

PUBLIC-PRIVATE PARTNERSHIP AS A POSSIBILITY FOR IMPROVING MUNICIPAL WASTE MANAGEMENT

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A consequence of the high concentrations of the population in big cities is the growth in the amount of municipal waste generated. This has resulted in an accelerating need for developing as efficient a municipal waste management system as possible on a local level, based on legal requirements and the rules of good conduct within this field. The city of Belgrade is used as a case study for analyzing the existing problem of waste management (based on the Waste Management Plan), system elements and operational performances (special waste disposal), and the possibilities for improving the system by contemporary technical and managerial solutions. This is especially analyzed on the basis of provisions and obligations stipulated in the recently signed PPP contract on public-private partnership (PPP). In this paper, the author discusses possible comprehensive improvements of the municipal waste management system based on the obligations of the signatories of the said contract.

Key words: municipal waste, management, PPP, Belgrade.

INTRODUCTION

The issue of generating an increasing amount of waste, along with its management and disposal is becoming a growing and alarming problem of the contemporary world, especially in developing countries (Ferronato and Torretta, 2019). Managing solid waste, in particular municipal solid waste (MSW) and food waste results in serious pressure on the environment and society as a whole, especially in cities (Dasgupta and Gondane, 2019). In order to manage and solve the issue of MSW, modern integrated facilities in accordance with the highest standards are used. Through their work, energy is acquired through waste combustion, as well as organic substratum (compost), and inorganic inert matter is placed in landfills. In addition, recycling is conducted wherever possible.

Reduction of the amount of waste deposited is a desirable option for waste management, since in this way, numerous risks associated with landfilling can be avoided (self-combustion, waste landslides, etc.), as well as the impact of the landfill itself, since they can have a significant negative impact on the environment and human health. Air, groundwater, surface water and the soil are directly affected, and noise pollution is another result (Ohajinwa *et al.*, 2019).

Air pollutants emitted from landfills are nitrogen and sulfur oxides, dioxins, furans, dust and heavy metals (Hussain and Bordoloi, 2019). Municipal landfills emit landfill gas (a by-product of the waste biodegradation process), of which about 50% is methane (potentially explosive gas), and unpleasant odors have a significant impact on the quality of life in the vicinity of the landfill. It can be said that (generally) there is no direct and instant impact of the work of landfills to human health. However, indirect threats to health can, over time, result from: uncontrolled waste distribution into the immediate environment by the wind (and by animals feeding on site) (Pornpilai Thanomsangad *et al.*, 2019), separating gaseous pollutants, the (self-) combustion of waste and resulting emission of (hazardous) products of combustion, the penetration of processed water from the landfill into subterranean waters, the endangerment of the water supply and watercourses in the wider area, as well as the spread of unpleasant odors. Inadequate management of (potentially hazardous) medical waste, as well as its treatment (World Health organization, 2018) and finally disposal, might lead towards an increased risk to the health of people located in the vicinity of landfills (Manzoor and Sharma, 2019). Thus, it is very important to clearly understand both the ecological impact of landfills and their impact on human health (Manjula *et al.*, 2019).

The contemporary concept of infrastructure planning for "green and smart cities" (Crnčević, *et al.*, 2017), as well as

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implementation of the “circular economy” concept (Ghisellini *et al.*, 2016) are nowadays widely accepted (Lieder and Rashid, 2016). In addition, the concept of public-private partnership (PPP) is increasingly being implemented in the field of public utilities and waste management (Brdarević and Jovanović, 2012), with the goal of improving the existing praxis and reducing risks to both people and the environment. The development of cities in the context of demographic changes (Pantić, 2019), the smart planning (Bijelić and Filipović, 2016) of previously used space (urban plans), and the effects of the created infrastructure all impact the quality of the environment, thus changing the existing urban praxis. This is because certain negative elements associated with spatial development are often linked to a lack of structure in planning or a lack of direction in the development of physical structures using planning guidelines (Niković and Manić, 2018).

Environmental issues and the democratization of society have placed such topics high on the priority list (Jovanović *et al.*, 2013) of contemporary society (Jovanović and Jovanović, 2014), with individuals (Jovanović *et al.*, 2015), and other interested parties (Petrović, 2012), gaining a high public and media presence (Jovanović and Aćimović, 2014; Jovanović and Aćimović, 2014a).

