

Termoverde Caieiras - Biogas Thermoelectric Plant – BRAZIL



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

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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.

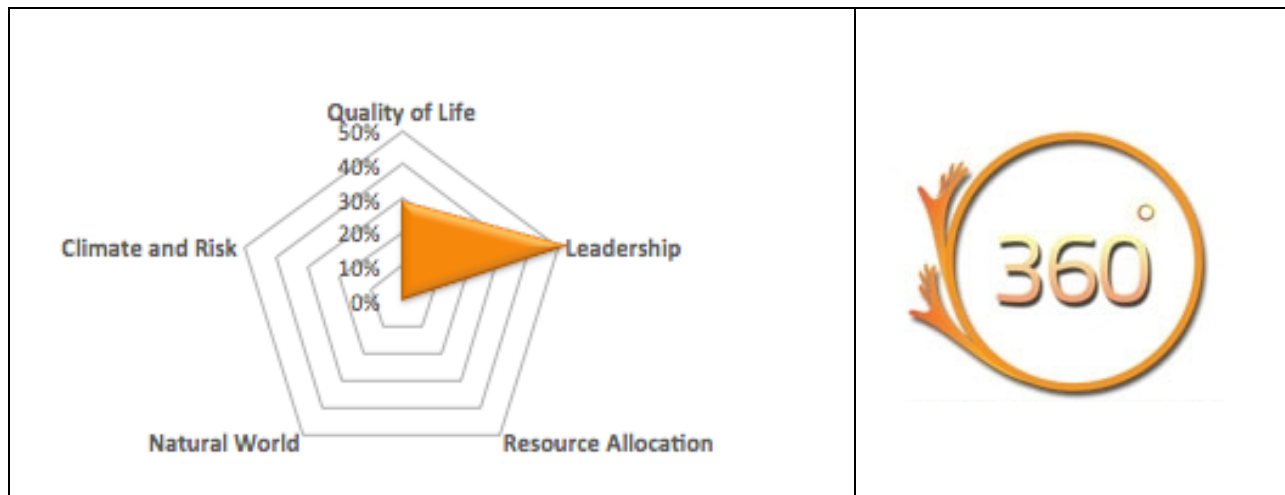


Figure 02: People & Leadership Award Summary of results

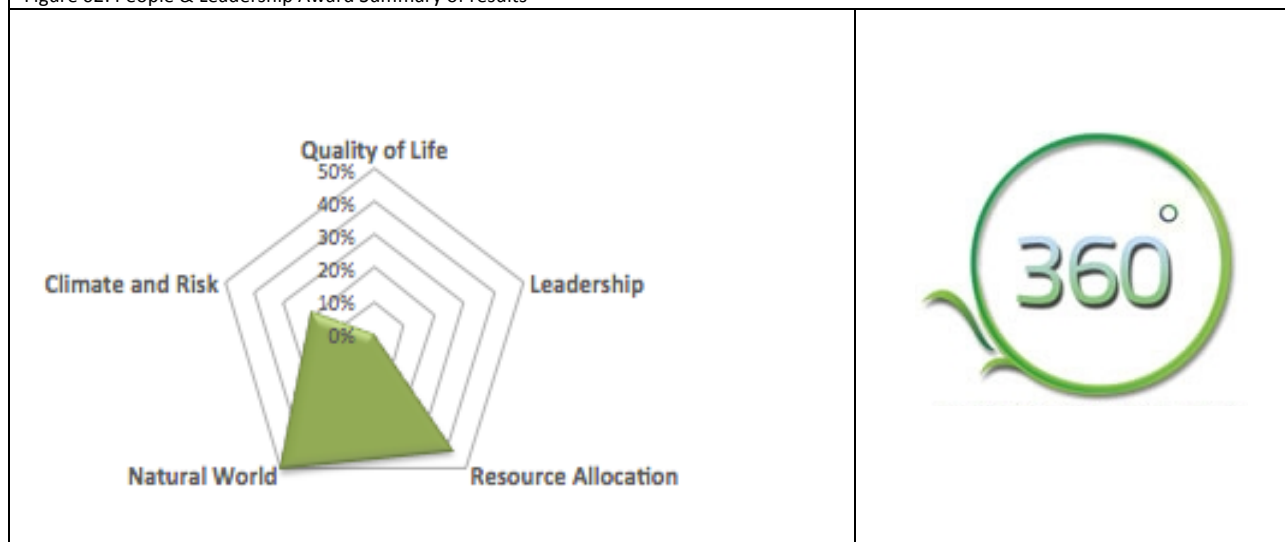


Figure 03: Climate & Environment Award Summary of results

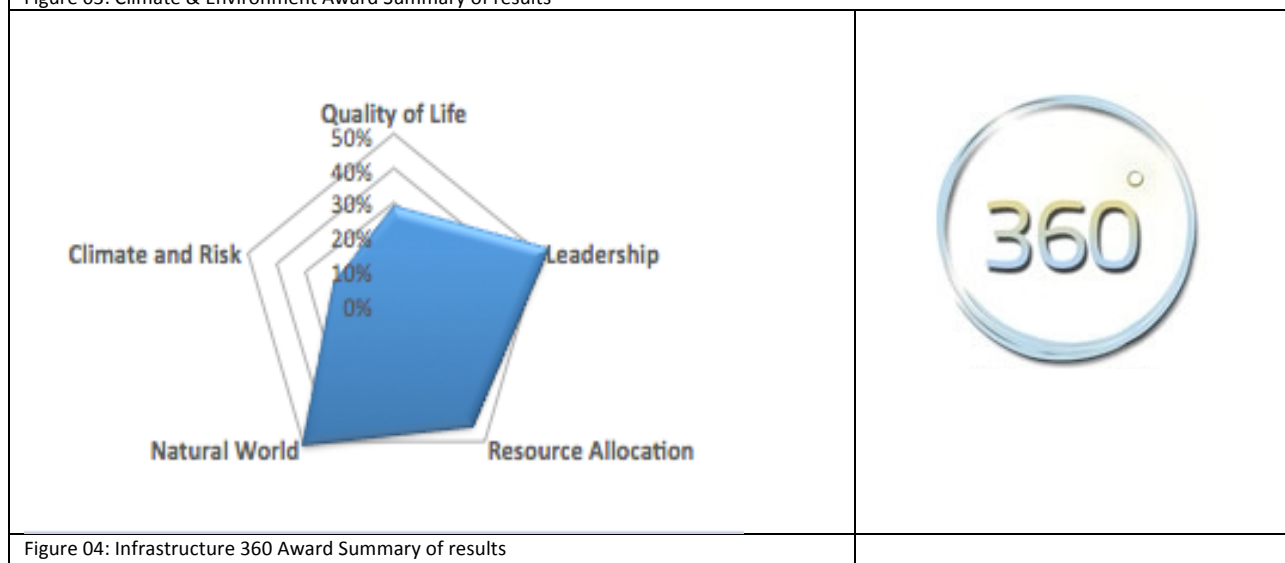


Figure 04: Infrastructure 360 Award Summary of results

1. PROJECT DESCRIPTION & LOCATION

Termoverde Caieiras is a thermoelectric plant that generates energy from biogas, located in the municipality of Caieiras, northeast of the Metropolitan Region of São Paulo. The thermoelectric plant is located inside the Caieiras Waste Treatment Center (CTR Caieiras) and will generate 29.5 MW/h from the biogas emitted at the CTR Caieiras landfill, which handles 10,000 tons of waste per day.¹¹ In terms of energy capacity, Termoverde is one of the largest biogas thermoelectric plants of all those in operation or under construction in Brazil.¹² It generates energy from biogas through 21 GE Jenbacher generator engines, and it is capable of providing energy for 300,000 inhabitants.¹³ Biogas is a fuel not commonly harnessed for power generation in Brazil. This project is aligned with the goals of Brazil's National Solid Waste Policy, which encourages the proper treatment of solid waste (avoided generation, source reductions, and reuse), and also increases recycling and the use of reverse logistics (which means that the waste products of one industry or activity become reused in another).¹⁴

The Termoverde thermoelectric plant is composed of three units: a biogas treatment system, power generation engines placed within containers, and substations connected to an energy transmission line. The process of electricity generation by the thermoelectric plant is composed of four phases: biogas capture and treatment, and the generation and distribution of electricity. The biogas produced in the landfill is sold by Essencis (see below) and is conducted by pipes to the treatment system of the thermoelectric plant. The biogas passes into the system linked to a vapor-liquid separator (demister) that condensates the liquid present in the biogas. Once the biogas is treated, it is conducted to the thermoelectric engines for combustion. When there is an excess of biogas, the excess is conducted to a flaring process.

The electricity generation of Termoverde occurs through the burning of the biogas in internal combustion engines, which assures the destruction of the methane present in the biogas. The burning of the biogas in the generator engines creates mechanical movement that then

¹¹ Nunes Bezerra, "Salvador Landfill and Other Thermoelectric Projects Using Biogas."

¹² Agência Nacional de Energia Elétrica (ANEEL), "Usinas do tipo biomassa em operação," in "Matriz energética do Brasil," accessed December 4, 2015, <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoGeracaoTipo.asp?tipo=5&ger=Combustivel&principal=Biomassa>; Agência Nacional de Energia Elétrica, "Usinas do tipo UTE em construção," in "Capacidade de geração do Brasil," accessed December 4, 2015, last modified December 4 2015, <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoGeracaoTipo.asp?tipo=5&ger=Combustivel&principal=Biomassa>.

¹³ This estimate is informed by Solvi's Social and Environmental Report 2014; the hourly energy consumption per inhabitant varies from 0.06 kWh to 0.15 kWh. Essencis, "Relatório anual socioambiental 2014."

¹⁴ Brazilian Ministry of Environment, "Brazilian National Solid Waste Policy," accessed August, 29, 2015, <http://www.mma.gov.br/pol%C3%ADtica-de-res%C3%ADduos-s%C3%ADlidos>.

generates electrical current. The 21 generator engines work independently and are located inside soundproofed containers meeting the 85 dB noise level as restricted by law. These engines also have a radiator cooling system to avoid overheating, allowing the generator engines to keep working.

The electricity produced by the generator engines is at a tension of 13.8 kV; it is conducted to a substation transformer which converts it from 13.8 kV to 138 kV, allowing the connection with the Mairiporã-Cabreúva Transmission Line, owned by a grid operator, the Companhia de Transmissão de Energia Elétrica Paulista.¹⁵ This electrical generation process has an important positive impact not only on the economic development of communities but also because it reduces climate change impacts by decreasing methane gas emissions.

According to the project sponsor, the Termoverde project's operation phase is expected to begin by mid-2016 and have an expected lifespan of 20 years.¹⁶ This plant has been recognized and authorized by the Brazilian Electricity Regulatory Agency as an independent electric power producer.¹⁷

The Solví Group is a holding company specializing in many engineering fields, such as solid waste through Solví Soluções Industriais and energy recovery through Solví Valorização Energética, the project's sponsor. Termoverde Caieiras is one of Solví Valorização Energética's three projects¹⁸ specializing in waste-to-energy via biogas.¹⁹ The total costs of the Termoverde project are estimated to be approximately US \$45 million.²⁰ The CTR Caieiras landfill, in which the Termoverde project is located, is an infrastructure project, which also belongs to the Solví Group holdings; it is managed by the company Essencis, which is part of Solví Soluções Industriais. The solid waste treatment center of CTR Caieiras represents a total area of 3.5 million m², of which 43% is covered by reforested vegetation.²¹ In order to mitigate the environmental impacts of the landfill, a reforestation compensation program was developed,

¹⁵ Migratio and Solví, "Presentation of the Termoverde Caieiras S.A. Project."

¹⁶ Nunes Bezerra, "Salvador Landfill and Other Thermoelectric Projects Using Biogas."

¹⁷ According to ANEEL, an independent electric power producer or a consortium of companies holding concessions, permits, or authorization to produce electricity is entitled to sell all or part of the energy produced at its own risk. Ministério de Minas e Energia, Portaria no. 293, October 22, 2014, 2.

¹⁸ The other two being thermoelectric plants in Salvador, Bahia and in Minas do Leão, Rio Grande do Sul. See Nunes Bezerra, "Salvador Landfill and Other Thermoelectric Projects Using Biogas."

¹⁹ Biogas is a result of the anaerobic digestion process that occurs in landfills, composed of methane, carbon dioxide, nitrogen, oxygen, hydrogen, and hydrogen sulfide. Agência Nacional de Energia Elétrica, "Parte II fontes renováveis biomassa," in "Atlas de energia elétrica do Brasil," 86.

²⁰ The amount of the cost was presented as BRL 100 million, according 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.

²¹ Essencis, "Essencis SP," accessed September 2015, <http://www.essencis.com.br/onde-estamos/regional-são-paulo>.

which has taken the form of a 200-meter-wide greenbelt around the landfill site.

Termoverde and CTR Caieiras are strongly related, as they operate synergistically. The CTR Caieiras landfill receives urban and industrial waste from the cities of the Metropolitan Region of São Paulo on a daily basis.²² This solid waste produces biogas by anaerobic decomposition. According to the documents presented, it is forecast that Termoverde will process an estimated 19,143 Nm³/h of biogas into electrical energy.²³ Since Termoverde is located in the landfill site previously developed by Essencis, the environmental and climatic aspects of landfill and thermoelectric project were considered together, as described by the environmental impact study for the landfill site.

The Termoverde Caieiras biogas thermoelectric plant is being considered for inclusion in the Clean Development Mechanism (CDM) of CTR Caieiras.²⁴ The landfill project comes under the CDM as its main goal is to reduce gas emissions; through a controlled collection of the biogas and its combustion via flaring process, CTR Caieiras promotes measurable greenhouse gas reductions. According to the project's sponsor,²⁵ Termoverde is expected to produce approximately 300,000 Certified Emission Reductions (CERs)²⁶ and CTR Caieiras to produce 574,000 CERs in 2016.

