

SELECTION OF AN APPROACH FOR THE CONSTRUCTION OF WASTE MANAGEMENT INFRASTRUCTURE IN THE KOSTINBROD AREA

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ABSTRACT. The current study covers the municipalities of the Kostinbrod Regional Waste Management Association. It includes the municipalities of Kostinbrod, Bozhurishte, Svoge, Slivnitsa, Godech, and Dragoman. The main objective of the research is related to the selection of an approach for the construction of additional infrastructure, including installations for composting of separately collected biodegradable and/or green waste. The effectiveness of the approach is demonstrated by the application of four groups of criteria: environmental, economic, financial, and technical.

Key words: waste, management, environment.

ИЗБОР НА ПОДХОД ЗА ИЗГРАЖДАНЕ НА ИНФРАСТРУКТУРА ЗА УПРАВЛЕНИЕ НА ОТПАДЪЦИТЕ В РСУО – КОСТИНБРОД

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РЕЗЮМЕ. Настоящото проучване обхваща общините от Регионално сдружение за управление на отпадъци Костинброд. В него са включени общините Костинброд, Божурище, Своге, Сливница, Годеч и Драгоман. Основната цел на изследването е свързана с избор на подход за изграждане на допълнителна инфраструктура, включваща компостиращи инсталации за разделно събрани биоразградими и/или зелени отпадъци. Приложени са четири групи критерии, обхващащи екологични, икономически, финансови и технически показатели, чрез които да бъде доказана ефективността на съответния подход.

Ключови думи: отпадък, управление, околна среда.

Introduction

The management of waste activities is a priority duty in the environmental policy of the country and originates directly from the National Strategy for Environmental Protection. The main objective in the Waste sector is to decrease the quantity of landfilled green and/or biodegradable municipal waste through their separate collection and recycling in order to ensure environmental protection on the one hand, and the funds needed to instrument the measures taken, on the other.

The waste hierarchy is generally the best option for the environment in waste legislation and policy.

The Waste Management Law (WML) regulates a hierarchy (Fig. №1) in waste management, which groups priorities such as:

Priority 1 - prevention of waste generation;

Priority 2 - recovery of waste through recycling, reuse and/or recovery of secondary raw materials and energy;

Priority 3 - final disposal, by landfilling or incineration of those types of waste which are impossible to prevent or recover.

The purpose of the hierarchy is to demonstrate a model of an integrated approach to waste management, and its application in this classification will contribute to the creation of a sustainable policy for their management.

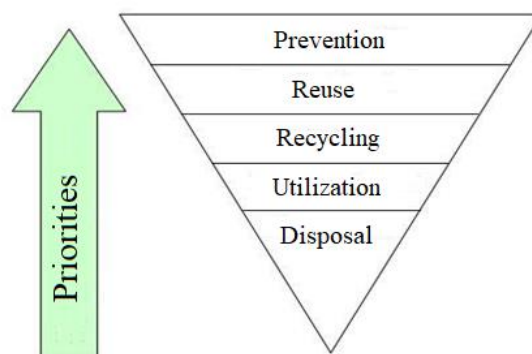


Fig.1. Administrative map of the Sofia Region

Statistics on the present state of waste management systems in the Kostinbrod Region

As a member of the European Union, the Republic of Bulgaria is obliged to observe and implement the common EU policy related to the environment, which includes waste as a factor influencing its condition. European strategic documents in recent years have changed the philosophy and approach to

waste - from purposeful waste management as a factor damaging the environment, to a policy of preventing their generation and their efficient use as resources. In this regard, the European Union legislation in the sector has also undergone major development. Unlike the more general provisions in the 1970s aimed at reducing the harmful effects of waste on the environment, today's legislative package contains specific requirements and quantitative targets for reducing landfills, for the recycling and recovery of specific waste streams, and for the prevention of waste generation.

At present, the biodegradable waste from the mixed household waste in the Kostinbrod Region is treated only by depositing at the Regional Landfill for non-hazardous and inert waste for the municipalities of Kostinbrod, Svoge, Slivnitsa, Bozhurishte, Godech, and Dragoman with land in “Gonyarevi Padini”, as there is no installation for the utilisation of household biodegradable waste on the territory of the Kostinbrod Regional Waste Management Association. The generated waste from the conservation of green public areas and green waste, collected separately through separate collection systems in some of the municipalities, are not recovered due to the above-mentioned reason but are transported to regulated sites or left on site (uncontrolled rot).

In connection with the completed reclamation of the old municipal landfills, there are tendencies to keep the quantities of landfilled waste within identical limits with a predominance of increase, due to the lack of waste treatment facilities before landfilling. Measures have been introduced by mayors against the dumping of waste in unregulated landfills, which has an impact on increasing waste.

On the territory of the Kostinbrod regional landfill for non-hazardous waste, there is no facility for the pre-treatment of mixed municipal waste before disposal by separating the useful components. Therefore, the percentage of recycled waste from the total amount of the same is not high enough.