WASTE MANAGEMENT IN THE REPUBLIC OF SERBIA

The field of waste management in the Republic of Serbia (RS) is covered by legal and strategic planning regulations (Živković, 2019). Waste management within the RS is defined by the Law on Waste Management (2018), the Law on Packaging and Packaging Waste (2019) and numerous other by-laws (regulations and decrees). Waste disposal within the RS is defined by the Decree on Waste Disposal in Landfills (2010) and the Rulebook on Methodology for the development of Rehabilitation and Remediation projects (2015), which defined the methodology for developing rehabilitation and remediation projects related to the existing unsanitary municipal waste landfills/dumps. Besides the aforementioned legal regulations, within the RS, practically the sole manner of waste management is still the disposal of waste in local landfills that (with very few exceptions) do not fulfill even the basic hygienic, technical and technological conditions.

Data on waste management within the Republic of Serbia is collected in accordance with the Law on Waste Management, and the report includes all types of waste (except Article 4 - Exemptions from application). The following entities are obliged to provide a report on the amount of waste generated (Article 75): the producer, owner and/or other waste holder, except households; legal entities participating in waste transport; producers and importers of products that, after being used, become special types of waste; operators at the facilities for recycling or reuse of waste; and landfill operators. All entities obliged to provide an annual report are also obliged to keep a protected daily record of the quantity of waste generated, collected, used, disposed of, imported and exported, and to submit it to the Agency for environmental protection (SEPA). These data are collected in accordance with applicable legislation in the RS, including rulebooks and decrees.

Chapter 4 of the Law on Packaging and Packaging Waste (2009), entitled “Reporting on Packaging and Packaging Waste” stipulates that reports should be written. The average daily quantity of waste generated per capita (kg) usually amounts to 1 kg (average annual value per capita amounts to 0.37 t), and the amount is higher in cities. The Ministry of environmental protection and SEPA have, based on the legal demands of the entities obliged to provide reports, created a unique report entitled “Waste Management in the Republic of Serbia in the Period 2011-2018” (2019). Based on the analysis in the report (2019), the number of facilities generating waste, as well as facilities participating in waste management constantly increased from 2011 (783) to 2018 (4571). Since the establishment of the reporting system (2013), the number of annual reports submitted from 2013 to 2018 ranged from 7,105 to 16,026. This trend of increase (from 2011 to 2018) is also expressed by the total amount of waste produced per capita annually (1.2-1.7 kg/inhabitant/per day), as well as the total amount of waste in comparison to the GDP (149-230.2 t/mil \$).

During 2018, the amount of municipal waste generated and collected continued to increase, with a slight increase in the scope of its collection, from 77% in 2011 to 87% in 2018. This expresses the success of the collection of certain fractions of municipal waste in local communities (waste paper, cardboard, packaging waste), as well as other types of waste that usually ended up in dumpsters, and an additional reduction in purchasing power as a consequence of the economic crisis (Managing waste in the Republic of Serbia in the period from 2011 to 2018, 2019).

Reports on the amounts of waste disposed of in 2018 were submitted by 32 operators. The amount of non-dangerous waste being disposed of is constantly increasing, from 347,367 t in 2011 to 1,716,092 t in 2018 (which is about five times more). Significant amounts of non-dangerous waste are made up of mixed municipal waste, street cleaning debris and bulky waste, to the amount of 822,000 t, followed by, based on reports, waste from slag processing from thermal processes, solidified waste from waste treatment plants, mixed waste from construction and demolition, waste land and rock, as well as mixtures or fractions of concrete, bricks, tiles and ceramics (Managing waste in the Republic of Serbia in the period from 2011 to 2018, 2019).

SOLID MUNICIPAL WASTE MANAGEMENT IN THE CITY OF BELGRADE

If we are to assume that the city of Belgrade has about 2,000,000 inhabitants (plus daily transit and tourists), and that every inhabitant generates (on average) about 1 kg of waste per day, we come to an amount of about 2,000 t of waste to be managed on a daily basis (Local Plan on Municipality Waste Management in Belgrade for the period from 2011 to 2020, 2011). The development concept of the city of Belgrade thus points to the existence of a need for urgent organizational and spatial definition of municipal waste disposal, as well as the remediation of existing locations, the activation of new ones, and the establishment of a recycling system.