In 2015 the Termoverde project was presented during the launch of the International Climate Protocol of São Paulo State at the Brazilian Embassy in Paris during COP 21. This initiative aims to foster reductions in greenhouse gas emissions and to mitigate the climate change effects in São Paulo State. The Solví Group is one of 60 companies that have adhered to the protocol and one of 25 that presented their activities on coping with climate change.²⁷

²² The cities that CTR Caieiras receives waste from are: Caieiras, Franco da Rocha, Francisco Morato, Mairiporã, Cajamar, Campo Limpo Paulista, Várzea Grande Paulista, Taboão da Serra, Embu-Guaçu, Itapeceira da Serra, and São Paulo. Giovano Candiani and Ana Tereza Caceres Cortez, "Analysis of the Implementation of the Mitigating Measures Established in Environmental Impacts Reports of Waste Treatment Center in Caieiras," São Paulo, 2013, accessed August 29, 2015, <http://www.periodicos.uem.br/ojs/index.php/BolGeogr/article/viewFile/13419/10959.119>.

²³ Ambconsult Estudos e Projetos Ambientais, "Balanço de emissões," 5.

²⁴ UNFCCC Project Design Document Form for CDM Project Activities, Caieiras landfill gas emission reduction, 2013, 7.

²⁵ Solví Valorização Energética, "Respostas questionário Termoverde Caieiras Protocolo Climático," 2015.

²⁶ According to UNFCCC, a Certified Emissions Reductions unit is equal to 1 metric tonne of CO₂ equivalent. CERs are issued for emission reductions from CDM project activities. UNFCCC, "Glossary of Climate Change Acronyms," accessed December 2015, http://unfccc.int/essential_background/glossary/items/3666.php

²⁷ Governo do Estado de São Paulo, Sistema Ambiental Paulista, "Governo Paulista promove lançamento internacional do Protocolo Climático de São Paulo."

2. APPLICATION OF THE ENVISION RATING SYSTEM

The Envision™ system is a set of guidelines that aid in optimizing the sustainability of an infrastructure project during the planning and preliminary design phases, as well as a means to quantify the relative sustainability of the project. Envision consists of 60 credits grouped into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Each credit pertains to a specific indicator of sustainability such as reducing energy use, preserving natural habitat, or reducing greenhouse gas emissions. Those credits are rated on a five-point scale referred to as a “level of achievement”: “improved,” “enhanced,” “superior,” “conserving,” and “restorative.” Evaluation criteria are provided to determine whether the qualifications for each level of achievement have been met for a particular credit. In each of the five categories there is a special credit called “Innovate or exceed credit requirements.” This is an opportunity to reward exceptional performance that applies innovative methods within the subjects that Envision evaluates.

The criteria for the levels of achievement vary from credit to credit, but generally an “improved” level of achievement is awarded for performance that slightly exceeds regulatory requirements. “Enhanced” and “superior” levels indicate additional gradual improvement, while “conserving” often indicates performance that achieves a net zero or neutral impact. “Restorative” is the highest level and is typically reserved for projects that produce an overall net positive impact. The Envision system weighs the relative value of each credit and level of achievement by assigning points. Credit criteria are documented in the Envision Guidance Manual, which is available to the public on the ISI²⁸ and Zofnass Program²⁹ websites.

3. QUALITY OF LIFE CATEGORY

Envision’s first category, Quality of Life, pertains to potential project impacts on surrounding communities and their well-being. More specifically, it distinguishes infrastructure projects that are in line with community goals, clearly established as parts of existing community networks, and consider long-term community benefits and aspirations. Quality of Life incorporates guidance related to community capacity building and promotes infrastructure users and local members as important stakeholders in the decision-making process. The category is divided into four subcategories: Purpose, Well-being, Community, and Vulnerable Groups.

²⁸ www.sustainableinfrastructure.org

²⁹ www.zofnass.org

Purpose

In the Purpose subcategory, aspects of the community such as job creation, growth, and overall improvement of the quality life are assessed. Termoverde needs to improve some aspects of the project to achieve a better performance in these areas. The project had a high performance in aspects related to improved community quality of life and to stimulating sustainable growth and development. However, in terms of developing local skills and capabilities, Termoverde got a low performance.

Although Termoverde is a recent project installed at the landfill, some efforts have been made to improve the community quality of life. First of all, the project will provide electric power for the households in the region using the biogas produced by the urban solid waste deposited. It also represents a solution to noxious odors emitted from the waste. Secondly, social programs including community needs and interests were defined after carrying out a social assessment. These programs are based on training for community leadership, developing cultural and sports activities for young people, and creating workshops on income generation and entrepreneurship. For example, a social event was recently carried out with the families in the surrounding areas with income generation workshops and playful interactive talks with the children about rational use of water.

Regarding the stimulation of sustainable growth and development, Termoverde has created 120 new jobs during the construction phase and will create 8 new jobs during the plant's operation.³⁰ (A smaller workforce is required to maintain, operate, and manage the thermoelectric plant once operational.) The sponsor states that during the installation of the project, preference was given to local suppliers. However, most of the jobs created are temporary due to the scope of the project, being focused more on cost efficiency.

It is important to state that the project improves the attractiveness of the region, since it brings a recovery value for the landfill. The innovation associated with the transformation of solid waste into electric power is an asset for the landfill context. Also, the project contributes to developing the local economy since the thermoelectric plant will generate income and also will employ members of the local workforce.

In order to develop local skills and capabilities, the sponsor affirms that social programs will include educational and professional training to answer the community's needs and enhance the residents' competitiveness. However, a low performance has been observed in this regard

³⁰ Solví Valorização Energética, "Anexo memorial de caracterização do empreendimento MCE de licença de instalação," 11.

as the project at this time is focused more on cost efficiency than long-term competitiveness.

Well-being

In the Well-being subcategory, it is important that the project considers maintaining or enhancing the character of the surroundings by such features as mobility, access, and mitigation of noise nuisance.

In this regard, the project had a satisfactory performance. However, some aspects could not be evaluated due to the lack of evidence and also because the project has not achieved some requirements.

Considering the aspect of safety, the project team has sought to evaluate the risks involved with the introduction of generator engines. The noise emitted by these is 115 dB, requiring strict use of safety equipment by the operators such as individual equipment protection. Also, the project team has implemented measures to reduce the noise emitted by the generator engines, placing them in soundproofing containers, which reduce the noise to 85 dB. A monitoring plan to evaluate the noise levels during operation will also be implemented.

However, there are many opportunities to improve the project. For instance, Termoverde should consider identify non-lighting alternatives for the project in order to minimize light pollution. Also, while the project does not impact community mobility and access, it is recommended to identify alternative modes of transportation and design strategies to expand not only mobility and access in the surroundings but also for the workers over the life of the project. Access signage for operating personnel and emergency personnel should also be considered.

Community

In the Community subcategory, the project should develop more efforts in order to enhance community livability, taking into account, for instance, the cultural aspects of the local community and working with stakeholders to improve public spaces. Termoverde can improve in these aspects, as the lowest performance was achieved on these issues, with many challenges remaining for the project.

According to the environmental impact assessment carried out by CTR Caieiras landfill, a historical and archaeological analysis of the site was performed, with no material evidence of scientific value being found there. Thus, the project will cause no damage to the archaeological or historical heritage of the site. However, it is important to take into account the cultural aspects linked to the character of the present community.

Also, because the CTR Caieiras landfill and Termoverde are located in an industrial area far from

residential areas, such projects have low impacts on the views. In this regard the 200 m greenbelt area plays an important role, blocking the dispersion of odors and noise as well as views of the operation. However, even though the two projects do not impact the views and local character of the community, they should consider developing a plan to restore natural landscapes directly damaged by the excavation for the landfill.

For the enhancing of public space, the Termoverde project team will use public spaces such as schools and community associations to implement its social programs. The sponsor has said that the project also aims to revitalize public space, but more information is needed regarding these intentions. The project should also consider surveying whether the public agencies and stakeholders are satisfied with these programs.

Vulnerable Groups

In the Vulnerable Groups subcategory, many opportunities for improvement have been found. Gender and diversity issues are important aspects for the development of a sustainable project. Evaluation showed that Termoverde gave low attention to these questions in the project design and operation; it should give more.

According to the project sponsor, an evaluation needs to be carried out to take into account the community's gender differences. For instance, a first social event was recently held with the local community which offered income generation workshops for both genders.

However, other strategies must be included in the scope of the project, such as work with designers and decision makers, to address diverse communities and gender equality issues. Also, it is important to consider performing an assessment of the hazards and risks for women's health and safety during the construction and operational phase.

The project could also enhance efforts to identify opportunities to hire local women and offer skills training, and also to find women-led suppliers.

4. LEADERSHIP CATEGORY

The Leadership category evaluates project team initiatives that establish communication and collaboration strategies early on, with the ultimate objective of achieving sustainable performance. Envision rewards stakeholder engagement as well as encompassing a holistic, long-term view of the project's life cycle. Leadership is distributed into three subcategories: Collaboration, Management, and Planning.

Collaboration

In the Collaboration subcategory, it is important that sustainable projects reinforce the input of all stakeholders in the project plans. Aspects such as teamwork and collaboration are equally relevant to a successful project performance. In this subcategory, Termoverde has many opportunities for improvement.

The project has shown various improvements in the effort to provide effective leadership and commitment. Termoverde has demonstrated a strong commitment to sustainability. For instance, the project meets the biogas program stated by the government of São Paulo State. Moreover, it is important to state the role played by the Solví Group, the holding company that owns both Termoverde and CTR Caieiras as well as and many other companies specialized in fields such as waste solid, sanitation, and energy recovery, managing concessions and contracts with public and private clients. The Solví Group's companies follow sustainable principles, creating projects aimed at developing technologies that enhance communities' quality of life and their empowerment through citizenship and income generation promotion.³¹

The project had a good performance in establishing a sustainability management system, though some challenges remain. All the companies belonging to the Solví Group follow its quality policy, using guidelines for environmental management systems under certification such as ISO 9001, ISO 14001, and OSHAS 18001. This quality policy aims to assure quality service to clients, maintain a healthy workplace, and preserve and recover the environment.

As to fostering collaboration and teamwork, the project performed moderately well. According to the sponsor, the project is formatted as a system interrelated with other systems, which enhances synergies for the overall project. It was not possible to evaluate the extent to which Termoverde has incorporated principles of collaboration and teamwork in the project. For this reason, it is recommended that the Termoverde team take these principles into account to improve its sustainable performance.

In relation to risk management, Termoverde follows the policy developed by the Solví Group, which is a complete policy establishing procedures, main activities in the event of risks, and the managerial roles and responsibilities of the Solví Group and its companies.

The project rated low in providing for stakeholder involvement. For instance, while Termoverde follows the model of risk and obligations management in which all the stakeholders' concerns and risks are identified, it was not possible to assess to what extent these issues were considered in the project plans and decision making. As Termoverde is intended to use the same program as CTR Caieiras in order to maintain a single-channel communication with the surroundings, it was not possible to evaluate the extent of Termoverde's engagement and dialogue with its stakeholders.

³¹ Solví, "Compromisso Solví," accessed December 2015, <http://www.solvi.com/compromisso-solvi/>.

Management

The Management subcategory evaluates efforts carried out by the project team such as using by-products in the construction of the project, improving infrastructure integration, and developing plans for monitoring. In this area Termoverde had overall outstanding results.

The project sponsor had an impressive performance in pursuing by-product synergy opportunities. The scope of the Termoverde project is based on use of the biogas produced by the landfill resulting from urban waste. In this sense, the biogas is the main by-product used for the operation of the project.

In terms of infrastructure integration, Termoverde had an astounding performance. The biogas thermoelectric plant is located inside CTR Caieiras; thus most of the infrastructure provided by the landfill is also used by Termoverde. This integration allows Termoverde to mitigate impacts caused by its installation. Moreover, the thermoelectric infrastructure also integrates with the regional community as it will be connected to the grid operator by a transmission line, providing for economic growth and development capacity.

Planning

The Planning subcategory seeks to assess the long-term planning of the project and also its actions to cope with conflicts in regulations and policies. In this Termoverde had a moderately good performance.

In terms of planning for long-term monitoring and maintenance, the project has incorporated two monitoring programs associated with maintenance and control of the noise and NO_x emissions released by the generator engines.

Additionally, Termoverde has carried out an extensive evaluation of laws, regulations, norms, and policies that could represent an obstacle to the implementation of the project. The sponsor has stated that it identified no regulation or policy that conflicts with the project's goals and purposes.

Termoverde meets all the laws and regulations and also receives incentives from the official agencies related to infrastructure development and transmission and distribution of electric energy.

In regard to long-term planning, it is important to highlight that Termoverde's activity is directly related to the lifespan of the landfill, as it depends on the biogas produced by the landfill. In this sense, the future reutilization of the infrastructure of the project is limited.

Nonetheless, Termoverde has designed for project flexibility in the placement of the generator engines; they are located in soundproofing containers, which makes it easier to move them and also enhances the durability of the generator engines. Also, according to the sponsor, even though the project has not yet started operation, an expansion of the plant is already forecast. For future improvements, the project team might consider reinforcing its assessment of ways to increase the flexibility, durability, and resilience of the materials used during Termoverde's operation.

5. RESOURCE ALLOCATION CATEGORY

The Resource Allocation category deals with material, energy, and water requirements during the construction and operation phases of infrastructure projects. The quantity and source of these elements as well as their impact on overall sustainability are investigated throughout this section of the Envision rating system. Envision guides teams to choose less toxic materials and promotes renewable energy resources. Resource Allocation is divided into three subcategories: Materials, Energy, and Water.