Choice of approach for the construction of additional infrastructure

Centralised approach: it envisages the construction of a waste management infrastructure to be used by all municipalities of the respective Regional Waste Management Association. The future site for a composting plant for separately collected biodegradable and/or green waste is planned to be built in close proximity to the already existing Kostinbrod Regional Landfill.

Decentralised approach: it envisages the construction of a waste management infrastructure to serve each municipality separately within the Kostinbrod Regional Waste Management Association. This approach envisages the construction of 3 separate composting plants for separately collected biodegradable and/or green waste as follows:

- One composting installation on the territory of the Slivnitsa Municipality for the needs of the Slivnitsa Municipality and the Dragoman Municipality;
- One composting installation on the territory of the Svoge Municipality to serve the needs of the municipality;
- And one composting installation on the territory of the Kostinbrod Municipality for the other municipalities.

Due to the geographical location of the Municipality of Svoge and the quantities of green and biodegradable waste generated by its population, it is recommended to establish a separate

installation for composting green and/or biodegradable waste on the territory of the municipality.

The analysis of the need to build additional facilities for composting separately collected biodegradable waste in the Kostinbrod Region proves the need to build such infrastructure because:

- the objectives under Article 52 of the WML by 2021 are not achieved, both at the municipal level and within the Kostinbrod Regional Waste Management Association;
- the requirements of the Ordinance on separate collection of biodegradable waste should be met, which obliges mayors to take measures for separate collection from households and utilisation of household biowaste and the total amount of green waste from the maintenance of public parks and gardens;
- the objectives for limiting the deposited quantities of biodegradable waste must be achieved;
- there is a lack of appropriate infrastructure for the recovery of green waste, both at the municipal level and in the region for the proposed locations.

The location of a composting plant for separately collected biodegradable and/or green waste under the centralised approach should be close to the already existing Regional Landfill - Kostinbrod. During the investigation, it was established that there is a suitable municipal property for the implementation of the project in the immediate vicinity of the landfill. It is envisaged that the site will be used in both the centralised and the decentralised approach, as it meets the size and location requirements for the construction of additional infrastructure

Criteria affecting the choice of approach for the construction of additional infrastructure

The Environmental criteria:

The assessment according to this criterion was performed on the basis of information about the protected areas taken from the "Register of Protected Areas" (<http://eea.government.bg/zpo/bg>). The review shows that the planned additional infrastructure for waste management - composting plants in both the centralised and the decentralised approaches - do not fall within the boundaries of protected areas declared under the Protected Areas Act.

- According to this criterion, both approaches receive the maximum number of points.

The Natura 2000 criterion:

Against the boundaries of protected areas of the *Natura 2000* Network, the assessment was performed on the basis of information about the protected areas of the information system for the protected areas of the *Natura 2000* ecological network (<http://natura2000.moew.government.bg>).

- According to this criterion, both approaches receive the maximum number of points.

The Flood Risk criterion:

The assessment of the location of potential sites based on information on areas with significant potential flood risk shows that in both the centralised and decentralised approaches, the sites are outside areas with significant potential flood risk.

- According to this criterion, both approaches receive the maximum number of points.

Regarding *water sources and facilities for drinking and domestic water supply*:

The assessment shows that the sites in both approaches are not in violation of the provisions of Ordinance № 3 of 16 October 2000 on the terms and conditions for research, design, approval, and operation of sanitary protection zones around water sources.

- According to this criterion, both approaches receive the maximum number of points.

The Registered Landslides criterion:

Compared to registered landslides, the assessment shows that the terrains are suitable.

- According to this criterion, both approaches receive the maximum number of points.

For sites subject to health protection:

Points are awarded only for sites that are not located in the leeward side and/or are at a distance of less than 100 m from sites for health protection.

- According to this criterion, both approaches receive the maximum number of points.

Economic criteria:

Climate change - CO₂ emissions:

CO₂ emissions (estimation of emissions according to kilometres travelled per year):

The evaluation of this criterion was performed in two stages:

1) Quantitative valuation, based on the kilometres travelled within one calendar year by the technique for collection and transportation of separately collected green waste.

2) After the quantitative evaluation, a qualitative determination of the criterion is made, as more points are awarded for a lower value.

The summarised results of the calculations are presented in the Table 1 below:

Table 1. Value of CO₂ emissions for both approaches

| Approach | Total traveled (km/y) | Unit price emission CO ₂ (lv/km) | Emission value CO ₂ (lv) |
|---------------|-----------------------|---|-------------------------------------|
| Centralized | 44 730 | 0,0139 | 621,747 |
| Decentralized | 32 490 | 0,0139 | 451,611 |

After the quantitative evaluation of the criterion, a qualitative evaluation was performed. The centralised approach received 5 points and the decentralised approach - 15 points.