According to the Local Plan on Municipality Waste Management in Belgrade for the period from 2011 to 2020

(LPMWM, 2011), improvement of the waste management system includes the following components:

- Replacement of existent dumpsters with underground dumpsters, which would contribute to building a more efficient organization of the collection process, reducing the waste spreading out of the dumpsters and improving the appearance of the city streets;
- Extending the scope of municipal waste collection;
- Setting up dumpsters for the primary selection of waste, with the goal of developing recycling – green islands;
- Construction of 14 centers for separate collection of recyclable waste – recycling yards in the city of Belgrade;
- Construction of two transfer stations in the city of Belgrade;
- Construction of three lines for separating recyclable waste;
- Construction of facilities for mechanical-biological waste treatment;
- Construction of facilities for combined production of thermal and electric energy (co-generative facility) that use waste fuel to produce electric and thermal energy;
- Construction and expansion of the landfill in Vinča in accordance with existing regulations;
- Remediation of existing landfills in Mladenovac, Sopot and Grocka, as well as provision of disposal sites until the new landfill is built;
- Reconstruction of a facility for treating waste of animal origin;
- Construction of a facility for producing biogas from agricultural waste;
- Construction of a facility for composting “green waste”; and
- Construction of a facility for recycling construction waste.

This Plan (that is, the new organizational structure) suggests that the (existing) public waste management company (PUC “City Sanitation”) should be divided into two companies: a company in charge of waste collection and transport and a company in charge of waste treatment and disposal. The PUC City Sanitation (for the collection and transport of waste) would be in charge of the collection and transport of waste to transfer stations and the center for waste management from municipalities with no transfer stations planned for them. The company would also have jurisdiction over setting up dumpsters for the separate collection of recyclable waste and for recycling yards, as well as lines for recyclable waste separation. In this way, waste management would be moved from public municipal companies in other municipalities (Grocka, Mladenovac, Surčin, Sopot) and merged into this company. The PUC City Sanitation (for the treatment and disposal of waste) would have jurisdiction over waste transport from the transfer station to the center for waste management, as well as over the center for waste management. Both PUCs in question would have contracts with the city for the provision of these services.

There are two possible methods of managing the waste collection system and center for waste management. According to the first suggestion, the PUC City Sanitation for the collection and transport of waste should manage the collection of waste, and the PUC City Sanitation for the treatment and disposal of waste should manage the centre for waste management. According to the second suggestion, the PUC City Sanitation for the collection and transport of waste should manage waste collection, and the PUC City Sanitation for the treatment and disposal of waste should operate landfills, but a private partner would operate the facilities for the mechanical and biological treatment of waste and the facilities for the mixed production of thermal and electric energy. The total management rights should not surpass 49% (LPMWM, 2011).