Materials

In the Materials subcategory, it is important to reduce the amount of materials used in infrastructure projects, considering their source, safety, durability, and stability. In this Termoverde had performed well, while some possible improvements remain.

The project team did not present any evidence by which to assess the use or reduction of net embodied energy of the materials. It is recommended to consider carrying out a life cycle assessment in order to evaluate the energy consumed in the extraction, processing, manufacturing, and transport of the materials used in the project.

The project had a low performance in efforts to procuring materials and equipment from sustainable sources. The project's use of biogas provided by CTR Caieiras is based on UN's CDM; also the project team procured generator engines that meet international emission standards. However, it was not possible to assess, from the documents presented, how much of the materials used in the project were certified by reputable third parties or whether the project team intends to identify the supplier's integrity.

The Termoverde project also had a low performance in the use of recycled materials due to the lack of specific calculations. However, the sponsor states that it has reused materials such as plastic for covering the containers, polyethylene pipelines in the drainage landfill system, and excavated soil for earthwork and covering the solid waste. Termoverde had an astounding performance in the use of regional materials and the reduction of materials taken off site. The project has purchased the main materials used during the construction from regional sources.

As mentioned before, all the excavated soil was reused, and it was not transported beyond the boundaries of the landfill during construction.

Additionally, all the waste produced will be disposed of at the landfill. Efforts to divert waste from landfills are especially important for this project. In regard to providing for eventual deconstruction, Termoverde had a high performance. The generator engines are located in containers that can be easily moved or transferred in case of future expansion of the thermoelectric plant. According to communications with the project sponsor, this equipment represents 60% of the total investment cost of the project.

Energy

The Energy subcategory analyzes whether the infrastructure project takes into consideration using renewable sources during its operation in order to reduce energy consumption. In this sense, Termoverde had an overall excellent performance.

The project showed reductions in its consumption of energy. It incorporates the use of a chiller to treat the biogas, which will reduce energy consumption for biogas treatment in preparing it for use in the generator engines. This technology presents a 39.8% energetic efficiency compared to alternative treatment methods.³²

Moreover, Termoverde had an excellent performance in using renewable energy in the project. The generator engines operate using a renewable source (the biogas produced in the landfill). This source not only generates the electric power delivered to the grid but also supplies the power needed for the plant's own operation.

Termoverde had its highest performance in the aspects of commissioning and monitoring. The commissioning is run by a third-party company to assure a better performance for the project's operation. The project sponsor has also presented documents on the required training for maintenance of the generator engines.

It is worth mentioning that an efficient system of measurement and control is incorporated in the biogas thermoelectric plant, with individual energy consumption meters in each of the 21 generator engines.

Water

In the Water subcategory, it is important to consider alternative uses of water such as stormwater runoff in order to reduce the project's overall water consumption, and also to monitor water systems to ensure their efficiency. In this respect Termoverde had a good overall

³² Ambconsult Estudos e Projetos Ambientais, "Balanço de emissões," 13.

performance.

In terms of protecting freshwater availability, the performance was excellent. For licensing purposes, the project has taken into account a water availability evaluation, presenting an estimate of 25 m³/day³³ of water consumption during the operation phase for sanitary and industrial purposes. Moreover, the sponsor states that the technology adopted in the project has taken low water consumption into account in the cooling system linked to the generator engines, a technology that can assure a reduced use of groundwater during the system's operation.

However, the project had a low performance with regard to reducing potable water consumption. It was not possible to assess whether alternatives such as stormwater or nonpotable water have been evaluated for incorporation in the project's operation and maintenance. To improve its score, the project team could consider reducing potable water by at least 25%, using harvested stormwater as an alternative source for the sanitary system, for instance.

In order to monitor the water system, the sponsor states that an initial commissioning will be carried out by an independent specialized company. The project team has also included a monitoring goal in order to evaluate water performance during operation (involving leak detection, level of water flows, and also consumption). For better achievement, the project should consider integrating the monitoring activities into operation in order to improve the efficiency of the system and also replenishing the quantity and quality of freshwater.

6. NATURAL WORLD CATEGORY

The Natural World category focuses on how infrastructure projects may impact natural systems and promotes opportunities for positive synergistic effects. Envision encourages strategies for conservation and distinguishes projects with a focus on enhancing surrounding natural systems. Natural World is subdivided into three subcategories: Siting, Land and Water, and Biodiversity.

Siting

The Siting subcategory assesses how ecological elements such as water bodies, wetlands, and habitat can be impacted by the infrastructure of the project. For this, the environmental impact assessment carried out by the CTR Caieiras landfill was considered in the evaluation of Termoverde since the two projects are related in terms of environmental issues. In this sense, the project achieved an overall good performance.

³³ Solvi Valorização Energética, "Relatório Outorga Poço," 2014, 5–6.

From the perspective of preserving prime habitat, the project was qualified with the highest performance. Termoverde and CTR Caieiras are located in an industrial zone judged by municipal law as an appropriate site for solid waste disposal and treatment activities; thus the site is not considered prime habitat. Also, CTR Caieiras has carried out a revegetation program in order to mitigate the impact caused in the site.

In regard to protection of wetlands and surface water, Termoverde had a low performance. According to the sponsor the project will operate far from wetlands, water bodies, and riparian zones. Also, in relation to CTR Caieiras project, wetlands and surface water were already impacted with the construction of a drainage system to divert water. In order to mitigate it, the landfill performed a surface and groundwater quality monitoring plan.

In terms of preserving prime farmland, the CTR and Termoverde had an excellent performance. Prime farmland is totally avoided in implement the project, given the characteristics of the site selected for the landfill.

Both projects have well performed in avoiding adverse geology. CTR Caieiras has established strategies to reduce the spill risk and to minimize the incidence of aquifer contamination. Additionally, Termoverde has conducted a water assessment for using groundwater in the project's activities and also has constructed a runoff system in order to divert the stormwater and used water.

The projects achieved lower performance in preserving floodplain functions. CTR Caieiras has considered a monitoring program in order to track the drainage system for stormwater. Also it has adopted controlling and preventing measures through a monitoring of soil movements, micro slopes, etc. However, the landfill should assess whether the project maintains riparian and aquatic habitat once water bodies are affected by the implementation.

Both projects performed very well in avoiding unsuitable development on steep slopes. The landfill encompasses a control plan in order to minimize the incidence of erosion and to survey and adopt the necessary prevention measures for areas vulnerable to soil movements, micro slopes, etc. For its part, Termoverde has developed design plans for earthwork and slope works in the site, according to documents provided by the sponsor.

In terms of preserving greenfields, Termoverde had a good performance. The biogas thermoelectric plant will operate in a previously developed site, the CTR Caieiras landfill, which belongs to the same group. Thus, the energy project will take advantage of the infrastructure of the landfill, mainly using the biogas produced at the landfill as raw material for electrical power generation.

Land and Water

In the Land and Water subcategory, the project team should take into account important

aspects such as potential contamination in order to protect the quality of the land and water. Overall, Termoverde and CTR Caieiras had a good performance.

Managing stormwater is very important in projects such as CTR Caieiras, as the project is involved in the treatment of urban solid waste. The landfill has two monitoring programs related to the stormwater drainage system and control of erosion. Both programs are relevant to protecting areas from flooding, sedimentation on the base flow, and also for avoiding landslide incidence.

In relation to the Termoverde project, the performance was low. As stated by the sponsor, the stormwater will be drained to avoid erosion of the land surface, with 100% of it conducted to the drainage system. As a recommendation for future improvements, Termoverde should work on a monitoring plan for water quality and its storage capacity. Also, the project team could design and incorporate strategies for stormwater treatment and reuse for operations and maintenance needs.

In terms of reducing pesticides and fertilizers, CTR Caieiras had a good performance. The project has considered this aspect during the application of a compensatory measure for recovering the greenbelt. For this, the landfill has adopted a methodology including the application of organic (manure) and chemical (nitrogen, phosphorus, and potassium) fertilizers with limited and specific use.

The performance of both projects was impressive in preventing surface and groundwater contamination. CTR Caieiras has incorporated into its environmental assessment a hydrogeological study analyzing the aquifers present in the landfill. After predicting the impacts over the wellheads, the project team had to drain it, contributing to changes in the local and regional landscape. A surface and groundwater quality assessment and a leak prevention plan were also considered due to the potential contamination by solid waste pollutants.

Additionally, oil leakage prevention and monitoring systems have been incorporated into the Termoverde project, according to the project sponsor. The project uses oil for the generator engines, which can be a factor in soil contamination and infiltration in the site. It is important to mention that all the oil used in the generator engines is headed for Essencis Soluções Ambientais, which recovers it correctly. For better achievement, the biogas thermoelectric plant should consider developing strategies and plans to restore the soil that may be polluted.

Biodiversity

The Biodiversity subcategory considers the project's strategies and plans for mitigating negative impacts on natural species and their habitat. For a complete assessment in this subcategory, the environmental assessment performed by the CTR Caieiras landfill has been considered. Both projects performed well in the biodiversity context, but some additional efforts are recommended for further improvement.

Termoverde had a low performance in preserving species biodiversity. As CTR Caieiras involves waste treatment activity, it is very important to carry out an evaluation of the local fauna and the potential impacts of the implementation of the project. An environmental impact assessment and also a compensation plan were taken into account by the project team. Thus, by carrying out a revegetation of the 200-meter greenbelt around the landfill, CTR Caieiras aims to enhance the conservation of the local fauna. However, issues such as vehicle movements in this area were not considered, which can be a negative factor for animals' behavior quite apart from running them over.

With regard to controlling invasive species, both projects had an excellent performance. A previous and careful assessment considered all the plant species on the site based on established methodology for scientific work and collection in the field. CTR Caieiras has also considered eliminating noxious plants and planting species that attract pollinators. Moreover, daily operational procedures are established to cope with invasive species (rats, cockroaches, flies), along with a monthly evaluation with public health organizations to follow up on the presence of disease vectors in the surroundings.

The projects had a remarkable performance in restoring disturbed soils. CTR Caieiras has a high impact on the soil due to the need for excavation to prepare for deposition of the solid waste. Prevention and control plans and operational procedures are considered to restore the soil, such as mitigation of contamination and coverage of the waste with disturbed land. For the construction of the Termoverde project, it has been stated that all the soil removed was used in the CTR Caieiras landfill.

In maintaining wetland and surface water functions the projects had a satisfactory performance. As CTR Caieiras has impacts on the surface water, monitoring plans were considered to evaluate the water quality and also to mitigate. Also, the project aims to monitor slope stabilization in order to avoid the silting of waterways and sliding of land over the landfill. There was no evidence in the environmental or social impact assessments that a survey or mitigating or monitoring plan was conducted in relation to efforts to maintain or enhance the habitat of the water bodies.

7. CLIMATE AND RISK CATEGORY

Envision aims to promote infrastructure developments that are sensitive to long-term climate disturbances. Climate and Risk focuses on avoiding direct and indirect contributions to greenhouse gas emissions, as well as promotes mitigation and adaptation actions to ensure short and long term resilience to hazards. Climate and Risk is further divided into two subcategories: Emissions and Resilience.

Emissions

In the Emissions subcategory, CTR Caieiras landfill and Termoverde's performance was impressive. In this aspect, the goal is to assess whether the project promotes reductions of gas emissions into the atmosphere.

In terms of reduction of greenhouse gas emissions, the UN's Clean Development Mechanism document shows that the CTR Caieiras landfill significantly reduces GHG emissions. The efficient collection and combustion system of the biogas through a flaring system at the solid waste landfill are highly relevant to achieving the GHG emissions reduction. This conclusion follows the UN's CDM and also the ACM0001 Version 15.0 on flaring or use of landfill gas methodology.³⁴

The Termoverde project is also directly aligned with the reduction of GHG emissions, as the thermoelectric plant will use the biogas provided by CTR Caieiras and convert it into electrical power, providing a sustainable alternative energy source. For the year 2016, 19,143 Nm³/h of biogas and 7,849 Nm³/h³⁵ of methane are forecast to be produced at the landfill site, which will be capable of generating 29.5 MW of electricity.³⁶

According to the sponsor, Termoverde will be included in the CDM project performed by CTR Caieiras. The production of carbon credits (CER) in 2016 is estimated to be approximately 300,000 for Termoverde and 574,000 for CTR Caieiras.³⁷ Thus the project brings an energy recovery alternative solution to the biogas produced from urban solid waste deposited in the landfill.

Regarding measures to reduce air pollutant emissions, Termoverde had a low performance. The documentation provided demonstrates that the project is designed to reduce odor concerns once the biogas is processed for internal combustion. CTR Caieiras has also made efforts to reduce odor concerns, applying a monitoring plan with measures such as covering the solid waste with a soil layer. However, the implementation of the biogas thermoelectric plant significantly increases air pollutant emissions. The running of generator engines releases nitrogen oxides estimated in 350.4 t NO_x/year,³⁸ which is higher than the level required by law

³⁴ UNFCCC Project Design Document Form for CDM Project Activities, Caieiras landfill gas emission reduction, 2013, 7.

³⁵ Ambconsult Estudos e Projetos Ambientais, "Balanço de emissões," 5.

³⁶ Ambconsult Estudos e Projetos Ambientais, "Plano de monitoramento das emissões atmosféricas," in "Licenciamento ambiental atendimento a exigências técnicas, termelétrica a biogás, Caieiras SP," June 2013, 3.

³⁷ Solvi Valorização Energética, "Respostas questionário Termoverde Caieiras Protocolo Climático," 2015.

³⁸ Ambconsult Estudos e Projetos Ambientais, "Balanço de emissões," 15.

