Belgrade, the capital city of Serbia, disposes of the waste generated by its 1.7 million population at a dumpsite located in Vinča about 15 km from City center, near the Danube river. With an annual volume dumped of circa 700,000 tons, no treatment of leachates (which are fully discharged to the Danube river) and landfill gas, frequent fires and landslides, the Vinča dumpsite ranks amongst the 50 most polluting dumpsites in the world listed in ISWA's Roadmap for Closing Waste Dumpsites.

The closure of the dumpsite and the development of an integrated waste management facility (including a thermal treatment plant) to efficiently recover and dispose of Belgrade’s 500,000 tons of municipal solid waste and 200,000 tons of construction and demolition waste have been a long-standing objective of municipal authorities, which were reflected in the City’s Local Waste Management Plan 2011 to 2020. The project is also part of the national agenda to demonstrate Serbia’s alignment with EU environmental acquis in the perspective of Serbia’s accession to EU.

In the context of limited investment capacities, and with the support of IFC (International Finance Corporation) – the World Bank’s private sector arm, the City of Belgrade (CoB) initiated a public procurement procedure aimed at selecting
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a professional private investor and specialized operator under a PPP (Public Private Partnership) contract to design, build, finance and operate the following facilities for a term of 25 years:

- remediation and aftercare of the Vinča dumpsite
- new Energy-from-Waste (EfW) facility with 340,000 t/a (tons per annum) capacity
- new sanitary landfill in Vinča for municipal solid waste in excess of the EfW capacity and EfW residues
- recovery and disposal of construction and demolition waste

Following a 2-year procurement process, the PPP contract was finally signed between the CoB and a consortium of Suez and Itochu (incorporated under the name of Beo Čista Energija d.o.o.) in September 2017, joined by the European infrastructure fund Marguerite II in October 2018. The project is currently in the permitting phase and is due to reach financial close by end 2019. Final closure of the Vinča dumpsite and start of commercial operation of all project facilities is planned in 2022. The total project costs to be financed and realized by the consortium amounts to 350 million EUR.

Due to the project’s complexity and the lack of PPP track record in Serbia, the CoB and IFC acknowledged that the public procurement procedure had to allow for a co-development of the project documents (in particular the PPP Contract) by the City and pre-selected bidders, in order to determine realistic outputs and a suitable and bankable allocation of risks. Only the structure of the project resulting from this competitive dialogue would be then submitted to the final tender.

Following a one-year dialogue, CoB decided to amend some of its initial intentions (as reflected in the Local Waste Management Plan) and resigned from its requirement that waste should be pre-treated at a 500 kt/a mechanical-biological treatment facility prior to thermal treatment. Alternatively, City allowed for a more affordable combination of a mass-burn facility of 340 kt/a, and direct landfilling of municipal waste beyond the EfW capacity. In this configuration, sufficient headroom was left for the future development of a separate collection of recyclables.

Special care was also given to clearly define the responsibilities of the private partner in terms of aftercare of the remediated dumpsite, to make sure that no legacy pollution shall create a liability on the private partner. In addition, the competitive dialogue allowed to make the PPP Contract suitable for project financing with a mix of investors’ equity and long-term debt from international financing institutions such as IFC and EBRD.

2. Introduction

It is generally pointless to close any dumpsite unless a sustainable substitute waste management solution exists or is developed in parallel and the generally higher costs of this solution are accepted. By acknowledging this condition, it is not only possible to achieve the environmental objectives, but also attract private sector financing for the
completion of the complete project, i.e. dumpsite closure and development of substitute facilities. The Belgrade Vinča Waste Management PPP project is a good illustration of this integrated approach.

The first part of this paper reviews the objectives of the project while the second part analyzes how the scope of the project was finally determined and highlights how the model and conducting of the procurement process has increased the focus on developing an affordable and efficient waste treatment strategy.

The third part focuses on the key success factors that, in the author’s opinion, allowed for a successful completion of the procurement procedure and should be considered by other project owners to combine their dumpsite closure projects with the development of modern waste management facilities.

3. Part 1 – project objectives

A reputation challenge for a modern European capital

In operation since 1977, Belgrade’s dumpsite is located in Vinča, about 15km from the city centre. The site lies over approx. 40 ha and is a constant source of pollution for the Danube river. Although the dumpsite is located in a relatively unpopulated area, frequent waste fires (including during several weeks in May to June 2017 and in December 2018) cause substantial nuisances to local neighbourhoods and the residents of Belgrade. Without any landfill gas capture system, the site has an adverse impact on climate change and it is estimated that emissions of 1 to 5 million tons of CO₂ equivalent would be avoided over the first 10 years following the dumpsite closure. Finally, several dozens of Roma people live and scavenge on the site – a social challenge for municipal authorities.

Faced with above issues and considering Serbia’s ambition to join EU, it was clear for both the central and local governments that Vinča dumpsite had to be closed and replaced by sustainable waste management facilities. For this purpose, an outline strategy was prepared and formulated in the Local Waste Management Plan 2011 to 2020 for the City of Belgrade, which served as an initial reference document for the project.