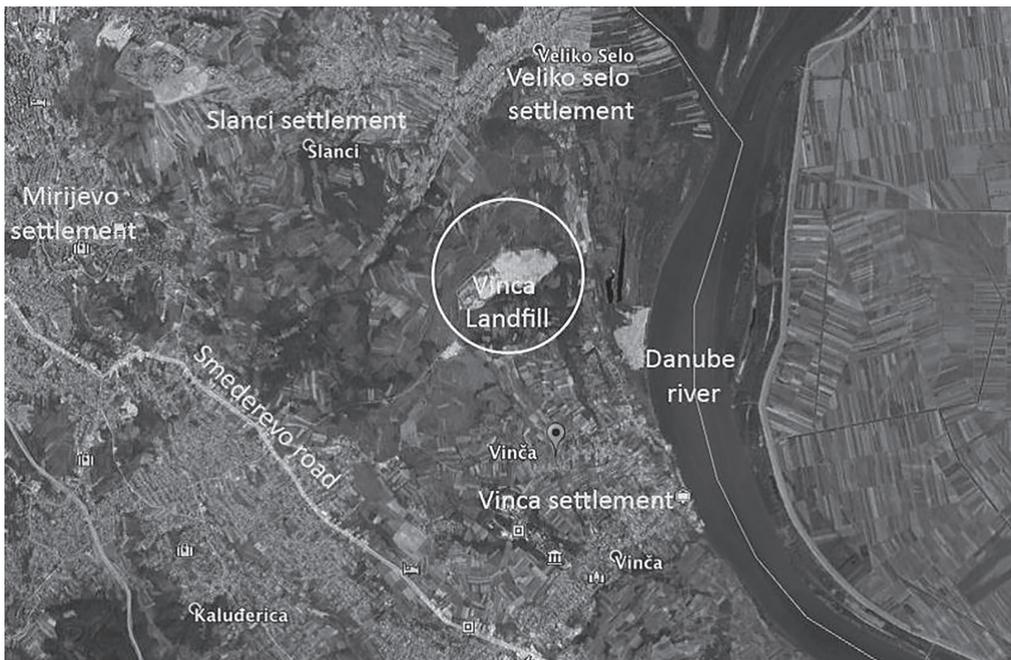


Figure 1. Location of the Project and surrounding settlements (Source: Stakeholder engagement plan, 2018)

ANALYSIS OF THE FULFILLMENT OF THE PROVISIONS OF THE PLAN FOR WASTE MANAGEMENT IN THE CITY OF BELGRADE

Using the method of analysis, activities, the obligations and the level of their fulfillment (activities) were analyzed on the basis of the LPMWM, as were the implementation deadlines (based on the available documentation of the city Secretariat), and the following conclusions shown in Table 1 were reached.

Analysis of the former activities of the SEP and PUC City Sanitation proves that the LPMWM was only partially implemented in relation to the replacement and procurement of above-ground dumpsters and procurement of equipment and mechanization for collecting and transporting municipal waste. Implementation of the requirement regarding the recycling centers (of which there are only three out of 14 planned) began in 2018 and continued in 2019 with procedures relating to obtaining building permits. The construction of two transfer stations is only in the phase of developing the urban project and drafting the DRP and technical documentation. The installation process for underground containers is also in its initial phase, given the fact that plans are being put in place for the installation of underground containers for selection and recycling for the period from 2019 to 2029 individually for each municipality.

Former experience and numerous studies have shown that privatization (PPP) often improves the work of state companies (PUC) in relation to the entire management system and requirements for preserving the environment (Impacts of privatization of the environment – lessons for developing countries, 2003). By concluding and implementing the PPP contract, the possibility of establishing an improved municipal waste management system on the territory of the city of Belgrade in accordance with the national positive regulations, standards and conditions of the EU Directives, has been opened. Certain components of the LPMWM that have not been fulfilled until now, that is, that have not even been set in motion, and that are not included in the PPP contract, clearly cannot be completed until the new plan is passed. This refers to remediation of the existing landfills in Mladenovac, Sopot and Grocka as well as to: the provision of disposal sites until a new landfill is built; reconstruction of the facility for the treatment of waste of animal origin; construction of a facility for the production of biogas from agricultural waste; and construction of a facility for composting green waste.

PPP AND MUNICIPAL WASTE MANAGEMENT IN THE CITY OF BELGRADE – AN ANALYSIS OF THE POSSIBILITIES AND POTENTIAL IMPROVEMENTS

With the goal of improving the municipal waste management system and solving the problem of the landfill in Vinča which has been present for decades, and at the suggestion of the city of Belgrade, in 2015 a competitive dialogue process was launched for selecting a private partner. Following the procedure in accordance with the positive regulations of the RS, and in compliance with the high EU standards on waste management and environmental protection, the Public-Private Partnership Contract (PPP) was signed in 2017 by the city of Belgrade, represented by the Secretariat for the

Environmental Protection, and the private partners Suez Groupe S.A.S (France) and I - Environment Investments LTD (England). For the purpose of implementing the contract, a special purpose company entitled Beo Clean Energy was established within the territory of the Republic of Serbia in order to manage the project. The basic purpose of the company is to provide the service of treatment and disposal of municipal solid waste (MSW).

This service includes the private partner fulfilling requirements in the fields of projecting, financing, construction, operation and maintenance of the facility for the treatment and disposal of about 510,000 t of MSW annually and over 200,000 t of construction and demolition waste. The amount of 340,000 t of MSW will be treated (incinerated) within a facility that produces electric and thermal energy from waste, and about 170,000 t of MSW will be treated and disposed of in a new sanitary landfill that will be constructed as a part of the project. Moreover, over 100,000 t of construction waste originating from demolition annually will be treated in the facility for the treatment of construction and demolition waste.