(40 t NO_x/year).³⁹ Nonetheless it is important to mention that the generator engines (GE Jenbacher) used were procured in order to meet the international NO_x emission standards⁴⁰, since there is no national standard defining emission limits of nitrogen oxide released by the biogas in landfill. At the time of the Installation License request, the newly adopted air quality standards of Sao Paulo State (PREFE in portuguese) were not published by the environmental institution Companhia Ambiental do Estado de São Paulo (CETESB). The project does follows international emissions limitations references such as the Gothenberg Protocol and the TA Luft.⁴¹

Resilience

In the Resilience subcategory, it is important that the project has applied prevention measures and has the ability to cope with potential short-term risks such as flooding and extended droughts. However, many opportunities could be found to improve the Termoverde project, as it had a very low performance in all resilience aspects. In most of them, no evidence was provided to evaluate whether the project team has considered strategies or elaborated plans to cope with climate change effects.

As an initial assessment of climate threats, the project sponsor stated that Termoverde's energy production could eventually be affected by extended drought, since this could decrease the production of biogas in the landfill. However, no documentation was provided to assess whether the project team has developed an impact assessment or an adaptation plan.

It was not possible to evaluate whether a plan was produced to avoid traps and vulnerabilities due to long-term environmental changes. While the project sponsor stated that Termoverde would be unaffected by climate change impacts, no documentation was provided to support this.

As to short-term hazards, there is no evidence to verify whether the project has included strategies to prevent and overcome short-term impacts from natural disasters. There is also a lack of information showing to what extent the project meets requirements for dealing with heat island effects.

³⁹ Ibid., 17.

⁴⁰ Termoverde's generator engines meet international restrictive limits for NO_x emissions, which is 500 mg/Nm³ of biogas established by Gothenberg Protocol and the TA Luft (German Technical Instructions on Air Quality Control). In the documentation provided, a table was provided comparing the emission restriction levels among six countries (USA, Germany, Italy, France and Denmark). Ibid., 8.

APPENDIX:

APPENDIX A: PROJECT PICTURES AND DRAWINGS



Figure 05: Panoramic view of Termoverde Caieiras project.
Sources: Solvi Valorização Energética.



Figure 06: Aerial view of the area where Termoverde is installed.
Sources: Solvi Valorização Energética.

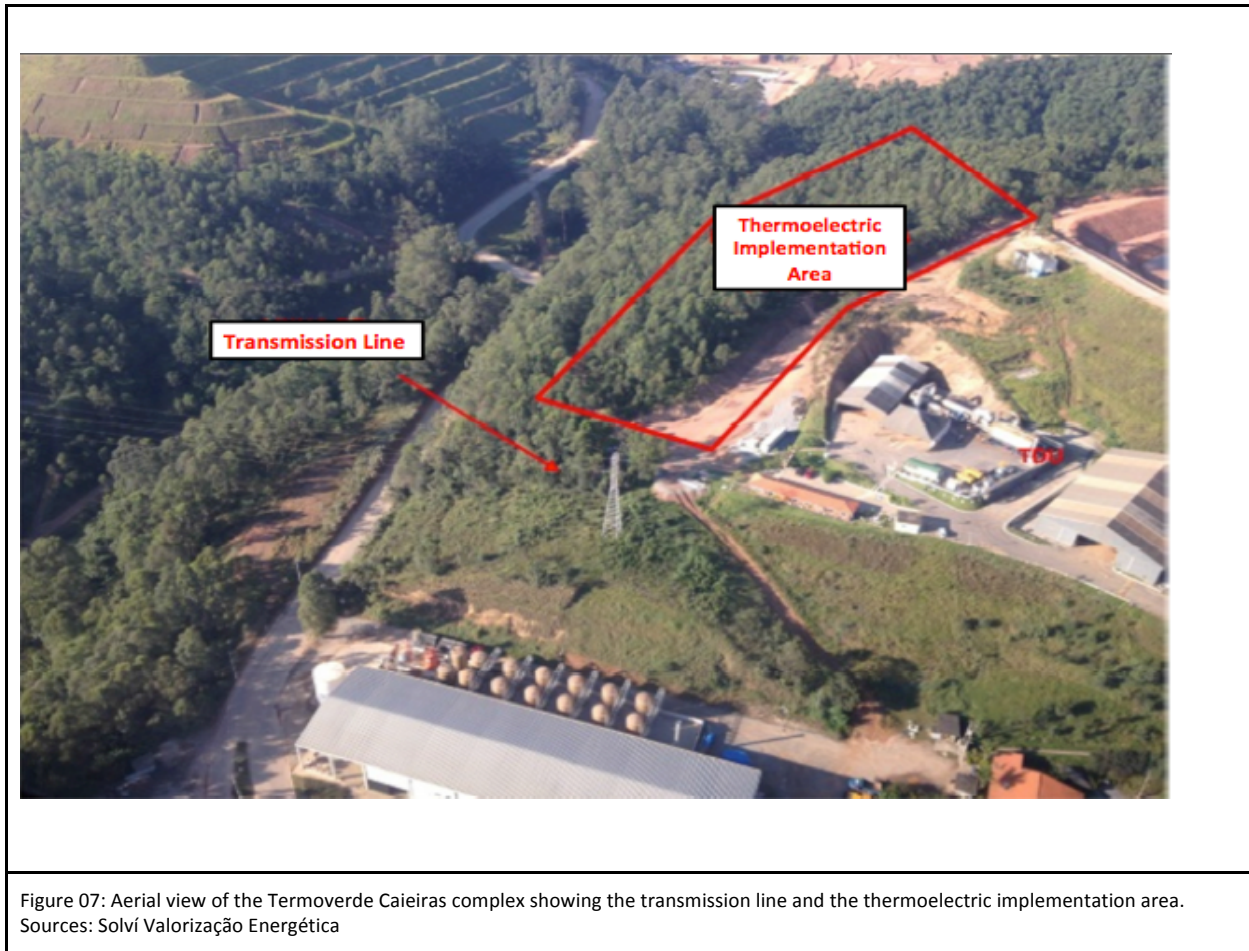


Figure 08: Aerial view of the CTR Caieiras landfill site where Termoverde Caieiras is located.
Sources: Solví Valorização Energética.

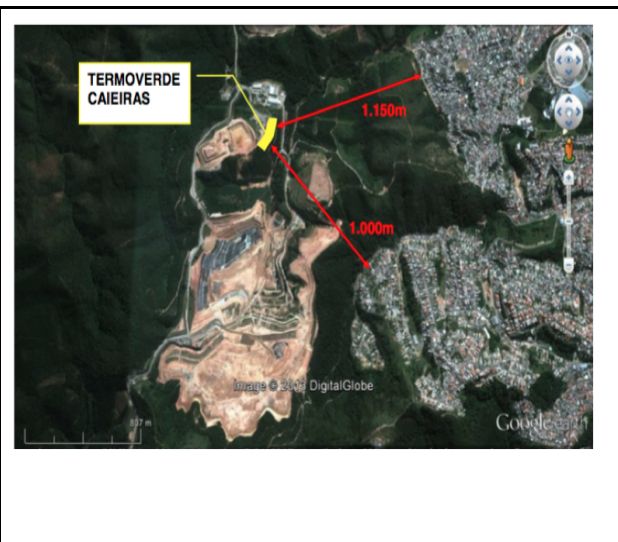


Figure 09: Location map indicating the distance between Termoverde Caieiras and the communities.
Sources: Migratio and Solví Valorização Energética.



Figure 10: Biogas capture from the CTR Caieiras landfill.
Sources: Solvi Valorização Energética.



Figure 11: Biogas Treatment System Unit.
Sources: Solvi Valorização Energética.



Figure 12: Example of GE generator engines located in soundproofing containers
Sources: Solvi Valorização Energética



Figure 13: General view of the containers.
Sources: Ambconsult Estudos e Projetos Ambientais.

Termoverde Caieiras - Biogas Thermoelectric Plant, Brazil



Figure 14: Substation where the tension of 13.8kV is transformed in 138kV to be connected to the Transmission Line.
Sources: Solví Valorização Energética.



Figure 15: Transmission Line 138kV
Sources: Solví Valorização Energética.



Figure 16: Aerial view of the communities near Termoverde Caieiras
Sources: Caran Consultoria em Serviço Social.



Figure 17: Panoramic view from the community Jardim Marcelino assessed by Caran Consultoria em Serviço Social. On the background the view of CTR Caieiras and Termoverde.
Sources: Caran Consultoria em Serviço Social.



Figure 18: The community Jardim Marcelino assessed by Caran Consultoria em Serviço Social. On right side a public school. Sources: Caran Consultoria em Serviço Social.



Figure 19: Spots used for leisure purposes. An offhand football field in the Jardim Marcelino community. According to the Caran Consultoria the dwellers do the maintenance. Sources: Caran Consultoria em Serviço Social.



Figure 20: View of the street of Vila dos Pinheiros community. Sources: Caran Consultoria em Serviço Social.



Figure 21: A sportive center in Vila dos Pinheiros community. It is not offered planned activities for dwellers. Children and adults use the space for leisure. Sources: Caran Consultoria em Serviço Social.



Figure 22: Playground at the sportive center in Vila dos Pinheiros community.
Sources: Caran Consultoria em Serviço Social.



Figure 23: Workshop generating income for men.
Sources: Caran Consultoria em Serviço Social.



Figure 24: Workshop generating income for women.
Sources: Caran Consultoria em Serviço Social.



Figure 25: Ludic interactive activities with the children for teaching rational water use.
Sources: Caran Consultoria em Serviço Social.

APPENDIX B: ENVISION POINTS TABLE

ENVISION POINTS TABLE

			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
		QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
		QL1.3 Develop local skills and capabilities	1	2	5	12	15
	WELLBEING	QL2.1 Enhance public health and safety	2	—	—	16	
		QL2.2 Minimize noise and vibration	1	—	—	8	11
		QL2.3 Minimize light pollution	1	2	4	8	11
		QL2.4 Improve community mobility and access	1	4	7	14	
		QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
		QL2.6 Improve site accessibility, safety and wayfinding	—	3	6	12	15
	COMMUNITY	QL3.1 Preserve historic and cultural resources	1	—	7	13	16
		QL3.2 Preserve views and local character	1	3	6	11	14
		QL3.3 Enhance public space	1	3	6	11	13
	VULNERABLE GROUPS	QL4.1 Identify and address the needs of women and diverse communities *	1	2	3	4	
QL4.2 Stimulate and promote women's economic empowerment		1	2	3	4		
QL4.3 Improve access and mobility of women and diverse communities *		1	2	3	4	5	
Maximum QL Points:						194*	
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
		LD1.2 Establish a sustainability management system	1	4	7	14	
		LD1.3 Foster collaboration and teamwork	1	4	8	15	
		LD1.4 Provide for stakeholder involvement	1	5	9	14	
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
		LD2.2 Improve infrastructure integration	1	3	7	13	16
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3	—	10	
		LD3.2 Address conflicting regulations and policies	1	2	4	8	
		LD3.3 Extend useful life	1	3	6	12	
Maximum LD Points:						121*	
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
		RA1.2 Support sustainable procurement practices	2	3	6	9	
		RA1.3 Use recycled materials	2	5	11	14	
		RA1.4 Use regional materials	3	6	9	10	
		RA1.5 Divert waste from landfills	3	6	8	11	
		RA1.6 Reduce excavated materials taken off site	2	4	5	6	
		RA1.7 Provide for deconstruction and recycling	1	4	8	12	
	ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
		RA2.2 Use renewable energy	4	6	13	16	20
	WATER	RA2.3 Commission and monitor energy systems	—	3	—	11	
		RA3.1 Protect fresh water availability	2	4	9	17	21
RA3.2 Reduce potable water consumption		4	9	13	17	21	
RA3.3 Monitor water systems		1	3	6	11		
Maximum RA Points:						182*	

ENVISION POINTS TABLE

			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	—	—	9	14	18
		NW1.2 Protect wetlands and surface water	1	4	9	14	18
		NW1.3 Preserve prime farmland	—	—	6	12	15
		NW1.4 Avoid adverse geology	1	2	3	5	
		NW1.5 Preserve floodplain functions	2	5	8	14	
		NW1.6 Avoid unsuitable development on steep slopes	1	—	4	6	
		NW1.7 Preserve greenfields	3	6	10	15	23
	LAND & WATER	NW2.1 Manage stormwater	—	4	9	17	21
		NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
		NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
	BIODIVERSITY	NW3.1 Preserve species biodiversity	2	—	—	13	16
		NW3.2 Control invasive species	—	—	5	9	11
		NW3.3 Restore disturbed soils	—	—	—	8	10
		NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
Maximum NW Points:						203*	
CLIMATE & RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
		CR1.2 Reduce air pollutant emissions	2	6	—	12	15
	RESILIENCE	CR2.1 Assess climate threat	—	—	—	15	
		CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
		CR2.3 Prepare for long-term adaptability	—	—	—	16	20
		CR2.4 Prepare for short-term hazards	3	—	10	17	21
		CR2.5 Manage heat islands effects	1	2	4	6	
Maximum CR Points:						122*	
Maximum TOTAL Points:						822*	

* Indigenous or afro-descendant peoples

** Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

Figure 26: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.

Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX C: GRAPHS

		TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT		IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
		TERMOVERDE CAIEIRAS - PLANTA TERMOELÉTRICA A BIOGÁS		MEJORA	AUMENTA	SUPERIOR	CONSERVA	RESTAURA
QUALITY OF LIFE CALIDAD DE VIDA	PURPOSE PROPÓSITO	QL1.1 Improve Community Quality of Life QL1.1 Mejorar la Calidad de Vida de la Comunidad						
		QL1.2 Stimulate Sustainable Growth & Development QL1.2 Estimular el desarrollo y el crecimiento sostenible						
		QL1.3 Develop Local Skills And Capabilities QL1.3 Desarrollar Capacidades y Habilidades Locales						
	COMMUNITY COMUNIDAD	QL2.1 Enhance Public Health And Safety QL2.1 Mejorar la Salud Pública y la Seguridad						
		QL2.2 Minimize Noise And Vibration QL2.2 Minimizar ruidos y vibraciones						
		QL2.3 Minimize Light Pollution QL2.3 Minimizar Contaminación Lumínica						
		QL2.4 Improve Community Mobility And Access QL2.4 Mejorar el acceso y la movilidad de la Comunidad						
		QL2.5 Encourage Alternative Modes of Transportation QL2.5 Fomentar modos alternativos de transporte						
		QL2.6 Improve Site Accessibility, Safety & Wayfinding QL2.6 Mejorar la accesibilidad, seguridad y señalización						
	WELLBEING BIENESTAR	QL3.1 Preserve Historic And Cultural Resources QL3.1 Preservar los recursos históricos y culturales						
		QL3.2 Preserve Views And Local Character QL3.2 Preservar las vistas y el carácter local						
		QL3.3 Enhance Public Space QL3.3 Mejorar el espacio público						
	VULNERABLE GROUPS GRUPOS VULNERABLES	QL4.1 Identify and address the needs of minorities QL4.1 Identificar y considerar las necesidades de minorías						
		QL4.2 Stimulate and promote women's empowerment QL4.2 Estimular y promover el empoderamiento femenino						
		QL4.3 Improve access and mobility of minorities QL4.3 Mejorar el acceso y movilidad de minorías						
	QL0.0 Innovate Or Exceed Credit Requirements QL0.0 Créditos innovadores o que exceden los requerimientos							

Figure 27: Quality of Life category_ Summary of results

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT TERMOVERDE CAIEIRAS - PLANTA TERMOELÉTRICA A BIOGÁS			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
			MEJORA	AUMENTA	SUPERIOR	CONSERVA	RESTAURA
LIDERAZGO	COLLABORATION COLABORACIÓN	LD1.1 Provide Effective Leadership And Commitment LD1.1 Proporcionar compromiso y liderazgo efectivo					
		LD1.2 Establish A Sustainability Management System LD1.2 Establecer un sistema de gestión de la sostenibil-					
		LD1.3 Foster Collaboration And Teamwork LD1.3 Promover Colaboración y trabajo en equipo					
		LD1.4 Provide For Stakeholder Involvement LD1.4 Fomentar la participación de las partes interesadas					
LEADERSHIP	MANAGEMENT GESTIÓN	LD2.1 Pursue By-Product Synergy Opportunities LD2.1 Buscar oportunidades de sinergia derivada					
		LD2.2 Improve Infrastructure Integration LD2.2 Mejorar la integración de infraestructuras					
LEADERSHIP	PLANNING PLANIFICACIÓN	LD3.1 Plan For Long-Term Monitoring & Maintenance LD3.1 Planificar el monitoreo y mantenimiento a largo plazo					
		LD3.2 Address Conflicting Regulations & Policies LD3.2 Lidar con reglamentos y políticas en conflicto					
		LD3.3 Extend Useful Life LD3.3 Extender la vida útil					
		LD0.0 Innovate Or Exceed Credit Requirements LD0.0 Créditos innovadores o que exceden los requerimientos					

Figure 28: Leadership category_ Summary of results

		TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT		IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
		TERMOVERDE CAIEIRAS - PLANTA TERMOELÉTRICA A BIOGÁS		MEJORA	AUMENTA	SUPERIOR	CONSERVA	RESTAURA
RESOURCE ALLOCATION	MATERIALS MATERIALES	RA1.1 Reduce Net Embodied Energy RA1.1 Reducir energía neta incorporada						
		RA1.2 Support Sustainable Procurement Practices RA1.2 Apoyar prácticas de adquisición sustentable						
		RA1.3 Used Recycled Materials RA1.3 Utilizar materiales reciclados						
		RA1.4 Use Regional Materials RA1.4 Utilizar materiales de la región						
		RA1.5 Divert Waste From Landfills RA1.5 Disminuir la disposición final en rellenos sanitarios						
		RA1.6 Reduce Excavated Materials Taken Off Site RA1.6 Reducir los materiales de excavación sacados del local del proyecto						
		RA1.7 Provide for Deconstruction & Recycling RA1.7 Prever condiciones para la remoción de la construcción y el reciclaje						
	ENERGY ENERGÍA	RA2.1 Reduce Energy Consumption RA2.1 Reducir el consumo de energía						
		RA2.2 Use Renewable Energy RA2.2 Usar energías renovables						
		RA2.3 Commission & Monitor Energy Systems RA2.3 Puesta en servicio y monitoreo de sistemas energéticos						
WATER AGUA	RA3.1 Protect Fresh Water Availability RA3.1 Proteger la disponibilidad de agua dulce							
	RA3.2 Reduce Potable Water Consumption RA3.2 Reducir el consumo de agua potable							
	RA3.3 Monitor Water Systems RA3.3 Monitorear sistemas de provisión de agua							
	RA0.0 Innovate Or Exceed Credit Requirements RA0.0 Créditos innovadores o que exceden los requerimientos							

Figure 29:Resource Allocation category_ Summary of results

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT TERMOVERDE CAIEIRAS - PLANTA TERMOELÉTRICA A BIOGÁS			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
			MEJORA	AUMENTA	SUPERIOR	CONSERVA	RESTAURA
MUNDO NATURAL	SITING EMPLAZAMIENTO	NW1.1 Preserve Prime Habitat NW1.1 Preservar hábitats de alta calidad					
		NW1.2 Preserve Wetlands and Surface Water NW1.2 Preservar humedales y aguas superficiales					
		NW1.3 Preserve Prime Farmland NW1.3 Preservar tierras agrícolas de alta calidad					
		NW1.4 Avoid Adverse Geology NW1.4 Evitar zonas de geología adversa					
		NW1.5 Preserve Floodplain Functions NW1.5 Preservar funciones de llanura aluvial					
		NW1.6 Avoid Unsuitable Development on Steep Slopes NW1.6 Evitar la ocupación inadecuada en pendientes pronunciadas					
		NW1.7 Preserve Greenfields NW1.7 Preservar áreas sin ocupación					
NATURAL WORLD	LAND + WATER IMPACTOS EN EL AGUA Y SUELO	NW2.1 Manage Stormwater NW2.1 Gestión de aguas pluviales					
		NW2.2 Reduce Pesticides and Fertilizer Impacts NW2.2 Reducir el impacto de fertilizantes y plaguicidas					
		NW2.3 Prevent Surface and Groundwater Contamination NW2.3 Prevenir la contaminación de aguas superficiales y profundas					
NATURAL WORLD	BIODIVERSITY BIODIVERSIDAD	NW3.1 Preserve Species Biodiversity NW3.1 Preservar la biodiversidad					
		NW3.2 Control Invasive Species NW3.2 Control de especies invasivas					
		NW3.3 Restore Disturbed Soils NW3.3 Restaurar suelos alterados					
		NW3.4 Maintain Wetland and Surface Water Functions NW3.4 Preservar los humedales y las funciones de aguas superficiales					
		NW0.0 Innovate or Exceed Credit Requirements NW0.0 Créditos innovadores o que exceden los requerimientos					

Figure 30: Natural World category_ Summary of results

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT TERMOVERDE CAIEIRAS - PLANTA TERMOELÉTRICA A BIOGÁS		IMPROVED MEJORA	ENHANCED AUMENTA	SUPERIOR SUPERIOR	CONSERVING CONSERVA	RESTORATIVE RESTAURA
EMISSIONS EMISIONES	CR1.1 Reduce Greenhouse Gas Emissions CR1.1 Reducir las emisiones de Gases de Efecto Invernadero (GEI)					
	CR1.2 Reduce Air Pollutant Emissions CR1.2 Reducir las emisiones contaminantes del aire					
RESILIENCE RESILIENCIA	CR2.1 Assess Climate Threat CR2.1 Evaluar amenazas relacionadas al Cambio Climático					
	CR2.2 Avoid Traps And Vulnerabilities CR2.2 Evitar situaciones de riesgo y vulnerabilidad					
	CR2.3 Prepare For Long-Term Adaptability CR2.3 Establecer estrategias de adaptación de largo plazo, frente al Cambio Climático					
	CR2.4 Prepare For Short-Term Hazards CR2.4 Preparación frente a riesgos de corto plazo					
	CR2.5 Manage Heat Island Effects CR2.5 Administrar el efecto Isla de Calor					
	CR0.0 Innovate Or Exceed Credit Requirements CR0.0 Créditos innovadores o que exceden los requerimientos					

Figure 31: Climate & Risk category_ Summary of results

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT, BRAZIL			PT.	Performance	
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve Community Quality of Life	20	Conserving
2			QL1.2 Stimulate Sustainable Growth & Development	5	Superior
3			QL1.3 Develop Local Skills And Capabilities	1	Improved
4		COMMUNITY	QL2.1 Enhance Public Health And Safety	2	Improved
5			QL2.2 Minimize Noise And Vibration	11	Restorative
6			QL2.3 Minimize Light Pollution	1	Improved
7			QL2.4 Improve Community Mobility And Access	4	Enhanced
8			QL2.5 Encourage Alternative Modes of Transportation	0	No Score
9			QL2.6 Improve Site Accessibility, Safety & Wayfinding	3	Enhanced
10		WELLBEING	QL3.1 Preserve Historic And Cultural Resources	7	Superior
11			QL3.2 Preserve Views And Local Character	1	Improved
12			QL3.3 Enhance Public Space	1	Improved
	VULNERABLE GROUPS	QL 4.1 Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)	0	No Score	
		QL4.2 Stimulate and promote women's economic empowerment	0	No Score	
		QL4.3 Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	0	No Score	
		QL0.0 Innovate Or Exceed Credit Requirements	0	N/A	
		QL	56		

Termoverde Caieiras - Biogas Thermoelectric Plant, Brazil

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT, BRAZIL			PT.	Performance	
13	LEADERSHIP	COLLABORATION	LD1.1 Provide Effective Leadership And Commitment	17	Conserving
14			LD1.2 Establish A Sustainability Management System	7	Superior
15			LD1.3 Foster Collaboration And Teamwork	4	Enhanced
16			LD1.4 Provide For Stakeholder Involvement	1	Improved
17		MNGMT.	LD2.1 Pursue By-Product Synergy Opportunities	12	Conserving
18			LD2.2 Improve Infrastructure Integration	16	Restorative
19		PLANNING	LD3.1 Plan For Long-Term Monitoring & Maintenance	3	Enhanced
20			LD3.2 Address Conflicting Regulations & Policies	1	Improved
21			LD3.3 Extend Useful Life	3	Enhanced
			LD0.0 Innovate Or Exceed Credit Requirements	0	N/A
			LD	64	

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT, BRAZIL			PT.	Performance		
22	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce Net Embodied Energy	0	No Score	
23			RA1.2 Support Sustainable Procurement Practices	2	Improved	
24			RA1.3 Used Recycled Materials	2	Improved	
25			RA1.4 Use Regional Materials	10	Conserving	
26			RA1.5 Divert Waste From Landfills	8	Superior	
27			RA1.6 Reduce Excavated Materials Taken Off Site	6	Conserving	
28			RA1.7 Provide for Deconstruction & Recycling	8	Superior	
29		ENERGY	RA2.1 Reduce Energy Consumption	7	Enhanced	
30			RA2.2 Reduce Pesticide and Fertilizer Impacts	20	Restorative	
31			RA2.3 Commission & Monitor Energy Systems	11	Conserving	
32		WATER	RA3.1 Protect Fresh Water Availability	2	Improved	
33			RA3.2 Reduce Potable Water Consumption	0	No Score	
34			RA3.3 Monitor Water Systems	3	Enhanced	
			RA0.0 Innovate Or Exceed Credit Requirements	0	N/A	
			RA	79		

Termoverde Caieiras - Biogas Thermoelectric Plant, Brazil

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT, BRAZIL				PT.	Performance
35	NATURAL WORLD	SITING	NW1.1 Preserve Prime Habitat	18	Restorative
36			NW1.2 Preserve Wetlands and Surface Water	1	Improved
37			NW1.3 Preserve Prime Farmland	12	Conserving
38			NW1.4 Avoid Adverse Geology	3	Superior
39			NW1.5 Preserve Floodplain Functions	2	Improved
40			NW1.6 Avoid Unsuitable Development on Steep Slopes	6	Conserving
41			NW1.7 Preserve Greenfields	15	Conserving
42		L & W	NW2.1 Manage Stormwater	0	No Score
43			NW2.2 Reduce Pesticides and Fertilizer Impacts	5	Superior
44			NW2.3 Prevent Surface and Groundwater Contamination	9	Superior
45		BIODIVERSITY	NW3.1 Preserve Species Biodiversity	2	Improved
46			NW3.2 Control Invasive Species	11	Restorative
47			NW3.3 Restore Disturbed Soils	10	Restorative
48			NW3.4 Maintain Wetland and Surface Water Functions	9	Superior
NW0.0 Innovate or Exceed Credit Requirements				0	N/A
NW				103	

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT, BRAZIL				PT.	Performance
49	CLIMATE	EMISSION	CR1.1 Reduce Greenhouse Gas Emissions	25	Restorative
50			CR1.2 Reduce Air Pollutant Emissions	0	No Score
51		RESILIENCE	CR2.1 Assess Climate Threat	0	No Score
52			CR2.2 Avoid Traps And Vulnerabilities	0	No Score
53			CR2.3 Prepare For Long-Term Adaptability	0	No Score
54			CR2.4 Prepare For Short-Term Hazards	0	No Score
55			CR2.5 Manage Heat Island Effects	0	No Score
CR0.0 Innovate Or Exceed Credit Requirements				0	N/A
CR				25	