Attracting private sector financing and know-how

Based on the experience of Western Europe, the CoB decided to call for private sector financing of the project in the form of a Public Private Partnership under Serbian PPP law, with a 25-year operation period. As a result, CoB would be able to allocate resources from its investment budget into other, less commercially viable infrastructure works such as roadworks and the public transportation system. For this purpose, CoB made plans to gradually increase the local waste tax charged to residents and businesses to remunerate the private partner from the start of operation planned in 2022.

Furthermore, CoB acknowledged that the substantial challenges associated with the design, construction and operation of the facilities requested know-how and expertise that were not, or only partly locally available.
4. Part 2 – project scope

A treatment strategy driven by recovery targets and affordability

In addition to the remediation and long-term aftercare (including treatment of landfill gas and leachates) of the Vinča dumpsite, the initial scope of the project included the material and thermal recovery of approx. 500,000 t/a of Municipal Solid Waste (MSW) and material recovery of 200,000 t/a of Construction and Demolition Waste (CDW).

A preliminary strategy to achieve the recovery purposes had been elaborated in the Local Waste Management Plan (LWMP) 2011 to 2020 for the City of Belgrade. The strategy relied on the development in Vinča of a material recycling facility to process source-segregated, co-mingled package waste, once a separate collection system is implemented by City. Pending development of source segregation and collection, and for any residual waste, the LWMP relied on a mechanical-biological treatment (MBT) plant to be built in Vinča to remove and stabilize organic waste and produce Residue-Derived Fuel (RDF). The RDF was planned to be incinerated in an EfW plant (also built in Vinča) and connected to the power and district heating systems of Belgrade. Residues from incineration and stabilized bio-waste from MBT plant were planned to be landfilled in new engineered cells to be built next to the closed dumpsite.

Following an internal assessment at the stage of defining the scope of the Public-Private Partnership, CoB decided to put a priority on the remediation of the Vinča dumpsite and the development of treatment facilities for non-recyclable waste, as the source of the most critical environmental issues for the City. Besides, CoB decided that the scope of the PPP project should be independent from the organization of municipal waste collection, a task which remains in the City’s sole responsibility. As a result, the development of a material recycling facility was removed from the PPP scope and left to be independently developed by City in the future, depending on the scope and effect of a source-separated collection of recyclables.

During the competitive dialogue, bidders raised concerns that the development of both a MBT plant and an EfW facility as initially contemplated in the LWMP would result in costs exceeding the end users’ affordability level and that the MBT facility was of little benefit considering that the vast majority of its outputs would be either landfilled or incinerated. After requesting initial pricings, CoB set an obligation that a minimum of 340,000 tons of MSW should be processed in an EfW with grate furnace technology operating in CHP (combined heat and power) mode. To guarantee the effectiveness of the incineration process, City further requested that a minimum 70 % landfill diversion shall be achieved for waste processed at the EfW facility.

CoB allowed bidders to plan new engineered landfill cells in an undeveloped area next to the remediated dumpsite for any excess MSW tonnage (estimated to approx. 170,000 t/a, pending development of recycling) as well as treatment residues from the EfW facility (incineration bottom ashes and solidified boiler/fly ashes).

In parallel, CoB reserved a right to exclude source-segregated recyclables from the project’s waste envelope.
For Construction and Demolition Waste, City acknowledged the lack of local offtake market for aggregates produced from CDW and imposed a treatment obligation (i.e. removal of non-inert waste, crushing and sieving into fractions) as well as marketing efforts, yet relieved bidders from final off-take commitments pending the arising of a sufficient market demand.

The following revenues were also made available to the private partner to subsidize the availability fee to be paid by the City:

- Electricity feed-in tariff of 86 Euro/MWh and off-take obligation by the national power operator in accordance with legislation on renewable energy for power produced by the EfW Facility and the landfill gas recovery unit, available during 12 years from start of operation; this revenue is planned to contribute to approx. 30% of project’s annual revenues.

- Heat off-take price of 30 Euro/MWh and a guaranteed heat volume offtake of 56 MWth during the heating season with the Municipal District Heating Company, available over 25 years, contributing approx. 10% of annual revenues.

As a result, the availability payment to be paid by City to the private partner amounted to about 60% of the total project revenues, for an estimated amount of 70 Euro/ton of MSW.

In order to fund such availability payment, City will need to double the waste disposal charge applied to households and businesses, currently at the level of 2 Euro/month/household. It has been calculated that the increased charge would not exceed 1% of the average household expenses, which is considered within the affordability range.

Overall, the competitive dialogue allowed to set outputs in accordance with CoB’s most urgent priorities, optimize investments and treatment methods, keep the project impact within end users’ affordability limits, and leave sufficient headroom for the future development of recycling in Belgrade.

A project structured for non-recourse project financing

The cost of all project infrastructure (including interest charges during construction) is estimated to approximately 350 million EUR.

Suez and Itochu, as the investors selected by the City of Belgrade to carry out the project, decided to raise necessary funds under non-recourse project finance, a typical method of financing for large public-private partnerships.