The private partner in the landfill in Vinča is obliged by the contract to provide a building permit for the following facilities and infrastructure: production of energy (electric and thermal) from waste; treatment of construction waste; wastewater treatment; gas production; construction of a new landfill; remediation and re-cultivation of the existent landfill and internal traffic as a part of the supporting infrastructure. The private partner (Beo Clean Energy) should acquire a building permit in accordance with positive national regulations. Upon completion of the facilities, the private partner is obliged to provide the service of the treatment and disposal of municipal waste to the service users, and upon the expiration of the 25-year contract, the private partner is obliged to return the management rights for the sanitary landfill to the city of Belgrade.

Regarding the infrastructure, 5 km of the 110kV power line should also be constructed. Thus, the new substation of the Vinča landfill would be linked to the EMS substation Beograd 20 (Plan for detailed regulation of the construction of lines of 35kV from the TS 35/10kV "Vinča" to the sanitary landfill Vinča, urban municipalities Zvezdara and Grocka, 2019), as well as the supply of electricity for self-consumption provided from the distribution network over the new 35/10kV power line (Plan for detailed regulation of the construction of lines of 35kV from the TS 35/10kV "Vinča" to the sanitary landfill Vinča, urban municipalities Zvezdara and Grocka, 2019) that shall be built within the Vinča landfill. This power line will be linked to the existing power line Vinča 35/10kV via the 5 km-long 35/10 circuit.

The thermal energy produced in the facility from the process of waste combustion (Waste to Energy) will be transported to the PUC Belgrade Power Plants via an 8-km-long mostly underground pipeline for district heating, which will connect the Vinča landfill with the Konjarnik district heating facility (Detailed regulation plan for the construction of a hot water network from the sanitary landfill in Vinča to the Konjarnik and Mirijevo heating plants – Urban municipalities Zvezdara and Grocka, 2019).

Table 1. Analysis of the provisions of the Plan for waste management in the city of Belgrade, and the level of fulfillment of its obligations in comparison to the planned activities

Activity planned by the plan	Obligations based on the Plan	Level of fulfillment of the Plan/Note
Replacement of the existing dumpsters with underground dumpsters and installation of underground dumpsters - contributing to more efficient organization of the collection process, reduction of waste spreading out of the dumpsters and improvement of the look of the city streets in 14 urban municipalities	Obligations – the city: Secretariat for the Environmental Protection (SEP) and Secretariat for Municipal and Housing Affairs (SMHA) Company: PUC City Sanitation	Continuous replacement of worn-out above-ground dumpsters is being carried out at existing locations in 14 urban municipalities on the basis of funds provided by the SEP, and the public procurement procedure is carried out by PUC City Sanitation. Installation of underground dumpsters was carried out until 2016. In total, 2,036 units (ranging in size from 5m ³ , 3m ³ , 1.8m ³ and 1.5m ³) were installed on the territory of 10 urban municipalities (Stari grad, Vračar, Savski venac, Palilula, Zemun, Novi Beograd, Rakovica, Zvezdara, Voždovac, Čukarica), where the cleaning, collection, transport and disposal of waste is conducted by PUC City Sanitation. Out of the stated number of underground dumpsters, during the year of 2019, a total of 208 of them have a recycling function for different types of recycling. Other recycling containers include: recycling side containers 3.2m ³ – municipal waste disposal jumbo, 114 units; and recycling bells for glass (78 units) and textiles (23 units). Because the requirements in the LPMWM (location, presence of underground infrastructure, construction, traffic, spatial and demographic characteristics) could not be completed within the 10-year period given, the city adopted a plan for installing underground dumpsters for selection and recycling for the period 2019-2029 in the Stari Grad urban municipality in 2019. Plans for other city districts will also be adopted. SMHA did not determine the type of containers used for the disposal of household waste.
Procurement of equipment and mechanization for primary waste selection with the goal of developing recycling-green islands	SEP PUC City Sanitation	SEP provides the means for procuring equipment (containers of different volume, abrollkippers, 240 l bins, recycling bells for glass, etc.) and mechanization (trucks, presses, forklifts and other mechanization needed for waste collection and transport), and the PUC City Sanitation conducts the process of public procurement. Note: for the majority of the equipment and mechanization, provision of the means and the public procurement were conducted in 2018 and 2019.
Construction of 14 centers for separate collection of recyclable waste – recycling yards in the city of Belgrade	SEP	Besides constructing 3 recycling centers, the procedure for obtaining the necessary documentation for issuing building permits for 9 recycling centers has been initiated – different stages of the process are underway under provisions of the law on planning and construction (collection of data on location conditions, drafting a PDR for certain locations, conducting expropriations for certain locations, etc.).
Construction of two transfer stations (TS) within the city of Belgrade	Obligation of the city: SEP 2 TS with recycling separation lines on site: 1TS for urban municipalities Zemun, Surčin, N. Beograd and 1TS for urban municipalities Čukarica Rakovica, Voždovac; For other urban municipalities (Vračar, Stari Grad, Savski Venac, Zvezdara, Palilula, Grocka, Sopot, Mladenovac), PUC collects and transports the waste to the center for waste management in Vinča	Location TS Zemun, Surčin, N. Beograd: urban project for transfer station located in Zemun Polje completed. Location TS 2, Mladenovac: the process of drafting a PDR and technical documentation for the TS is currently underway. Note: the procedures currently underway were launched in 2018 and 2019.
Construction of facilities for mixed production of thermal and electric energy (co-generative facility) powered by fuel acquired from waste	SEP	Related to the fulfillment of obligations under the PPP Contract
Construction and expansion of the landfill in Vinča in accordance with regulations	SEP	Related to the fulfillment of obligations under the PPP Contract
Remediation of the existing landfills in Mladenovac, Sopot and Grocka, and provision of a disposal site until the new landfill is built	SEP	Not fulfilled
Reconstruction of facilities for treating waste of animal origin	SEP	Not fulfilled
Construction of facilities for the production of biogas from agricultural waste	SEP	Not fulfilled
Construction of a facility for composting green waste	SEP	Not fulfilled
Construction of facilities for recycling construction waste	SEP	Related to the fulfillment of obligations under the PPP Contract
Remediation of waste disposal sites – “wild landfills” on the territory of the city of Belgrade	SEP and PUC City Sanitation	During each year, according to a pre-determined plan, remediation and cleaning of wild landfills is carried out in locations that are, as a rule, a permanent place of uncontrolled waste disposal. This problem is not addressed adequately and considerable financial resources are invested in the short-term remediation of sites, which again become waste disposal sites.