Total points	327	0
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Figure 32: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank. Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX D: CREDIT DETAIL

TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT: CREDIT SPREADSHEET WITH DETAILS

CATEGORY I, PEOPLE AND LEADERSHIP		
SUB CATEGORY: QUALITY OF LIFE		
	Score	TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT
QL1.1 Improve Community Quality of Life	20	<p>Conserving</p> <p>The intent of this credit is to improve the quality of life for all communities affected by the project. This credit is assessed through the measures which have been taken to assess community needs, and improve quality of life, while minimizing negative impacts.</p> <p>The CTR Caieiras landfill, and Termoverde which is located on-site, had improved upon the communities’ quality of life. CTR Caieiras is designed to treat urban waste from all of the Sao Paulo metropolitan region on a daily basis, ths reducing gas emissions through an efficient flaring process. Additionally, the implementation of Termoverde project allows for the conversion of biogas produced by the landfill into electrical energy.</p> <p>Specifically for the Termoverde project, the project sponsor has noted many social projects which have addressed community needs will continue to be carried out in order to improve the local quality of life. A comprehensive social assessment was recently conducted by an independent company that is specialized in developing social programs. Therefore, the main needs and interests of the three communities near Termoverde were identified, and five social programs were planned in order to attend to the community’s interests. These social programs considered themes such as leadership training for the communities, cultural and athletic activities for children and teenagers, as well as workshops for generating income and entrepreneurship. As part of the social programs which have been under development, a social event was held at a public school in the neighbourhood. This activity aimed to discuss important environmental issues, such as the rational use of water, and also conducted workshops for generating income (teaching how to make jewelry and belts). This component demonstrates that it is aligned with the income needs of the community in addition to Termoverde’s environmental purpose.</p> <p>Through the “Previous Licensing” (LP) process in Brazil, the project team has identified the potential negative impacts directly associated with the operation of the thermoelectric plant. The main concerns which arose were related to the noise caused by the generator engines, and the odors emitted from the waste; these impacts can significantly affect the neighbourhood. In order to respond to these nuisances, Termoverde has carried out monitoring plans for the noise and odors, which will also be complemented by a monitoring plan which has been developed by the CTR Caieiras landfill. Both Termoverde and CTR-Caieiras help to reduce the odors that are emitted by the waste. In CTR-Caieiras, a gas collection system captures biogas from waste; then, Termoverde recovers the biogas, treats it, and combusts it in order to generate electricity. In addition, a greenbelt area which has been conserved by CTR Caieiras</p>

<p>QL1.2 Stimulate Sustainable Growth & Development</p>	<p>5</p>	<p>provides for a natural barrier for the odors that may be dispersed beyond the site.</p> <p>In relation to engagement with the community during the project design process, it was not possible to assess whether this component had been considered within the scope of the project design. Additionally, no evidence was presented to demonstrate whether the affected community is satisfied with the Termoverde project. However, the project team intends to be part of a CTR Caieiras initiative to establish communications channels with the local community. Moreover, it is relevant to state the importance of Termoverde’s reach, not only in terms of its surroundings, but also on a larger scale. The implementation of a biogas thermoelectric plant in a landfill will bring an renewable energy generation solution from solid urban waste coming from many cities in the metropolitan region of São Paulo. Moreover this electricity will be capable of providing energy for 300,000 inhabitants.</p>
		<p><u>Source:</u> Caran Consultoria em Serviço Social, Relatório de Atividades Serviço Social - Solvi Valorização Energética. September, 2015. (hereafter cited as Relatório de Atividades). Ambconsult Estudos e Projetos Ambientais, “Plano de Monitoramento das Emissões Atmosféricas.” Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP. São Paulo: June, 2013. 3-9. (hereafter cited as Licenciamento Ambiental). “Programa de Monitoramento do Ruído.” in <i>Licenciamento Ambiental</i>, 1-5. CNEC, “Programa de Monitoramento: Programa de Monitoramento Climático.” in <i>Estudo de Impacto Ambiental - EIA/RIMA</i>, 1998, 10-12 (hereafter cited as EIA/RIMA). Ibid., 6-8. Giovano Candiani and Ana Tereza Caceres Cortez, Análise da implantação das medidas mitigadoras estabelecidas no estudo de impacto ambiental da central de tratamento de resíduos – Caieiras – São Paulo. 2013. Accessed August 29, 2015, http://www.periodicos.uem.br/ojs/index.php/BolGeogr/article/viewFile/13419/10959. Caran Consultoria em Serviço Social, Diagnóstico das Comunidades. December, 2015. Essencis, “Relatório Anual Socioambiental 2014”. Accessed August 29, 2015, http://www.essencis.com.br/SiteAssets/sustentabilidade/RELATÓRIO%20SOCIOAMBIENTAL%202014.pdf.</p>
		<p><u>RECOMMENDATIONS</u></p> <p>The project team should incorporate community engagement into the scope of the project at all levels. It is very important that the team be aware of the environmental role that Termoverde has, within both a local and regional context. It is equally important to explain to the neighbourhoods the innovative aspect of the project in converting solid waste into electrical energy, and how it will directly benefit them. These actions will enhance community awareness and acceptance of, as well as pride in the project.</p>
		<p>Superior</p> <p>Infrastructure projects should support and stimulate sustainable growth and development, including improvements to job growth, capacity building, productivity, business attractiveness, and general livability. This is measured through an assessment of the project’s impact on the community’s sustainable economic growth and development.</p> <p>According to the documentation which was provided, Termoverde has created 120 new jobs during the construction phase, and eight new jobs for the operations phase.</p>

	<p>Moreover, the sponsor states that during the installation of the project, local suppliers were given preference. At the time of this assessment there were 60 employees, which vary, depending on the level of activity. One local technical professional was set to be hired by the end of 2015. The project has also contributed to community growth and development by increasing entrepreneurial capacity and and recreational facilities. After a social assessment was conducted by a third-party company, one of the social programs which was established was related to developing entrepreneurial and income generation workshops for community members as a way of attending to their needs and interests. For example, as part of this social program, an event was carried out which included workshops related to income generation for adults, and ludic interactive activities with the children for teaching rational water use.</p> <p>In terms of improvement of competitiveness, Termoverde plays an important role within the region, due its innovation and technology which is used in order to generate energy from waste. By providing an alternative solution for the waste, this innovation can make the region more competitive and enhance investments in this type of project for implementation in other landfills throughout Brazil. Moreover, according to the sponsor the project provides many economic and environmental benefits for the community. The recovery of energy from biogas promotes the reduction of methane emissions into the atmosphere, and also provides for the security and stability of the landfill as this gas is highly flammable. Furthermore, the sale of the electrical power from using this innovative technology will positively impact the local and regional economies. With regards to the improvement of community attractiveness, the project will contribute to the development of the local economy, as the installation of the thermoelectric plant will generate income and employ a local workforce. Embedded gains can be considered in relation to local commerce, such as the purchasing of materials for the maintenance of the project. According with the sponsor, as Termoverde is installed within the CTR Caieiras landfill, all of the previously existing infrastructure was also used by Termoverde, such as those related to access, security, lighting, and refectory, among others.</p> <p><u>Source:</u> Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 11. Caran Consultoria em Serviço Social, <i>Relatório de Atividades Serviço Social - Solví Valorização Energética</i>. September, 2015. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November, 2015, 2. Caran Consultoria em Serviço Social, <i>Diagnóstico das Comunidades</i>. December, 2015.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team should consider identifying existing community assets, both local and regionally. By doing so, the project could potentially develop community activities to enhance their competitiveness; this does not need to be directly related to the scope of the project. For instance, the project team could identify the infrastructure needs of the city, or other surroundings, in order to bring improvements that can enhance livability for citizens. Additionally, aspects of cultural and recreational assets could be equally identified and restored in a way that can also enhance livability.</p>
	<p>Improved</p>

<p>QL1.3 Develop Local Skills and Capabilities</p>	<p>1</p>	<p>This credit looks at how infrastructure projects expand the knowledge, skills, and capacity of the community workforce, in order to improve its ability to grow and develop. The credit is measured by the extent to which the project will improve local employment levels, skills mixes, and capabilities.</p> <p>According to the sponsor, as well as the documentation provided, the project contributes little to the development of local skills as the project was mainly focused on cost efficiency. As stated in the provided documentation, during the installation phase the project employed 120 workers, ranging from engineers to construction workers, and for the operational phase it had eight employees. The sponsor has indicated that for construction, the need for employees was higher due to the extent of the implementation of the biogas thermoelectric plant. As Termoverde’s activities are based in maintenance, operations, and administrative tasks, the need for only eight employees remained after construction. Moreover, as stated by the sponsor, Termoverde seeks to employ a professional from the Caieiras municipality or another regional city, such as Osasco or Jundiaí.</p> <p>According to the sponsor, the project team has used local and regional suppliers during the construction of the thermoelectric plant, thus providing some benefit to the local economy. Moreover, the sponsor has confirmed that a social program which encompasses educational and professional training was being carried out by Termoverde, at the time of this assessment, in order to answer community needs and enhance competitiveness. In relation to the professional training of workers, documents which were provided allow for inference that the project team has focused on cost efficiency, seeking to train workers on an as-needed basis.</p> <p><i>Source:</i> Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 11. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November, 2015, 2.</p> <p>RECOMMENDATIONS</p> <p>The project could have considered establishing programs that focused on the development of skills and capabilities for the community. Infrastructure project should address future community competitiveness by working with community leaders and establishing programs to identify educational and employment needs and shortfalls. Termoverde should work more with the community in order to improve, and retrofit the local skills base, thereby improving long-term competitiveness. Additionally, it is important to note that the project team could consider making commitments and planning for hiring local workers from disadvantaged groups.</p>
<p>QL2.1 Enhance</p>	<p>2</p>	<p>Improved</p> <p>Infrastructure projects should take into account the health and safety implications of</p>

<p>Public Health And Safety</p>		<p>using new materials, technologies, or methodologies, above and beyond meeting regulatory requirements. This credit is measured through efforts to exceed normal health and safety requirements, while taking into account additional risks in the application of new technologies, materials, and methodologies.</p> <p>New technology is used for the operation of the thermoelectric plant. The generator engines which are used to transform biogas to electrical energy were purchased by following international rules standards for nitrogen oxide (NOx) emissions. The project team assessed the risks involved with the introduction of this new technology. According to the documents, the generator engines emit noise levels of 115dB, and thus require the strict use of safety equipment by the operators, such as personal protective equipment (PPE).</p> <p>Additionally, appropriate changes have been made during the project design in order to reduce the noise of the generators. The generator engines have been placed within soundproofed containers (85 dB at a distance of one meter), which meet the legal requirements stated by national standard ABNT 10151. This measure mitigates noise nuisance in the surroundings avoiding negative effects for their health for well-being. Furthermore, a monitoring plan will be implemented in order to evaluate the noise effects caused by the energy plant during the operations phase. However, amongst the documentation which was submitted by the project team, it was not possible to assess whether the project has received approval by the appropriate environmental and public health safety officials.</p> <p>Moreover, according to the project sponsor, documentation was still required to initiate the suppliers' work during the construction phase; these documents would include aspects such as engineering and occupational health and safety services, PPE provisions, operational health control programs, and the program for the prevention of environmental risk, which aims to create an internal commission of prevention accidents, assuring the workers' safety.</p> <p><i>Source:</i> Solví Valorização Energética, Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação. 11.</p> <p>RECOMMENDATIONS</p> <p>In order to achieve a higher score, the team should seek the approval from relevant environmental and health safety officials. Additional assessments that cover potential risks for project works is also important for consideration; the project could consider benchmarking against successful projects which have adopted the same technologies.</p>
<p>QL2.2</p>	<p>11</p>	<p>Restorative</p> <p>To maintain and improve community livability, infrastructure projects should minimize</p>

<p>Minimize Noise And Vibration</p>		<p>the noise and vibration which is generated during construction and operations of the completed project. The metric which is used is the extent to which noise and vibration have been (or will be) reduced during construction and operations.</p> <p>The documentation which was provided was not enough to assess whether Termoverde has carried out studies to predict the noise levels during the installation and operations phases. However, the project has included a monitoring plan in order to assess the noise levels emitted during the operation of generator engines. Termoverde will incorporate the standard monitoring program that already carried out by CTR Caieiras and stated in its environmental impact assessment (EIA). Therefore the same monitoring locations and collected data as CTR Caieiras will be used, with two additional points of measurement; one located 10 meters away from the generator engines, and other one will be on the boundary of the thermoelectric plant.</p> <p>This monitoring plan is relevant to evaluating whether additional control measures are required, or even if the program should be continued. The monitoring will be conducted by a technician with expertise in environmental noise assessments, as well as a proofed experienced engineer qualified in the field, being responsible for reporting and data analysis.</p> <p>It is worth mentioning that the project design reduces ambient noise levels due to the placement of the generators within soundproofed containers, in accordance with national standard NBR 10151 (85 dB at a distance of one meter). Additionally, the thermoelectric plant will be installed one kilometer away from the local community. Thus, the project has a neutral impact in regard the ambient noise and vibration not being necessary to improve the community's livability.</p> <p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. 5-6. "Programa de Monitoramento do Ruído". in <i>Licenciamento Ambiental</i>. 1-4. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 9. "Diagnóstico Ambiental: Ruído." in <i>EIA/RIMA</i>. 36-37.</p> <p><u>RECOMMENDATIONS</u> As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
<p>QL2.3 Minimize</p>	<p>1</p>	<p>Improved It is important that a sustainable project seeks to prevent excessive glare, light at night</p>

<p>Light Pollution</p>		<p>(to conserve energy), and reduce obtrusive lighting. To achieve this, the project has to meet certain minimum standards for safety, but light should not spill over into areas beyond site boundaries.</p> <p>The project documentation lacked an overall assessment of lighting needs. According to the information and documentation which was provided by the sponsor, the project has considered using the electricity produced by the thermoelectric plant for external lighting. The design of the outdoor lighting was conducted primarily based on economic considerations; the project uses 26 sodium-vapor street lamps in order to illuminate the biogas plant. According to the sponsor, this lamp was chosen due to its 16,000 hour lifespan, and lower energy consumption than mercury-vapor lamps. Although the project sponsor states that using energy-efficient lighting was considered, it was not possible to evaluate whether the project has designed lighting components in a way that reduces energy requirements, due to a lack of documentation.</p> <p>With regards to efforts to reduce or eliminate light spillage into the external environment and preserve the night sky, Termoverde did not present an assessment concerning the respective impacts of lighting. Despite the fact that the energy plant will be limited by the landfill site boundaries, far away from communities (as stated by the sponsor), it is important to carry out this type of diagnostic in order to evaluate to what extent the project increases light pollution.</p>
		<p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação. CNEC, Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. JFS Desenhos Técnicos, <i>Instalações Elétricas, Implantação Geral - Distribuição de Iluminação e Infra de Telefonia</i>. May, 2015. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November, 2015.</p>
		<p><u>RECOMMENDATIONS</u></p> <p>The project team should consider developing a lighting assessment and identify the overall lighting needs of the project, in order to better manage energy costs and excess lighting. Within the scope of Termoverde’s needs, non-lighting alternatives can also be an important component, such as clear, reflective signage and roadway lines. Additionally, for future improvements the project team could consider the use of more energy efficient alternatives for lighting, such as the use of LEDs or photovoltaic street lighting. It is also important to consider implementing full cutoff lighting on the Termoverde site; this will help to minimize light spillage into the sky.</p>
<p>QL2.4 Improve</p>	<p>4</p>	<p>Enhanced</p> <p>This credit assesses efforts to locate, design, and construct the project in way that</p>

<p>Community Mobility And Access</p>		<p>eases traffic congestion, improves mobility and access, and otherwise improves community livability through related efforts. This is measured by how the project improves access and walkability, and reduces commuting and traverse times to existing facilities and transportation access points. Additionally, how a project improves user safety, considering all modes of transportation (e.g., personal vehicle, commercial vehicle, transit, and bike/pedestrian), is an important factor in determining achievement for this credit.</p> <p>Site access is satisfactory, through the Bandeirantes highway which has exclusive access for the CTR Caieiras landfill, and thus Termoverde. Additionally, according map of the site, the location of the project is far from communities, and thus does not cause impacts to community mobility and access. Regarding the alternatives modes of transportation, based on the documentation which was provided, it was not possible to conclude whether Termoverde has developed plans in order to reduce traffic; or if the team has designed strategies to expand mobility and access to the project over the long-term.</p> <p>It is important to state that, as this project is run by the Solví Group (the same as for CTR Caieiras), all of the regulations and norms established of the landfill related to access have been followed by Termoverde during the installation and operational phases. Additionally, CTR Caieiras has performed an assessment within the environmental impact assessment (EIA) regarding to the impacts to highway traffic flow from waste trucks. It has also shown that the daily transportation of 146 trucks of solid waste has a low impact on the air pollution.</p> <p><u>Source:</u> Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. “Avaliação dos Impactos Ambientais: Emissão de Gases Decorrentes do Transporte de Resíduos.” in <i>EIA/RIMA</i>. 16-17.</p> <p><u>RECOMMENDATIONS</u> Although the project is located in an industrial area which is far from urban areas and communities, developing alternative modes of transportation to improve community mobility, and thus improve livability could be considered,. Termoverde could also provide for sustainable alternatives; for example by implementing a program in the Caieiras municipality (or in the project’s surroundings) for providing for or participating in the actualization of activities that enhance community access and mobility, such as bicycle share programs or the construction of bicycle path.</p>
<p>QL2.5 Encourage Alternative Modes of Transportation</p>	<p>0</p>	<p>No Score</p> <p>It is important for infrastructure projects to improve accessibility to non motorized transportation and public transit. Moreover, the project has consider promoting alternative transportation, and reduce congestion. In order to achieve such results, the degree to which the project has increased walkability, the use of public transit, and non-motorized transit is evaluated. However, it was not possible to evaluate such efforts for the Termoverde project, as there is no related evidence found in the documentation which has been provided by the sponsor.</p>

		<p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p><u>RECOMMENDATIONS</u> Alternative modes of transportation could be included in the design of the project. It is recommended to integrate the design with the existing public transportation system; for the internal traffic of the landfill, the project could consider alternatives such as electric vehicles; which would be a good alternative to use as soon as the biogas thermoelectric plant produces electrical energy.</p>
<p>QL2.6 Improve Site Accessibility , Safety & Wayfinding</p>	<p>3</p>	<p>Enhanced</p> <p>This credit evaluates whether the project has considered and implemented strategies for improving user accessibility, safety, and wayfinding of the site and its surrounding areas. The clarity, simplicity, readability in wayfinding, user benefit, and safety are all taken into account.</p> <p>As the CTR Caieiras landfill and Termoverde are both located in the same site, some of the infrastructure access has connections for both projects (for example, the main entrance of the landfill). In this sense, some signage throughout the area is also valid for Termoverde. For example, an internal e-mail for visual communication was sent to collaborators, in order to notify of and guide enhancing traffic safety and mobility across the site. This communication is important because there is intensive truck movement for depositing the waste collected by the landfill. According to the project sponsor, safety and wayfinding were addressed during the construction phase. However, there is no evidence concerning improvements made during the operational phase, or related to overall signage and emergency personnel access. Moreover, according to the sponsor (and based on inferences drawn from the site location), there is no evidence of sensitive areas near the thermoelectric plant.</p> <p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Essencis, <i>Comunicação de Normas de Tráfego de Veículos</i>.</p> <p><u>RECOMMENDATIONS</u> It is important to develop plans for access, as well as design signage for overall and emergency personnel access. The project could also consider looking to better reference CTR Caieiras design standards for access/egress routes, in order to facilitate better accessibility and mobility for the plant workers. For better improvements, Termoverde could also consider installing bike lanes to encourage bicycling as a mobility alternative within the landfill.</p>
<p>QL3.1</p>	<p>7</p>	<p>Superior</p>

<p>Preserve Historic and Cultural Resources</p>	<p>It is important that an infrastructure project preserves or restores historical and cultural sites and related resources in order to enhance community cultural resources. Efforts are analysed through the steps developed by the project team to identify, preserve, or restore cultural resources.</p> <p>CTR Caieiras has carried out an historical and archaeological diagnosis for the region where the landfill is located, including fieldwork and bibliographic sources. This assessment aimed to find material evidence that could reveal whether the site could have contained cultural remains; archaeological research was also performed. However, according to the environmental impact assessment (EIA), no damage to the archaeological or historical heritage of the site will be caused, as the material evidence that was found is of little historical scientific value. Neither the CTR Caieiras landfill, nor the Termoverde project cause negative impacts to the historic and cultural resources which were.</p> <p>Termoverde has conducted a social assessment in order to identify the need and interests of the communities located near the energy plant. People in the communities were interviewed in order to achieve a better analysis of the social situation, and also to develop social programs to meet their needs. Some of the social programs which have been planned will use public spaces, such as schools and associations, in order to implement activities.</p> <p><u>Source:</u> “Diagnóstico do Meio Sócio-Econômico: Patrimônio Arqueológico”, in <i>EIA/RIMA</i>. 231-263. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Caran Consultoria em Serviço Social, <i>Diagnóstico das Comunidades</i>. December, 2015.</p> <p><u>RECOMMENDATIONS</u> It is important to assimilate with the surroundings, and form relations with the local citizens, in order develop an analysis to properly verify cultural resources that define the character of community. For example, the project team could consider closely communicating with community leaders in order to upgrade or expand associated recreational educational facilities that have been identified to match stakeholder needs.</p>
<p>QL3.2 Preserve Views and Local Character</p>	<p>1 Improved</p> <p>This credit evaluates whether the project is designed in a way that maintains the local character of the community, and does not negatively impact community views. Evaluation is based on efforts to identify important community views and aspects of local landscapes, including communities, and incorporate such aspects into the project design.</p> <p>Termoverde is located in the center of the CTR Caieiras landfill, which is an industrial</p>

	<p>area, far away from the views of the community. Moreover, the 200 m wide green belt around the site which has been conserved by CTR Caieiras provides a natural barrier that avoids the surrounding communities from having a view of the operation; it also blocks the dispersion of odors and noise. The green belt is a result of a compensation plan carried out by CTR Caieiras, after the landfill's activities had impacted the buffer zone. Official organizations such as IBAMA (Brazil's national environmental organization) and DEPRN (the state of São Paulo's environmental department), had approved the implementation of the landfill, conditional upon a compensation plan.</p> <p><u>Source:</u> Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. "Proposição de Programas Ambientais: Programa de Recuperação da Faixa de Transição com Floresta Nativa." in <i>EIA/RIMA</i>. 2-4. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>.</p> <p>RECOMMENDATIONS CRT Caieiras strongly impacts the site's landscape due to the active landfill operation of the site. Additionally, Termoverde had changed the landscape for the installation of thermoelectric plant. For this reason, it is important to develop a plan to restore the natural landscapes which have been directly damaged by the projects, or propose adequate compensatory programs in the surroundings.</p>
<p>QL3.3 Enhance Public Space</p>	<p>1 Improved</p> <p>This credit assesses whether the project improves public spaces such as parks, plazas, and recreational facilities, in order to enhance community livability through plans and commitments to preserve, conserve, enhance the defining elements of the public space.</p> <p>The Termoverde project is located in a landfill in an industrial area; therefore, it has no impact on public spaces. However, it is important to note that the project has performed a social assessment which considered public spaces. Elements presented in the communities near Termoverde such as public schools, medical centers, religious, cultural and sportive associations, as well as community associations were identified; the assessment stated the main respective problems and vulnerabilities found. In this regard, the project will use these public spaces, such as schools and associations, in order to implement social programs for the community.</p> <p>The project also aims to implement programs for public space recovery, such as the revitalization of plazas and schools, however, no evidence was provided regarding these measures.</p>

	<p><u>Source:</u> Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Solví Valorização Energética, “Anexo A - Layout da Termelétrica Termoverde Caieiras.” <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 13. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Caran Consultoria em Serviço Social, <i>Diagnóstico das Comunidades</i>. December, 2015.</p> <p><u>RECOMMENDATIONS</u> The project team should consider evaluating whether the public agencies and stakeholders are satisfied with the projects that involve public spaces. It is equally important to develop programs that consider the interests and needs of the stakeholders, and rely upon their participation for successful public space improvements.</p>
<p>QL 4.1- Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)</p>	<p>No Score</p> <p>0 In order for a project to achieve a better sustainable performance, it is important to consider improving the quality of life for women and diverse groups living in the surrounding areas of the project. This credit evaluates if measures were taken to assess the needs of women and diverse communities.</p> <p>According to the project sponsor, Termoverde has carried out a social assessment which identified the communities’ needs, in addition to developing social programs to improve upon their quality of life. For example, an event related to income generation and entrepreneurship was held for the local community and sponsored by Termoverde (according the provided report). Among many activities, the event included income generation workshops for both genders; women could receive jewellery production training in order increase their household incomes.</p> <p>However, no evidence shows that the project team has worked (or will work) with designers and decision-makers to address diverse communities and gender equality issues, specifically. Moreover, the project only encompasses general health and safety methodologies and protocols. No assessment of the hazards and risks for women’s health and safety were taken into account.</p> <p><u>Source:</u> Caran Consultoria em Serviço Social, <i>Relatório de Atividades Serviço Social - Solví Valorização Energética</i>. September, 2015. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Caran Consultoria em Serviço Social, <i>Diagnóstico das Comunidades</i>. December 2015.</p>

		<p><u>RECOMMENDATIONS</u></p> <p>The project team should consider working with community leaders and decision-makers in order to evaluate the diverse communities' needs, as well as the interests of women. It is equally important to maintain a relationship with stakeholders, and seek to work collaboratively in order to find solutions, and develop programs directed towards diverse groups and women's needs and interests.</p>
<p>QL4.2 - Stimulate and promote women's economic empowerment</p>	<p>0</p>	<p>No Score</p>
		<p>This credit assesses efforts to promote women's economic empowerment through sustainable livelihoods, local procurement, job creation, and training programs; these are important aspects to be considered in a sustainable project. However, in relation to the Termoverde project, it was not possible to assess to what extent women have been involved in the project design and construction. With regards to the women of the communities, the project team has recently participated in a social program which has resulted in women's economic empowerment through their participation in income generation workshops.</p>
		<p><u>Source:</u></p> <p>Caran Consultoria em Serviço Social, <i>Relatório de Atividades Serviço Social - Solví Valorização Energética</i>. September, 2015.</p> <p>Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013.</p> <p>Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>.</p> <p>CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998.</p> <p>Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p>
		<p><u>RECOMMENDATIONS</u></p> <p>In order to promote women's economic empowerment, it is very important enhance related efforts, and develop a strategy to identify opportunities for hiring local women and offering skills training within the project.</p>
<p>QL4.3 - Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)</p>	<p>0</p>	<p>No Score</p>
		<p>In order to improve access and mobility for women and diverse communities, it is important to incorporate the needs and various patterns of mobility of different social groups into the project design.</p>
		<p>Regarding Termoverde, according to the sponsor, there is no evidence as to whether the implementation of the project will impact the mobility of women or diverse communities. No assessment was performed to evaluate this, and no measures were taken to improve access and mobility for women.</p>
		<p><u>Source:</u></p> <p>Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013.</p> <p>Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>.</p> <p>CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998.</p> <p>Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p>
		<p><u>RECOMMENDATIONS</u></p> <p>The team should consider carry out an evaluation that considers the gender-based differences in the design, construction, and operations of the project. By doing so, the</p>

		project can achieve a better understanding of the needs for mobility and the safety of women.
QL0.0 Innovate Or Exceed Credit Requirements		N/A
	56	