For this purpose, Suez and Itochu incorporated a special purpose vehicle (SPV) under the name of Beo Čista Energija d.o.o. (BCE). A 20% stake in the SPV was taken in October 2018 by Marguerite II, a EUR 745 m infrastructure fund raised in 2017 with commitments from 6 European public financing institutions - EIB, Germany’s KfW, France’s Caisse des Dépôts et Consignations, Italy’s CDP, Poland’s BGK and Spain’s ICO.

It is intended that BCE will receive equity from its shareholders up to approx. 25% of the funding needs and take long term credit from lenders for the remaining 75%. The debt, an A-B loan structure, will be sourced from international financing institutions.
(eg IFC, EBRD), OeEB the Austrian development bank and a group of commercial banks. Reimbursement of credits are being secured by the SPV’s cash-flows generated by the project. BCE has decided to entrust the construction of the EFW facility to CNIM, a prime French EPC contractor and the landfill remediation and construction works to Energoprojekt Niskogradnja, while SUEZ is planned to supply the leachate and biogas treatment facilities, as well as carry out the operation and maintenance of the complete system for the 25 years.

The project organization is schematized below, highlighting the key interactions among the stakeholders.

Figure 1: Organization of the Belgrade Public-Private-Partnership project – key interactions among the stakeholders

5. Part 3 – key success factors

Competitive dialogue procedure

In order to benefit from experience and receive inputs from competent and reliable investors and operators, CoB advised by IFC decided to prequalify 5 potential bidders based on their track-record of PPPs in the waste industry. As a second step, City organized a competitive dialogue procedure to refine the treatment strategy, adjust the risk allocation and develop a bankable PPP Contract. The dialogue took place during most of 2016 and was organized in 5 successive rounds with as many consecutive versions of the draft PPP Contract, along with substantial communication and exchanges between the meetings allowing the parties to request and provide feedback and positions on the key project parameters. As an example, Suez – Itochu submitted more than 40 detailed clarification requests and suggestions and provided answers and positions
to 20 information requests from CoB. Although a competitive dialogue procedure is heavy to organize and requires substantial support from legal, technical, financial and insurance advisors on all sides, it is probably the most efficient way to ensure that such a complex project will achieve an optimum balance in the parties’ interests, allocate each risk to the party that can best manage it, and minimize the risk for City that the tender is unsuccessful.

As a result of the dialogue, CoB published the final terms of tender and invitation to bid in February 2017, allowing for a 5-month final bid preparation phase. The contract was finally awarded to Suez-Itochu in August 2017 and the PPP Contract was signed on 29 September 2017.

Figure 2: Procurement procedure of the Belgrade PPP project

Overall, the procurement procedure took approximately 2 years (starting with prequalification in August 2015) and was made possible by the preparation of a preliminary strategy by CoB in the form of the Local Waste Management Plan 2011 to 2020.

Bankable risk allocation

The overarching success factor for any PPP project procurement is the allocation of risks and responsibilities among the public and the private partner, which allows to secure both sponsors and lenders participation to the project on affordable terms.

In the case of the Belgrade PPP, the general risk allocation is based on the private partner’s responsibility for design and permitting, financing, construction and operation costs as well as energy and environmental performance, whereas the public partner is responsible for securing the land rights (including for the connection to high voltage power system) and building a connection to the district heating system.

Due to its responsibility for collection of MSW in the project area, CoB took the volume risk for the MSW delivered to the EfW facility by implementing an availability payment system covering the private partner’s financing and fixed operation costs. Besides, considering the impossibility to finance the project in local currency, CoB covers the forex risk on the availability payment.

On the other hand, the private partner accepted the waste calorific value risk, which will be mitigated by the flexible combustion diagram of the EfW facility (from 340 kt at 8.5 MJ/kg to 385 kt at 7.5 MJ/kg) and the availability of surplus waste, considering the overall waste envelope of 500,000 t/a.
Finally, the contamination risk associated with the long term environmental impact of the Vinča dumpsite after its closure, which is impossible to fully mitigate due to the lack of bottom sealing, was allocated to CoB subject to proper management of effluents and ad-hoc monitoring by the private partner.

6. Conclusion

The closure of the Vinča dumpsite in Belgrade is on its way to be realized thanks to an integrated approach with the development of modern facilities able to achieve CoB’s objectives of recovery and safe disposal.

By making the choice of developing the project as a PPP with reliable partners and organizing a competitive dialogue with the help of experienced advisors, CoB made sure that its initial assumptions were tested and adjusted to allow for a viable and affordable project. In particular, a suitable allocation of risks and responsibilities was developed to ensure that the private sector would be able to finance the project and deliver the expected benefits at a reasonable cost.

In the authors’ opinion, this approach can be considered as a replicable case study, in particular in other emerging countries.

Acknowledgements

Belgrade Municipality, Serbia
International Finance Corporation
Itochu

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Several plants in Germany have been provided with this technology. Figure 8 shows a plant, realised with a dry hydrator for a Ca(OH)₂ production capacity of approximately 3 t/h. As an alternative, it is possible to install the dry hydrator close to the additive and inject CaO2 directly into the reactor without temporary storage in a silo. Figure 9 shows such a dry hydrator as well as the corresponding WtE plant.

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