE, NEW TECHNOLOGIES FOR WASTE TREATMENT ETC.

1. Introduction

Solving the problems of the development of alternative energy sources through usage of domestic sources imposes a re-view of the traditional or conventional approaches to forming the requirements for the reporting of effects of their application. The development of this process has to be combined with both the usage of modern technologies and technics and the search for more flexible forms of organization for application with all economical side effects. With that, the consumption of electricity is one of the main social bases for the survival of population, and the usage of energy resources, on the other hand, is one of the main sources of greenhouse gas emissions. The world is facing the challenges of the climate changes caused by the increase of the amount of greenhouse emissions. Because of this stable energy development the reduction of greenhouse emissions is outlined as the main goal of the world energy policy.

The usage of renewable energy sources is looked at as one of the main impactful factors for transitioning to low-carbon economy, for the development of new high tech production and the provision of the so called "green" growth and "green" workplaces. The effectiveness of production of renewable energy sources is defined by the demand of the offered services / production. The appeal of the end product depends on the amount of the waste generated in the process, which is predetermined by the amount of the population served [3,10]. Therefore, the influence factors on the effectiveness of renewable energy sources can be said to be the factors that define the amount of demand or the amount of the waste generated.

They are Internal factors consisting of: amount of population that is going to be served by the depot and the tendencies in the demographic development of the region [5]., which includes:

- The economical state of the population – in particular increased or decreased consumption
- The growth of the business environment in the region. For electricity to be generated from RES (biomass), good conditions for the collection, disposal, temporary storage, separation, landfilling and burning, composting, pre-treatment and production of electricity from the generated waste need to be assured.

External factors: Main external factor that affects it is the Bulgarian EU membership. The special regulations concerning the renewable sources of energy have a great impact. The usage of RES is looked at as one of the main impactful factors for transitioning to low-carbon economy [7].

1. Forming an approach to determine the economical side effects of constructing a RES using domestic waste.

Financially-economical structure of the expenses and incomes of the electic energy generated by the RES using domestic waste.

In the process of formulating the current approach the concept of the financial analysis is being used and the only thing being looked at are the cash flows as the non-monetary, including accounting entries, deprecations charges and reserves for unforeseen expenses are not included. Also not included are cash flows for VAT. Cash flows are considered in the year in which they arose and for the defined above reference period. The European and national standards for acceptable and unacceptable expenses.

Structure of the expenses for production and distribution of the electricity based on domestic waste.

The technology (production) of electricity is being served and accompanied by many cost activities (economical, financial, exploitational, social, maintenance, repairs etc.). This environment is special in its structure and components and is established as unified. One of the components of this structure is the cost analysis for the technological cost of a unit of produced electricity.

It is known that the expenses for the production can be classified into: variables (a) and conditionally-constants (b). The general expenses are determined by the relation [1, 2]

$$C_Q = aQ + b$$

where:

a – variable expenses;

в – conditionally-constant;

Q – amount of produced electrical energy

For the purposes of the regulatory mechanism when determining the needed income and its components the following types of expenses, prices and price-formatting factors of electricity are being applied. The conditionally-constant expenses are determined by the electricity distribution companies based on a projection for the regulational period and presented jointly and separately for the following activities:

1. Maintenance of the distribution networks;
2. Development of the distribution networks, related to connecting consumers;
3. Supplying the end users.

Except in that way, expenses are also classified as follows;

Technological expenses. They include the acceptable technological cost amounts for the production, transfer and distribution of electricity. These are expenditures of electrical energy that are inherent to the technological processes of transferring and distributing electrical energy (networks, transformers, means of measurement, load schedules, distributed energy, etc.). The energy companies have the right to compensate for these expenditures

through the price of transfer/distribution of the electrical energy. They are defined as a percent of the purchased electricity. In that case, they belong to the variable expenses.

Unrecoverable expenses. These are expenses including already made investment and/or done deals that cannot be undone as they are connected to the transitioning to a competitive electricity market as well as expenses resulting from the completion of obligations to the society, including ones related to the security of the supply, protection of the environment and energy efficiency.

Another way of sorting and classifying is by phases of the process, or in other words – investment and operational phases.

