Green landfill : A zero-impact waste disposal facility

VEOLIA offers a new approach to waste management on landfills in which all resources are used to create positive-impact sites: no methane emissions from the waste, positive energy balance, no leachate released into the natural environment.

Starting date of the project	Belgrade project: **October 2019** - start of construction **July 2021** - Commissioning of new waste compartments and start of the rehabilitation of existing waste
Project Localisation Places of implementation of the project at this stage and targeted geography if replicable.	Project already implemented in Serbia, Greece and France. The project can be replicated in all countries of the European Union.
Project objectives Type of climate innovation of the project with a description of the problem/issue addressed	Reduction of the carbon footprint of household waste landfills by capturing and recovering biogas in order to produce electricity and heat.
Detailed project description	With the Green Landfill project, VEOLIA offers municipal waste management with zero environmental impact, and which is adapted to all contexts. This management would result in zero CH4 emissions from the waste breakdown process, no leachate discharges, and no plastic discharges into the environment. Green Landfills contribute to circular economies by recovering green energy to produce biogas, which can then be reinjected into the gas distribution network or used to produce electricity and heat. Biogas is produced from the anaerobic fermentation of the organic matter of the waste stored in covered waste compartments. It is collected using vertical wells, mixed or horizontal drains, and then prepared before being recovered for cogeneration. Its recovery into electricity is ensured by a biogas motor and requires prior dehumidification and activated carbon filtration. On average, biogas production is at approximately 80 Nm3/t of landfill, for biogas containing 50% methane. A biogas motor with a capacity of 500 Nm3/h has an electrical capacity of 1MW. For example, the Belgrade project includes two biogas motors with a combined electrical capacity of 3.2 MW. The electricity that is produced is used to power the site, in particular the leachate treatment unit, and/or sold to the electricity distribution network. Heat production can be recovered, in particular, through the district heating network. In Belgrade, it reduces the natural gas consumption of the Konjarnick thermal power plant by almost 80% during the cold season. Biogas is also used as a heating source for the site, replacing the fuel oil used in the boiler for the evaporation of concentrates from the membrane treatment of leachates.
Main project's drivers for reducing the greenhouse gas emissions	

Reduction levers	**Details on the aspects of the project**
☐ Energy and resource efficiency (including behaviour)	
☒ Energy Decarbonisation	Recovery of captured biogas
☐ Energy efficiency improvements	
☐ Improving efficiency in non-energy resources	
☐ Emissions absorption: creation of carbon sinks, negative emissions (BECCS, CCU/S, ...)	
☐ Financing low-carbon producers or disinvestment from carbon assets	
☒ Reduction of other greenhouse gases emission	Capture of diffuse methane emissions generated by the on-site breakdown of household waste

Emission scope(s) on which the project has a significant impact and quantification of GHG emission reductions per emission scope

	Aspects of the project contributing to the reduction of emissions by emission category	Quantification of associated GHG emissions by emission category *Please follow the quantification methodology used in the Afep guidelines.*
Reduction of the company's carbon dependency		
Scope 1 *Direct emissions generated by the company's activity.*	Reduction of diffuse CH4 emissions via biogas capture	Example taken from Belgrade: Annual reduction of approximately 150,000 t CO2e compared to the current uncovered landfill (1)
Scope 2 *Indirect emissions associated with the company's electricity and heat consumption.*	Reduction of emissions due to * the partial elimination of the site's own electricity consumption * the substitution of fossil energy used to reduce leachate treatment by-products	Example taken from Belgrade: Reduction of GHG emissions associated with the site's energy consumption, i.e. annual reduction of approximately 1,500 t CO2e (2)
Scope 3 *Emissions induced (upstream or downstream) by the company's activities, products and/or services in its value chain.*		
Increase of carbon sinks		
Emissions Absorption *Carbon sinks creation, (BECCS, CCU/S, …)*	Inorganic carbon (plastic, etc.) is sustainably sequestered in the waste compartments	Currently being determined
GHG emissions avoided by the company at third parties		
Avoided Emissions *Emissions avoided by the activities, products and/or services in charge of the project, or by the financing of emission reduction projects.*	Reduction in the consumption of natural gas for district heating and of non-renewable electricity for public distribution of electricity.	Example taken from Belgrade: 22,000 t CO2e emissions avoided per year

Clarification on the calculation or other remarks: click here to specify

(1) i.e. an average reduction in the volume of annual emissions from 225,000 tCO2e to 75,000 t CO2e (ADEME quantification protocol applied)
(2) Calculated on the basis of the "Protocol for the quantification of greenhouse gas emissions from waste management activities", or "EPE Protocol", and data from the IEA on the carbon content of the local electricity mix. Both protocols are in line with the GHG Protocol

Modality of verification of the quantification.

Calculation standard used (ADEME base, GHG protocol, etc.): click here to enter the information
Application of existing standards (Verra, Gold Standard)

Verification of the calculation (internal or external): click here to enter the information
External audit

Other environmental and social benefits of the project

In addition to its contribution to SDGs, this zero-impact landfill project introduces numerous co-benefits 11, 12 and 13:

- Production of water from treated leachates, which can be reused for agricultural or industrial ends (SDG 6 Clean Water and Sanitation)
- Conservation of natural assets (soil, water) and biodiversity thanks to site remediation, preservation of wildlife in the landfill zone (wetlands, nesting sites, etc.), elimination of leachate discharges into the natural environment (SDG 14 Life Below Water and SDG 15 Life on Land)
- Job creation: 50 direct jobs created in Belgrade in terms of operations (SDG 8 Decent Work and Economic Growth)
- Contribution to public health by avoiding fires, the use of aerosols and the dissemination of solid waste in the environment (ODD 3 Good Health and Well-being).

Project maturity level

☐ Prototype laboratory test (TRL 7)
☐ Real life testing (TRL 7-8)
☐ Pre-commercial prototype (TRL 9)
☐ Small-scale implementation
☒ Medium to large scale implementation

Remarks: click here to enter the level of maturity of the project

Capacity and conditions of the project reproducibility, with associated climate impact mitigation potential	The Green Landfill project can be reproduced in any municipal waste recovery context. It is particularly well-suited for the remediation of existing landfills in emerging countries or countries in the process of integrating the EU, while also meeting increasingly strict regulations. The success of this project relies on various factors: * Compliance with local regulations in order to obtain an operating permit * The presence of energy buyers on a local level (e.g. Electricity distribution network and district heating network)
Amount of investment made (in €)	**Example taken from the Belgrade landfill (Serbia):** €47 M invested in the remediation of the current site (40 hectares) and extension of the site for the treatment of 170,000 t of municipal waste + 60,000 t of inert waste (construction waste) / year
Economic profitability of the project (ROI)	☐ ST (0-3 years) ☐ MT (4-10 years) ☒ LT (> 10 years) **Remarks:** click here to enter the information
Engaged partnerships	Depending on the contractual model, a number of contracts (design, construction, operation) can be signed with local authorities and project partners. Example taken from the Belgrade landfill: a construction contract and a 25-year operation and maintenance contract by a consortium composed of VEOLIA, Itochu and the Marguerite Fund.
Open comments from the project owner	/
More about the project	
Contact the company carrying the project	Beo Čista Energija: bce@bcenergy.rs
Project URL links	hiips://www bcenergy rs/about.html
Illustrations of the project	Previous landfill: 

New zero-impact landfill: