

Termoverde Caieiras - Biogas Thermoelectric Plant – BRAZIL



Figure 01: Aerial view of the biogas thermoelectric plant.
Sources: Solví Valorização Energética.

Ágata Takara Zanotti prepared this case study under the supervision of Judith Rodriguez ENV-SP and Cristina Contreras ENV-SP as part of the Harvard-Zofnass program directed by Dr. Andreas Georgoulis by initiative of IDB for the purposes of research and education.

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EXECUTIVE SUMMARY

Termoverde Caieiras is one of the largest biogas energy thermoelectric plants in Brazil. It is located in Caieiras municipality in São Paulo State, inside the Caieiras Waste Treatment Center (CTR Caieiras) landfill. Termoverde's main goal is to generate energy by harnessing the biogas produced by the landfill as fuel, which plays an important role in the Brazilian context as biogas is produced in landfills in large quantity. The project is owned by Solví Group and was developed at a total cost estimated at US \$45 million.¹ Termoverde is expected to start operations in May of 2016, with an estimated lifespan of 20 years.² The capacity of this infrastructure is expected to be 29.5 MW/h generated from biogas, through 21 generator engines,³ comparable to the power needed for 300,000 households.⁴

Termoverde's thermoelectric installation is composed of three main units: a biogas treatment system, generator engines, and substations connected to the energy transmission line. The operational process consists in capturing the biogas produced by the landfill in CTR Caieiras, treating it, combusting it, and converting it into electrical energy. This electrical energy is distributed via the Mairiporã-Cabreúva Transmission Line, also part of the project.

The project has demonstrated a good performance in enhancing the quality of life of the surrounding communities. First of all, the project will generate energy power for the households in the region via a waste-to-energy process. Secondly, five social programs were planned that address the needs and interests identified in nearby communities. These programs are related to themes such as training for community leadership, developing cultural and sporting activities for young people, and creating income-generation and entrepreneurial workshops. Additionally, the project will contribute to the development of the local economy once the installed thermoelectric plant starts generating income, employing the local workforce, and purchasing regional materials.

Considering the safety and health aspect of the project, Termoverde has evaluated the risks involved in the implementation of the equipment (generator engines) responsible for the

¹ The cost was presented as BRL 100 million by the project sponsor. Estimated exchange rate: BRL 2.21 = US \$1 for the period from May 2014 to September 2015. This period was based on the construction works' timeline provided by the sponsor.

² Carlos Alberto Nunes Bezerra, "Salvador Landfill and Other Thermoelectric Projects Using Biogas," August 2014, accessed August 29, 2015, http://abes-dn.org.br/eventos/seminario_residuos_solidos/Paineis_SNRS/Painel1/15.pdf.

³ Migratio and Solví, "Presentation of the Termoverde Caieiras S.A. Project," accessed August 29, 2015, <http://www.migratio.com.br/leiloes/Informações%20do%20Projeto%20-%20Termoverde%20Caieiras%20SA.pdf>.

⁴ This estimate is informed by Solví's Social and Environmental Report, 2014; the hourly energy consumption per inhabitant varies from 0.06 to 0.15 kWh. Essencis, "Relatório anual socioambiental 2014," accessed August 29, 2015, <http://www.essencis.com.br/SiteAssets/sustentabilidade/RELATÓRIO%20SOCIOAMBIENTAL%202014.pdf>.

electricity generation. These engines produce high noise levels, and measures were taken to cope with this. Workers will use safety equipment, and the engines are located in soundproof containers to decrease the noise level in the environment. Two monitoring programs associated with maintenance and control of the noise and emissions released by the generator engines will be applied during the operational phase.

In terms of leadership, the project had an excellent performance. Termoverde has shown a strong commitment to sustainability. For instance, the project meets the biogas program stated by the government of São Paulo State, which presented the project during the launch of the International Climate Protocol of São Paulo State at the Brazilian Embassy in Paris during COP 21 (the 2015 conference of the parties to the UN Framework Convention on Climate Change).⁵

The project team did not find any laws, regulations, norms, or policies that could represent an obstacle to the implementation of the thermoelectric project. On the contrary, it receives incentives from the official agencies since its scope is linked to renewable energy generation.

In terms of identifying synergies opportunities, the project team accomplished using the main unwanted product (biogas), produced by the CTR Caieiras landfill, into electrical energy.

It is important to manage the resources allocated such as the quantity, durability, and consumption of materials, energy, and water in all phases of the project. The project had an astounding performance in this regard, purchasing materials from regional sources and reusing all the excavated soil and transporting it for use at the landfill.

As for the energy consumption by the project's activities, the implementation of generator engines which meet international emissions standards brings an energetic efficiency of 39.8%.⁶ An independent company will be responsible for monitoring the energy system in a way that assures a better performance for the project's operation. Moreover, Termoverde will use a renewable source in its activities. The biogas produced by the CTR Caieiras will not only generate power energy to the grip operator but also maintain the operation of the project when running. Additionally, due to the scale of the project, Termoverde has a low need for water, its consumption being estimated at 25m³/day for sanitary and industrial purposes.⁷ The

⁵ Governo do Estado de São Paulo, Sistema Ambiental Paulista, "Governo Paulista promove lançamento internacional do Protocolo Climático de São Paulo," accessed December 10, 2015, <http://www.ambiente.sp.gov.br/blog/2015/12/09/governo-paulista-promove-lancamento-internacional-do-protocolo-climatico-de-sao-paulo/>.

⁶ Ambconsult Estudos e Projetos Ambientais, "Balanço de emissões," in "Licenciamento ambiental atendimento a exigências técnicas, termelétrica a biogás, Caieiras SP," June 2013, 13.

⁷ Solví Valorização Energética, "Relatório outorga poço," 2014, 6.

monitoring of the water system will be carried out by a third-party company.

In terms of managing the natural world, Termoverde had an overall impressive performance. In this category, the evaluation has considered the environmental assessment carried out by CTR Caieiras landfill once both projects are located on the same site and have environmental issues in common.

Termoverde is located in a previously developed landfill site, not on prime land. However, CTR Caieiras landfill works had previously caused impacts to the environment. In order to compensate for these, CTR Caieiras carried out a recovery program of revegetating an area 200 meters wide around the site, with appropriate species planted and fertilizer applied only for limited and specific use. As to controlling invasive species, the landfill has made a careful plan to eliminate noxious plants and plant pollinating ones. A monitoring plan was also carried out to prevent the invasion of animals and insects attracted by the solid waste.

Additionally, the Termoverde project is concerned about the potential contamination of the soil and of surface and groundwater due to its activities. A leakage prevention and monitoring system have been considered by the project team. The soil disturbed by the excavation was properly used for earthworks and to cover the waste in the landfill.

In terms of climate and risk management, the CTR Caieiras landfill and Termoverde presented a high performance. First of all, CTR Caieiras comes under the UN's Clean Development Mechanism project, which states that the landfill significantly reduces GHG emissions, thanks to the controlled collection of the biogas and its combustion through a flaring system. Additionally, the Termoverde project is directly aligned with reductions as it will convert the biogas provided by the landfill into electric power. According to the sponsor, Termoverde will be included in the CDM project performed by CTR Caieiras. The forecast for the production of carbon credits (CER) in 2016 is approximately 300,000 for Termoverde and 574,000 for CTR Caieiras.⁸ Thus the project brings an energy recovery alternative solution to the biogas produced from urban solid waste deposited in the landfill.

There are opportunities for Termoverde to improve its sustainable performance, especially to improve the quality of life of communities. In terms of enhancing local skills and capabilities, the project should shift from cost-efficiency-based employment to long-term enhancing of workers' competitiveness. Considering ways to minimize light pollution and preserve night sky, it is important that Termoverde develop non-lighting alternatives. It is also recommended to

⁸ Solví Valorização Energética, "Respostas questionário Termoverde Caieiras Protocolo Climático," 2015.

identify alternative modes of transportation and design strategies to expand mobility and access for the workers over the long term of the project.

In terms of allocation of materials, the project should consider carrying out a life cycle assessment in order to evaluate the energy consumed during the construction work and operation. It is important to estimate the reduction in consumption of materials, energy, and potable water required by the project's activities. For future improvements in water management, Termoverde could verify its impacts on the aquifer and develop a risk management plan to respond to them. Additionally, the project should work on a monitoring plan for water quality and consider the storage and reuse of stormwater for operations and maintenance needs.