Investment phase. The investment phase includes "Construction of an integrated system of installations for domestic waste treatment".

Operational phase. The expenses in the operational phase arise after the realization of the construction phase and extend for 30 years from the projection period when the reference period of the projects expires. For a more detailed representation, the expenses in this phase are separated into two groups, maintenance expenses and operational expenses respectively.

Consistency and evaluation of the incomes forming the financial result

For an evaluation of the relevance of the strategy for renewable energy source electricity production development, cash flows need to be worked out in the within the reference period. The reference period is a period in years to which the projections, included in the analysis of the expenses and incomes, refers to. The projections of the project cover a period corresponding to the economical profitable life span of the installations and the depot, and long enough to cover its probable long term impacts. The reference period horizon by sectors (based on the international practice and recommended by the European Commission) fixes a period of 30 years for the sector of the environment [7].

Incomes are expressed in the price of landfilling that the private and the public consumers pay. The receipts are estimated and corresponds to the "analysis of demand" in which the amounts of deposited by the interested parties waste are settled. The estimated fee is calculated based on a ton of landfilled waste as the projection is based on the average prices for depositing a ton of waste in an already existing depots for non-hazardous waste [3,11].

Determining the cash flows

In summing the cash flows actualized throughout the years, the time value of the money is determined. From this follows that the future cash flows get discounted to the present moment using a decreasing with the time discount factor whose value is determined according to the discount rate. The used for the purpose of the financial analysis discount rate reflects the alternative price of the capital for the investor. It is determined as a missed return from the best alternative project. The Commission recommends 5% financial discount rate to be applied in real terms as an indicative purpose for public investment projects, co-financed by the Funds. The present analysis takes for the value of the real financial discount percent to be 5, 0%. The cash flows can be positive or negative.

Positive cash flows

The financial incomes are expressed in the price of the landfilling that the private and public consumers pay. The receipts are estimated and corresponds to the "analysis of demand" in which the amounts of deposited by the interested parties waste are settled. The estimated fee is calculated based on a ton of landfilled waste as the projection is based on the average prices for depositing a ton of waste in an already existing depots for non-hazardous waste in Bulgaria. The cost of disposing of a ton of waste to the public is determined on a real cost basis and is within the competence of the City Council. Given the nature of the landfill - whether regional or not, and the presence of of municipalities, we have set the cost of landfill waste based on the maintenance cost and the average cost in the present moment, assuming that the landfill is managed as an independent economic unit.

Negative cash flows.

The negative cash flows are:

- Investment costs
- Operational costs
- Maintanance and repair costs

2.Consistency of execution of the approach to determine the side effects of the construction of RES using domestic waste.

Discounted – positive and negative cash flows.

The discount rate reflects the public norm of time preferences[1,3]. The norm of time preferences expresses the ratio between future and current consumption. n the long run, it should be aligned with the market interest rate. Thus it expresses the norm of time preferences of the whole society. It is this norm that is adequate for the purposes of analyzing and evaluating public projects in modern economy.

The public discount rate is the minimum required rate of return from the public investment project. If the expected return is below this rate, the project should not be funded if only the financial effect is important.

The discount rate used for the purpose of the financial analysis reflects the alternative cost of capital for the investor. It can be defined as a missed return from the best alternative project. It is recommended as an indicative target for public investment projects co-financed by the Funds to apply a 5% financial discount rate in real terms.[7] In order to create the conditions for comparability of financial projections over the projection period and eliminate the "time" factor, which is fundamental to the importance of the value of money during the period, it is necessary to perform a so-called discounting of the flows. In this case, all streams will be brought to a time point by discounting. The use of this method ignores the inflationary processes that would develop in the country and, at the same time, the interest rates. Although our currency unit is directly related to the EURO as a means of payment, deviations from inflation and interest rates in some EU countries have been noticed. In practice, the only thing taken into account is the risk in the project. When the projection is developed, the practice of so-called "stop prices" is used, ie it is operated at the same price level for all services offered throughout the procjection period period. The same applies to the prices of materials and energy [7,8]

Determining the actual performance indicators

Net present value (NPV)

The purpose of this approach is to determine the net financial effect of the project realization, evaluated at the starting point of the reference period.

The methodological approach is to apply the following procedure:

- The investment costs projected are divided by the years of their implementation;
- The current investment costs are calculated and summed up;
- The net cash flows generated in the implementation of the project on an annual basis are determined. We have to say that this is an "internal" project year, which does not always coincide with the calendar, resp. with the accounting year. For this purpose, a fiscal accounting approach is chosen - eg. by normalizing the first reporting period to a duration of less than a year.
- the current net cash flows are computed and summed up.

The cash flows in the financial analysis of the investment during the first years of the projection period are negative, while in the following years they are positive. Given the theory of money movements over time, negative values in the first years have a greater weight than positive values in recent years. This means that the choice of the time horizon is of utmost importance for the definition of NPV. **There are two types of Financial NPV - investment and capital.**

The Financial Net Present Value of the Investment (FNPV / C) is the sum of the discounted cash flows of the investment for the entire planning period, and for this project (household waste) it is negativehis means that the cumulative effect of the investment that will be made is also negative as a whole, or in other words, the discounted revenue for the entire projected period will not exceed the total costs. With such indicators, projects are usually inefficient and unattractive to investors. On the other hand, however, FNPV / C indicator like this is common for public projects dominated by the social factor. In this case, the negative value of FNPV / C is mainly indicative of the impossibility of the project implementation in the absence of an EU grant scheme [4,7,8].

There are, therefore, several groups of problems –

The first group of problems is related to the correct determination of the distribution of investment costs as well as to the estimated cash flow projections during the project period. A long-term projection is set within the reference period. Moreover, the volatility of the forecast is further increased by the fact that we discount the cash flows and investment costs, ie. this determines the flow pattern over time and makes the risk distribution in otherwise symmetric investment decisions marked asymmetrically.

The second group of problems are domestic, social and environmental.

Internal rate of return (IRR)

The internal rate of return is the ratio of the profits made to the investments made. The simplest way to estimate profitability is to measure the internal rate of return on investment, ie the discount rate, where the sum of the discounted cash flow of costs and project revenue gives zero [1,7].

The expected IRR may be strictly dependent on the risks inherent in the project. In turn, the risks depend on a number of factors, including: the socio-economic conditions in the municipality where the project is being implemented, the difficulties with the project implementation, its economic life, the exchange rate risk and, above all, the risk related to the planned revenue. These elements should be properly addressed in the sensitivity and risk analysis.

In the present case, similar to the financial net present value of investment and capital, and the financial internal rate of return on investment (FNPV / C) is negative. The financial internal rate of return on capital (FNPV / K) is also negative, but at the same time higher than the financial performance. The financial model of the investment does not show a return on the project. This means that the project can not be implemented in the order of usual project financing [3]

Profitability Index

In this approach, we calculate the effect of a unit of invested capital that is relevant to the most commonly used rationality criterion. The application of this approach is characterized by the fact that benefits (income and positive influence) are compared to costs (including negative influence). The range of the coefficient boundary is +/- 1. [1,4,8,9] and includes the influence of: Introduction of new economic indicators;

Price distortion of incoming and outgoing resources.

Current input and output resource prices can not reflect their social value due to market distortions, e.g. monopoly regimes, barriers to trade, etc. Current prices resulting from market imperfections and pricing policy in the public sector may not reflect the alternative cost of inputs. In some cases, this may be relevant for project appraisal, and financial data may be misleading as indicators of well-being [5,7].

In some cases, prices are regulated by the state to compensate for the perceived market failure in a way that is in line with its policy objectives, indirect taxation is used to correct external factors. In other cases, however, real prices are distorted due to legal constraints, historical reasons, incomplete information or other market imperfections (eg feed-in tariffs such as energy, fuel). An example of price distortion is a project requiring significant terrain, e.g. a production site (as in the present project) whereby a public authority provides the land free of charge, where otherwise it could collect rent; These distortions are directly related to social problems.

Distortions in the labor market

Labor distortions (minimum wages, unemployment benefits, etc.) generally lead to a situation where the wage is higher than the alternative labor cost.

Adjustments from market to book prices can be made in addition to fiscal and external factors when:

- Actual input and output resource prices are distorted due to market imperfections;
- Wages are not related to labor productivity.