Noise emissions:

The kilometres travelled for one calendar year are taken from the vehicles that transport waste from the settlements to the site, respectively with a centralised and decentralised approach. It should be borne in mind that the kilometres travelled are defined as the sum of three elements: kilometres travelled in urban, and rural areas.

After the quantitative evaluation, a qualitative determination of the criterion was performed.

- According to this indicator, the centralised approach receives 5 points, and the decentralised - 15 points.

Financial criteria:

Investment costs:

Land purchase costs: For the purposes of the analysis, the sites on which the construction of composting plants is envisaged in both the centralised and the decentralised approach are considered municipal property and no additional land purchase is required. That is why both approaches receive an equal number of points: 5 each.

Costs for the construction of basic infrastructure: Under the centralised approach, the installation serving the six municipalities with a capacity of 6,000 - 10,000 tons per year needs investment costs amounting to BGN 3,000,000.

The decentralised approach will require the construction of three composting plants, and the investments will amount to BGN 5,000,000.

Investments for the decentralised approach are higher than those needed for the centralised one. In this case, and in accordance with the instructions of the *Environment Operational Program*, for qualitative valuation, the centralised approach receives 5 points, and the decentralised - 1 point.

Costs for the construction of supply infrastructure: The centralised approach envisages the construction of a composting plant in the immediate vicinity of the site of the existing landfill. Given that there is no water supply and sewerage system next to the landfill site, in case the centralised approach proves to be more effective, it is assumed to build one.

Under the decentralised approach, new sites will be built which will also require the construction of lead infrastructure. In this regard, the centralised and the decentralised approaches receive 1 point each.

The estimated operating costs for the two approaches are given in Table 2

Table 2. Estimated operating costs

| Municipality | Limits within which the capacity of the installations | Annual operating expenses in BGN |
|---|---|----------------------------------|
| Kostinbrod, Bozhurishte and Godech | 3 000 - 10 000 | 700 000 |
| Slivnitsa and Dragoman | 1 000 - 3 000 | 210 000 |
| Svoige | 1 000 - 3 000 | 210 000 |
| Total for a decentralized approach | | 1 120 000 |
| Common installation - centralized approach | 10 000 - 13 000 | 910 000 |

After the quantitative evaluation of the criterion, we moved to qualitative determination. As the quantification shows that the decentralised approach has a lower indicative total value of operating costs, this approach receives 10 points and the centralised approach - 5 points.

Annual transport costs:

Transport costs on an annual basis are presented in Table 3 below:

Table 3. *Transport costs in a centralised and decentralised approach*

| Approach | Total traveled km/y | Costs related to waste transportation total for the territory of the RWMS (lv.) |
|---------------|---------------------|---|
| Centralized | 44 730 | 93 962,70 |
| Decentralized | 32 490 | 60 401,70 |

From the performed quantitative evaluation of the criterion, it can be seen that the annual transport costs in the decentralised and centralised approach are of similar values. According to the instructions for the preparation of the quantitative evaluation, if completely identical or similar in value results are obtained for both approaches, then, according to this criterion, in the qualitative evaluation, the same number of points (5 p.) is allotted.

Expected revenue

Part of the final compost obtained will be used for own needs, and the rest will be sold in order to partially cover the costs of operation of the plants under both approaches. In this regard, the centralised and decentralised approaches receive the same number of points – 5 p.

Technical criteria:

The National Waste Management Plan for the Kostinbrod Regional Waste Management Association identifies the need to build additional infrastructure for composting. The Kostinbrod Region is included in Annex № 2 and Annex № 4 of the plan. For this reason, both approaches receive an equal number of points – 5 p.

Ensuring the achievement of the objectives under Article 31 of the WML:

Both the centralised and the decentralised approach lead to the achievement of the objectives under Article 31, para. 1, item 2 of the WML even after 2020. According to this criterion, it follows that both approaches receive 10 points each.

Connection with the existing regional system:

A regional landfill for non-hazardous waste has been put into operation. Both approaches receive 10 points each.

By building a composting plant for green/biodegradable waste, the two approaches - centralised and decentralised - will

contribute to achieving the objectives under Article 31, paragraph 1, item 2 of the WML.

Conclusions

The results of the analysis of the efficiency of the centralised or decentralised approach for the construction of composting plants for green waste show that the decentralised approach is more efficient.

According to this analysis, the implementation of measures and action plans of municipal programs and the regional program, as well as the provision of appropriate infrastructure, ensure the provision of conditions for meeting the targets for the diversion of biodegradable waste from landfills.

To fulfil the objectives under articles of the WML and the requirements, set in the national and European legislation and related to waste management, three composting installations should be built on the territory of the Kostinbrod Regional Waste Management Association, as follows:

- A composting facility on the territory of the Kostinbrod municipality - serving the municipalities of Kostinbrod, Godech, and Bozhurishte;
- A composting facility on the territory of the Slivnitsa municipality - serving the municipalities of Slivnitsa and Dragoman;
- A composting facility on the territory of the Svoge municipality - serving the needs of the municipality of Svoge.

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