Considering climate and risk, the generator engines release nitrogen oxides in a higher level than the one required by law (40 t NO_x/year).⁹ However, Termoverde's project sponsor has stated that there was no legal limit established in Brazil related to emissions of nitrogen oxide released by the biogas in landfill. At the time, when the project team requested the Installation License, the new air quality standards requirements for the Sao Paulo State (PREFE in portuguese) had not been published by the local environmental institution, the Companhia Ambiental do Estado de São Paulo (CETESB).¹⁰

The project team did present a monitoring plan for NO_x emissions, but it is important to take into account the need for developing a compensatory plan in order to mitigate emissions and meet the PREFE standards, once the thermoelectric starts operations.

Furthermore, it is highly recommended to carry out an assessment of climate threats, identifying potential short-term risks such as flooding and extended droughts and also developing a long-term adaptability plan.

⁹ This level was established by the state law (Decreto n°59. 113/2013). One year after, the new air quality standards requirements PREFE were published. The PREFE stated emissions reduction goals for the Metropolitan Region of Sao Paulo (MRSP), which apply to the Caieiras' municipality. For the MRSP, it is required to reduce 20,5% of NO_x emission, which means 5,373 t/yr for stationary sources.

¹⁰ CETESB has published the PREFE in 2014 and also listed the companies that have to adopt the PREFE, which Essencis Soluções is considered.