When it comes to the labor market, a lack of distortion was accepted, so no shadow wage was calculated. But essentially, here we have an influence on the social factor as well [3,6].

Adjustment of market prices:

The economic analysis of the project requires adjustments to the market prices used in the financial analysis. Market prices are considered to be remote from their long-term equilibrium due to numerous distortions due to taxes, subsidies, import duties and other financial transfers. To reflect the alternative costs, economic data should account for external impacts and eliminate all types of financial transfers [4,6].

Commodity in free circulation in international trade shall be subject to a standard conversion rate to adjust the market price and to calculate the accounting prices that reflect the alternative costs. World market prices represent the real trade opportunities of the country and are thus an appropriate measure for alternative costs. In this case, we must take into account the impact of all three factors, domestic, social and environmental.

Method of calculating present economic net value and economic rate of return

A model conforming to the concept of the financial analysis model has been prepared for the calculation of the PENV and the ERR. Flows that are discounted reflect economic benefits and costs, rather than purely financial flows.

Costs and benefits that occur at different times should be discounted. The discounting process takes place, just as in the financial analysis, after the economic analysis table has been determined. The discount rate for the socio-economic analysis of investment projects - the so-called social discount rate - is an attempt to reflect the social point of view on how the future benefits and costs should be measured against the current ones.

After determining the amount of economic costs and benefits, the standardized discounted cash flow methodology is applied, using a social discount rate. Based on the long-term level of economic growth and the theoretical preference levels,

How to calculate economic indicators and determine the effectiveness of the approach.

After adjusting the price distortion, it is possible to calculate the economic rate of return (ERR). After selecting an appropriate social discount rate, it is possible to calculate the economic net present value (ENPV) and the benefit / cost ratio.

The difference between ERR and FRR is that the former uses accounting or alternative prices for goods and services instead of imperfect markets and, as far as possible, includes social and environmental externalities. Since in this case external factors and shadow prices are taken into account, most projects with low or negative FRR will prove to have positive ERR.

Conclusion.

In conclusion, it can be assumed that an approach is proposed for calculating the economic indicators at the stage of designing, applying and using RES from domestic waste. In addition, economic performance indicators can be defined in the first phase - design phase.

After adjusting the price distortion, it is possible to calculate the economic rate of return (ROI). After selecting an appropriate social discount rate, it is possible to calculate the economic net present value (INIC) and the benefit / cost ratio. The Economic Net Present Value (NNS) must be greater than zero in order for the project to be economically feasible. Economic rate of return (ROI) must be greater than the social discount rate;***Literature:***

1 Angelova, Y., Issues of the liberalization of the electricity market in Bulgaria. Sofia., 2008

2. Angelova, Y., Determining the price of the electric energy. S. 2008

3. Ivanov, Alexander Dimitrov., Waste: Socio - environmental problem of the global society: Model for solving / Alexander Ivanov. - [Sofia] : RA Euromedia, 2015.

4. Donchev, Dimitar., Financial analysis; Sofia 2009

5. NSI (2015) Energy balances 2013, Sofia

6. Costs and benefits of renewable energy sources in Europe up to 2030, DIA-CORE Policy Brief, June 2014.

7.CEER (Council of European Energy Regulators) (2017), *Status Review of Renewable Support Schemes in Europe*, CEER, Brussels.

8.CEER (Council of European Energy Regulators) (2017), Status Review of Renewable Support Schemes in Europe, CEER, Brussels.

9. Koleva, N. & Andreev, O. (2015). Influence of Degree of Customer's Co-Participation on Their Assessment of Products Design and Functionality, Ecinomic Alternatives Journal, Issue 1, ISSN 1312-7462, pp. 91-99.

10. Koleva, N. (2018), Industry 4.0's Opportunities and Challenges for Production Engineering and Management, International Scientific Journal Innovations, issue 1, pp. 17-18, ISSN 1314-8907;

11. В. Спасова „Създаване на базирани на знания визуални съветващи системи с Actor Prolog", Втора национална научна конференция „Информатиката в научното познание", ВСУ „Ч. Храбър", юни 2004 г.