The project is financed through loans from international financial institutions (IFI) and in accordance with the regulations of the Republic of Serbia and the environmental and social demands of the IFI financials, especially the International Financial Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD). The city of Belgrade, besides being obliged to finance the remediation of the existing landslide in the body of the landfill, is also obliged to pay a certain amount expressed in RSD annually exclusively for the provision of treatment of municipal waste from the moment the provision of services started.

By analyzing the potential improvements to municipal waste management by implementing the PPP concept (based on the signed contract), the City of Belgrade might expect to achieve the potential system improvements expressed in Table 2.

issue of its realistic fulfillment comes to the fore. Namely, its goals, such as an increase in the scope of the organized waste collection to 100%, developing building capacities for the treatment and disposal of waste and the introduction of a system that would use the waste resources (30% recycled, 35% used for the production of energy 35% of waste disposed of in a sanitary landfill), have not yet been met.

According to the analysis shown in the tables, and based on the available internal documents of the city SEP, it might be stated that the majority of activities required of the city originating from the current LPMWM were only started after the conclusion of the PPP contract in 2017. Activities carried out in accordance with the LPMWM were insignificant before the signing of the contract. In support of this statement, it is sufficient to state that only the procurement of equipment and mechanization for waste collection and transport, as well as the remediation of wild

Table 2. Possibilities for potential improvements to municipal waste management in the city of Belgrade based on the obligations stipulated in the PPP Contract

Activity	Contractual obligations and deadlines	Possibility of improvement / Note
Construction, expansion and remediation of the landfill in Vinča in accordance with the regulations	Signed PPP Contract on September 29, 2017 within the obligations of the private partners (PP); Effective Date: December 31, 2018	Closing the unsanitary landfill, construction of new facilities, remediation and re-cultivation of the landfill, use of the landfill for managing municipal waste from the effective date of the PP services (01.10.2021) for a period of 25 years, that is, until 01.10.2046.
Remediation of landfill landslides and stabilization of a part of the landfill in Vinča	Obligations of the MEP, deadline: 31.12.2019. The obligation was fulfilled in June 2019	Through remediation and construction of the supporting structure and by forming new channels and separators for the collection of wastewaters, stopping of the further landslide of the landfilled waste materials on the pedal part of the landfill in the watershed of the Ošljanski stream that flows into the Danube River.
Construction of a facility for mixed production of thermal and electric energy (co-generative facility) powered by fuel acquired from waste, and the acquisition of a production license	Obligation of the PP in accordance with positive regulations. Deadline: license for production of electrical energy - 05.10.2022. Deadline: license for production of thermal energy - 05.10.2022.	Based on legal requirements (Law on Waste Management, Law on Environmental Protection and Energy Law), the use of waste to produce energy.
Construction of a facility for gas production	Obligation of the PP in accordance with positive regulations. Deadline: linked to acquisition of an integrated license - 18.11.2023.	Based on the legally prescribed obligations (Law on Waste Management, Law on Environmental Protection, and Energy Law), the use of waste to produce energy.
Construction of a facility for treatment of construction waste	Obligation of the PP in accordance with positive regulations. Deadline: linked to acquisition of an integrated license - 18.11.2023.	Based on the legally prescribed obligations (Law on Waste Management), establishment of a municipal waste management system on the territory of the city and fulfillment of obligations under EU directives in the field of waste management.
Construction of a facility for wastewater treatment	Obligation of the PP in accordance with positive regulations. Deadline: linked to acquisition of a integrated license - 18.11.2023.	Based on the legally prescribed obligations (Law on Waste Management, Law on Environmental Protection), fulfillment of conditions for operating a sanitary landfill

Through this project, the city of Belgrade plans to treat the maximum amount of biodegradable MSW generated and limit the use of the landfill for the disposal of treated residue and inert waste, thus contributing to the RS fulfilling the demands of EU Council Directive 1999/31/EC of 26 April, 1999 on the landfill of waste, regarding the reduction of biodegradable MSW disposed of landfills. However, by analyzing the current LPMWM that sets the strategic goals until the year 2020, the

landfills, have been continuously carried out. Certainly, it should be noted that implementation of the PPP contract implies the harmonization of its regulations with existing ones in order to establish a municipal waste management system. In this regard, the City of Belgrade has adopted new regulations, amendments and supplements to the existing documents, as well as planning documents, related to the subject area.

CONCLUSION

If we perceive waste as potential and realistically available raw material, then its disposal represents material, energy and financial loss, which is the least desirable option for waste management. On the other hand, the costs of collection, processing and disposal of waste are significant and require a large quantity of energy (fuel), a work force and an adequate organizational model that can support this. This paper discusses two possible solutions (based on LPMWM) for the treatment of MSW in Belgrade (in order to implement the PPP concept of elimination of MSW, or not) that provide the most environmentally acceptable option in the present situation. The city of Belgrade wishes to develop an economically viable, comprehensive and modern mixed complex for treating (biodegradable) waste that would generate energy from the waste produced on the territory of the city. Moreover, the city wishes to build a facility for treating construction and demolition waste and a new sanitary landfill for waste treatment, as well as to conduct remediation by collecting landfill gas on the location of the existing landfill to use for the production of electric and thermal energy in Vinča. Thus, this project and its implementation are a national and local priority.

The LPMWM analysis shows that the PPP represents a real possibility when speaking of fulfillment of the all provisions stipulated in the Plan for Waste Management in the City of Belgrade. All of the above is analyzed in the paper on the basis of the provisions and obligations stipulated in the recently signed contract on public-private partnership (PPP) and environmental benefit. Also, some of the possible comprehensive improvements to the municipal waste management system are presented based on the obligations of the signatories of the PPP contract. On a local level, as a form of improvement in this field, new regulations and amendments to the existing and planned documents are planned. A significant fact is that, by signing the Contract on PPP, the treatment and storage of waste over the following 25 years is the responsibility of the private partner, and not of the public waste management company, as planned by the LPMWM for the city of Belgrade. The signed contract, as well as the implementation of its provisions, represents a realistic possibility for making significant improvements in the field of municipal waste management in Belgrade.

Without significant and additional investments in the field of waste management in the city of Belgrade, it is not possible to fulfill the provisions of the plan. That is why the concept of the PPP is imposed as the optimal solution (foreseen by the plan) to fulfill all of its requirements. Based on comprehensive analysis, it can be concluded that the current PPP model is at the time being the most appropriate option for addressing MSW issues in the city of Belgrade in the context of contemporary management, technological trends and environmental requirements.

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