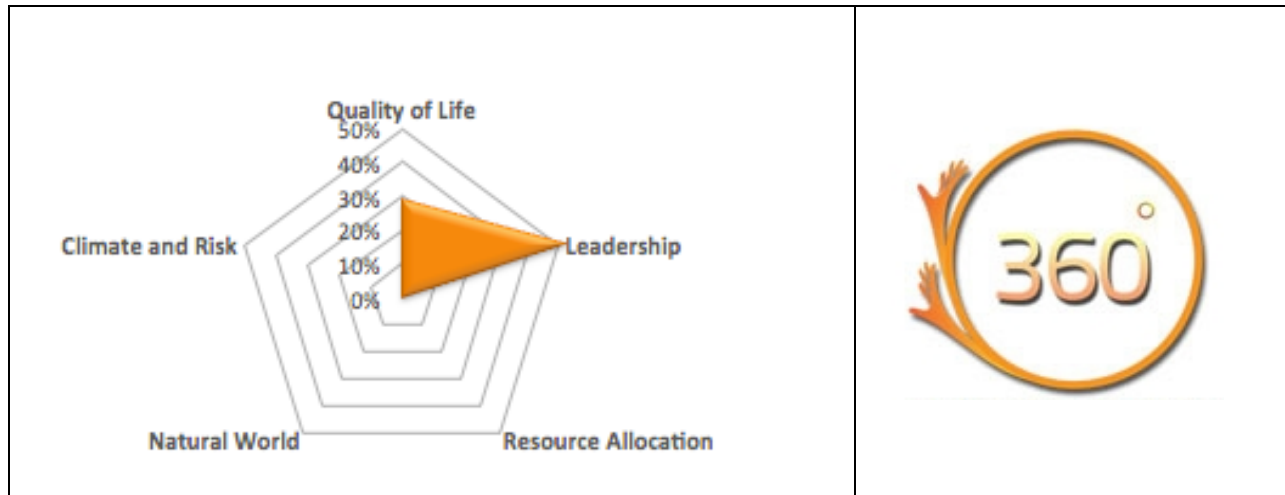


Figure 02: People & Leadership Award Summary of results

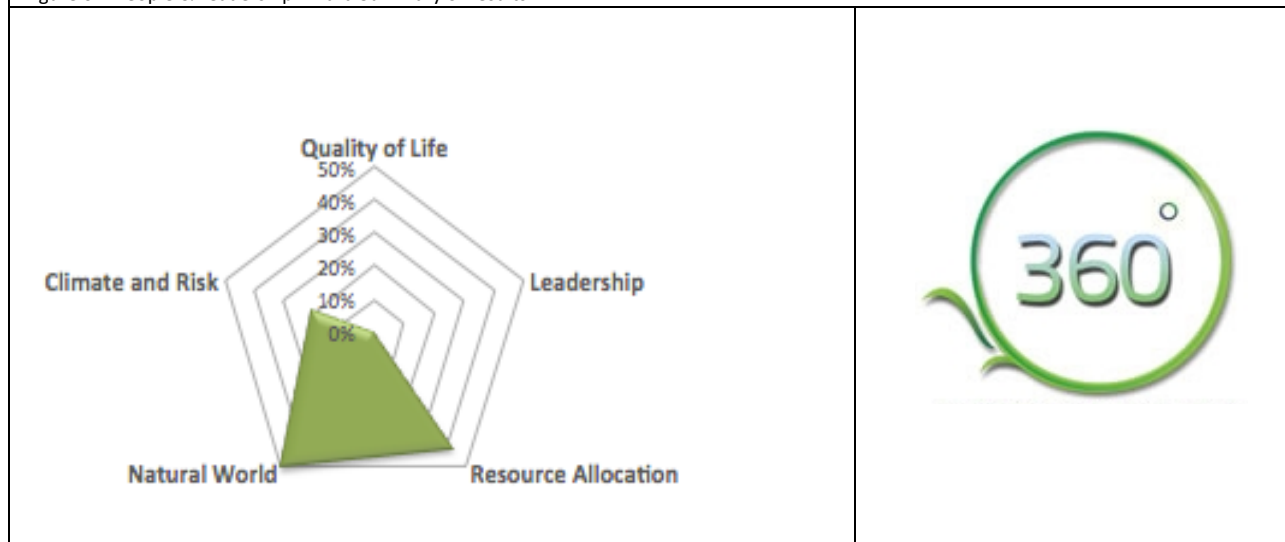


Figure 03: Climate & Environment Award Summary of results

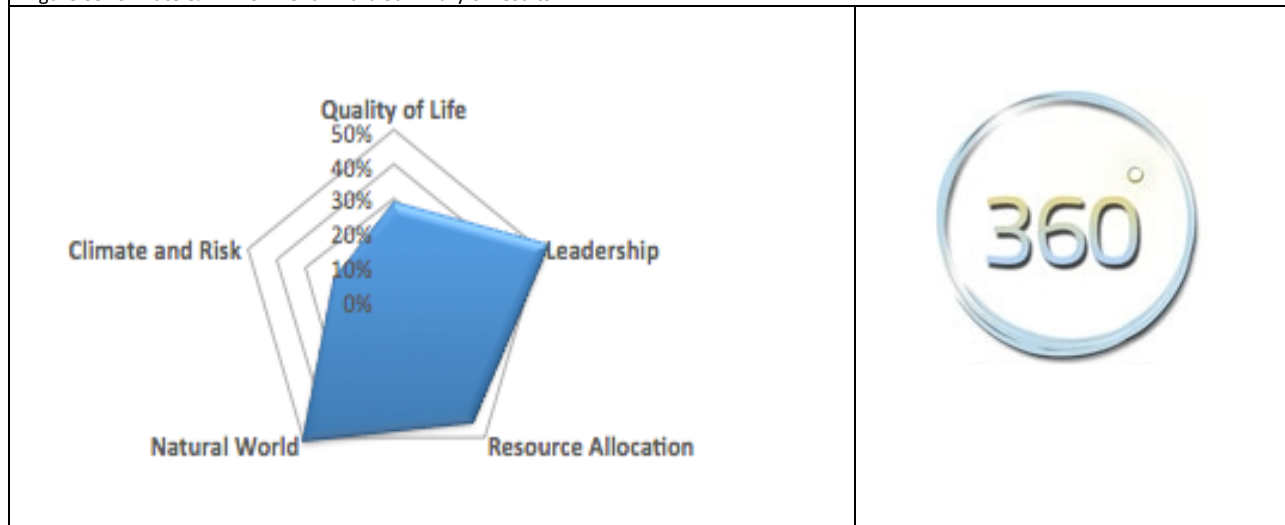


Figure 04: Infrastructure 360 Award Summary of results

APPENDIX E: SOURCES

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