SUB CATEGORY: LEADERSHIP		
	Score	TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT
LD1.1 Provide Effective Leadership And Commitment	17	<p>Conserving</p> <p>This credit assesses whether the project provides for effective leadership and commitment to achieving sustainable goals. For this, the demonstration of meaningful commitments by the project team to the principles of sustainability and sustainable performance improvements is the metric used for evaluation.</p> <p>As the Termoverde project has not already initiated its operation within the CTR Caieiras landfill, public commitments and obligations towards sustainability have been limited to meeting the norms and policies stipulated by the environmental and energy regulatory agencies. For example, according to the documentation which was provided by the project sponsor, Termoverde is based on the sustainable principles under the biogas program that has been outlined by the government of the state of São Paulo. This program aims to promote and extend renewable energy sources within the state of São Paulo’s energy grid. Moreover, through the official public declaration by the Brazilian ministry, Termoverde is considered to be eligible as a special incentive beneficiary when the project begins to contribute to infrastructure development.</p> <p>It is important to highlight that both the CTR Caieiras and Termoverde Caieiras projects are incorporated under the Solví Group. In this regard, according the Termoverde project sponsor, the holding includes 30 companies that are specialized in many fields, such as solid waste, sanitation, and energy recovery. Solví Group aims to offer solutions for waste, sanitation, energy recovery, and the operating and managing of concessions and contracts for both public and private clients. By doing so, Solvi provides for the development of communities and their workers, and creates value for stockholders,</p>

		<p>suppliers, and governments. As stated on their website, Solví Group’s has the vision to be the largest holding for management engineering, and act as a leader in innovative and integrated services.</p> <p>Moreover, annual reports are presented by Solví Group in order to show the main figures and results that have been achieved by each segment of the group, based on the triple bottom line. Solví Group’s companies follow sustainable principles by creating projects whose main goal is in developing technologies that enhance the quality of life for communities, as well as community empowerment through citizenship and the promotion of income generation.</p>
		<p><u>Source:</u> Diário Oficial da União, “Ato Declaratório Executivo N° 1, de 8 de janeiro de 2015.” <i>Delegacia da Receita Federal do Brasil em Jundiaí</i>. 2015. Ministério de Minas e Energia, <i>Portaria n° 293, de 22 de outubro de 2014</i>. 2014, 1-2. Governo do Estado de São Paulo, <i>Decreto N°58.659, de 4 de dezembro de 2012</i>. São Paulo, 2012. Solví, <i>Relatório Anual 2015 Exercício 2014</i>. São Paulo, 2015. Solví, <i>Compromisso Solví</i>, Accessed December, 2015. http://www.solvi.com/compromisso-solvi/. Solví, <i>Meio Ambiente</i>, Accessed December, 2015. http://www.solvi.com/meio-ambiente/.</p>
		<p><u>RECOMMENDATIONS</u> Termoverde Caieiras should start reporting of the importance of Termoverde’s role in its surroundings, highlighting the sustainable performance of the project.</p>
LD1.2	7	Superior

<p>Establish A Sustainability Management System</p>		<p>The intent of this credit is to create a project management system that can manage the scope, scale, and complexity of the project. In order to achieve these goals, the organizational policies, authorities, mechanisms and business processes that have been put in place are evaluated, as well as the judgement that they are sufficient for the scope, scale, and complexity of the project.</p> <p>According to the project sponsor, authorities, responsibilities, and roles are clearly defined, and a management policy has been implemented that encompasses the scope, scale, and complexity of the project. Moreover, all of the companies owned by the Solví Group follow its quality assurance policy by using guidelines for an environmental management system under certifications such as ISO 9001, ISO 14001, and OSHAS 18001. This quality assurance policy aims to ensure quality service for clients, maintain a healthy workplace, and preserve and recover the environment.</p> <p>With regards to assessment and prioritization of the environmental, economic, and social aspects of the project, an environmental policy has been implemented by the Solví Group, which is followed by all its companies, during all phases of the project. Additionally, from an economic perspective, Termoverde has sought out the viable implementation of new technologies in order to mitigate impacts to the environment. Social aspects were also considered by the project team; a social diagnostic, and social programs were defined and conducted.</p> <p><u>Source:</u> Caran Consultoria em Serviço Social, Relatório de Atividades Serviço Social - Solví Valorização Energética. September, 2015. Solví, Meio Ambiente. Accessed December, 2015. http://www.solvi.com/meio-ambiente/. Caran Consultoria em Serviço Social, Diagnóstico das Comunidades. December, 2015.</p> <p>RECOMMENDATIONS</p> <p>Some improvements which could be considered are related to the ability of the project team to handle unexpected events and extreme conditions. Additionally, the Termoverde project should consider developing multiple business processes and mechanisms to manage project complexities and changing conditions.</p> <p>Enhanced</p> <p>This credit evaluates efforts to eliminate conflicting design elements and optimize the system by using integrated design and delivery methodologies, as well as collaborative processes. For assessing the performance of the project in this regard, the extent of collaboration within the project team and the degree to which the project delivery processes incorporate whole-systems design and delivery approaches is evaluated.</p>
<p>LD1.3 Foster Collaboration And Teamwork</p>	<p>4</p>	<p>The project team has approached the project as a system. Regarding the efforts to foster collaboration and teamwork, the project sponsor has indicated that the project team handles the project as a system that is interrelated with other systems. However, no detailed information was provided in order to assess to what extent the project has incorporated principles of collaboration and teamwork.</p> <p>Moreover, Termoverde follows the risk management policy developed by the Solví Group. This policy's purposes are based on an identification of risks and obligations, analysis, assessment, treatment, monitoring, and communications with stakeholders. The policy also states the main activities for risk and obligations management, as well as the roles and responsibilities of Solvi and its departments.</p>

		<p><u>Source:</u> Solví, “Gestão de Riscos” in <i>Macro Política Solví</i>. 2012, 1-3. Solví, <i>Código de Conduta - Programa de Integridade Solví</i>. 2014.</p> <p><u>RECOMMENDATIONS</u> For successful delivery of the project, it is important that the project’s owner take into account collaboration and integrated working, in order to have a holistic view of the development of the project. Therefore, by strengthening a multidisciplinary project team, it will be easier to find ways to improve sustainable performance, in line with the owner’s goals, technical costs, feasibility, and appetite for risk.</p>
LD1.4 Provide For Stakeholder Involvement	1	<p>Improved</p> <p>The intent of this credit is to establish sound and meaningful programs for stakeholder identification, engagement, and involvement in project decision-making. For assessment, the performance of the project is evaluated by the extent to which stakeholders are identified and engaged with in project decision-making. Additionally, the satisfaction of stakeholders and decision-makers in the involvement of the process is taken into consideration.</p> <p>According to the project sponsor, Solví Group has a model for risk management, and an obligations policy which is followed by all of the group’s companies. In this model of risk and obligations management, all of the stakeholders, as well as related concerns and risks are identified. However, it was not possible to assess to what extent the project team has solicited stakeholder issues and concerns through meetings and information exchanges, nor was it possible evaluate if the project owner has incorporated stakeholder input into project plans and decision-making. It is important to highlight that according to the project sponsor, Termoverde aims to use the same program that is run by CTR Caieiras in order to communicate and receive suggestions and complaints of the landfill activities from local communities.</p>
		<p><u>Source:</u> Solví, “Gestão de Riscos” in <i>Macro Política Solví</i>. 2012, 1-3. CNEC, “Proposição de Programas Ambientais: Programa de Divulgação das Ações do empreendedor,” <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998, 8-10. (hereafter cited as EIA/RIMA).</p>
		<p><u>RECOMMENDATIONS</u> By using the communication channel already provided by CTR Caieiras, Termoverde should consider strengthening the relationship with community leaders, in order to enhance the involvement of the community. This is very important to not only incorporate the community issues and interests into the project, but also to make the community aware of the importance of the thermoelectric plant, and the positive local and regional impacts that it creates.</p>
LD2.1 Pursue	12	Conserving

<p>By-Product Synergy Opportunities</p>	<p>The goal of this credit is to reduce waste, improve project performance, and reduce project costs by identifying and pursuing opportunities to use unwanted byproducts or discarded materials from nearby operations. For this assessment, the metric that is used is the extent to which the project team has identified project material needs, sought out nearby facilities with by-product resources that may meet those needs, and identify synergy opportunities.</p> <p>The most significant unwanted product that will be used by the Termoverde project is the biogas produced by the CTR Caieiras landfill. This unwanted product comprises the methane that is used by Termoverde to produce electrical energy. It's important to mention that the methane, which is the main component present in the biogas, will be 99.5% combusted by the generator engines installed by Termoverde. Moreover, by 2016 Termoverde is forecasted to process 19,143 Nm³/h of biogas, and 7,849 Nm³/h of methane, which is capable of generating 29.5 MW of electricity.</p> <p>With regards to the use of byproducts, all the packaging (pallets, plastic) from purchased equipments were used during the construction of the thermoelectric plant. Additionally, stormwater was stored to be used in earthmoving operations in the ways that avoid dust being generated. Although the project seems to follow some aspects to use byproducts during the operations phase, no documentation was provided to support this notion.</p> <p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. (hereafter cited as <i>Licenciamento Ambiental</i>). Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. "Balço de Emissões" in <i>Licenciamento Ambiental</i>. 5.</p> <p>RECOMMENDATIONS</p> <p>The base of the Termoverde project is with regards to the use of biogas, the largest unwanted product generated by the CTR Caieiras landfill, for the generation of electricity. In order to achieve the implementation of the project, the project team had successful negotiations with the managers of nearby facilities for securing by-product synergy applications. Additional synergy opportunities should be identified for a higher level of achievement in this credit.</p>
<p>LD2.2 Improve Infrastructure Integration</p>	<p>16 Restorative</p> <p>The main concept for this credit is to assess whether the project team has taken the operational relationships with other elements of community infrastructure into account when creating the project design; this results in an overall improvement in infrastructure efficiency and effectiveness. The metric used for assessment is based on evaluating the extent to which the design of the delivered works integrates with existing and planned community infrastructure, and results in a net improvement.</p> <p>As shown in the layout of the project, Termoverde is strategically implemented within the CTR Caieiras landfill in a way that takes advantage of the infrastructure provided by the landfill, and thus mitigating more impacts of the site. In this sense, according to the sponsor, the project and delivered works are viewed as an integrated system. Moreover, it is important to highlight that not only the infrastructure is provided by CTR</p>

	<p>Caieiras, but also that the biogas produced by landfill is the fuel used by Termoverde to produce electrical energy. The project is also recognized and authorized by the Brazilian electrical regulatory agency as an independent electric power producer (IEPP). In this regard, its infrastructure will be connected to the grid, and will benefit the regional community in terms of economic growth and development capacity.</p> <p><u>Source:</u> Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Solvi Valorização Energética, “Anexo A - Layout da Termelétrica Termoverde Caieiras.” in <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 13. Ministério de Minas e Energia, <i>Portaria n° 293, de 22 de outubro de 2014</i>. 2014, 2.</p> <p><u>RECOMMENDATIONS</u></p> <p>As the maximum level of achievement was realized for this credit, no further recommendations are provided at this time.</p>
<p>LD3.1 Plan For Long-Term Monitoring & Maintenance</p>	<p>3</p> <p>Enhanced</p> <p>This credit evaluates whether the project put in place plans and sufficient resources to ensure that, to a practical extent, ecological protection, mitigation and enhancement measures are incorporated into the project and can be carried out. The comprehensiveness and detail of long-term monitoring and maintenance plans are considered for this assessment, in addition to the commitment of resources to fund the activities.</p> <p>As the the project has an expected lifespan of 20 years, Termoverde has included two monitoring programs within the project that are associated with the maintenance and control of noise and nitrogen oxide (NOx) emissions from the generator engines. For the noise monitoring program, the project will additionally consider the program carried out by the CTR Caieiras landfill, along with its established procedures, including defining a responsible party for the program, and the monitoring of human and materials resources. With regards to emissions monitoring program, the project team has developed evaluation procedures that consider strategies and methodologies to monitor the emissions of NOx. Moreover, according to the sponsor, a maintenance and operations plan was being developed at the time of assessment, and was planned to also encompass provisions for the incidence of fires, and the maintenance of the thermoelectric plant structure.</p> <p>The team has established the responsible and the necessary human and materials resources for both monitoring programs. However, although the sponsor states that enough resources are planned for the maintenance and monitoring plans, no documentation was provided in order to know whether and how funding will be allocated.</p> <p><u>Source:</u> “Plano de Monitoramento das Emissões Atmosféricas.” in <i>Licenciamento Ambiental</i>. “Programa de Monitoramento do Ruído.” in <i>Licenciamento Ambiental</i>.</p>

		<p><u>RECOMMENDATIONS</u></p> <p>Although Termoverde had begun operations at the time of this assessment, it is important that the project owner ensure that adequate resources are available, and that the assigned personnel understand their roles and responsibilities. Project collaborators should also be aware of the importance of the project, and its positive impacts towards urban waste issues, and therefore to the community; this will bring an involvement with and commitment to the purpose of the project's.</p>
LD3.2 Address Conflicting Regulations & Policies	1	<p>Improved</p> <p>The purpose of this credit is to work with officials to identify and address laws, standards, regulations, or policies that may unintentionally create barriers to the implementation of sustainable infrastructure. This is measured through efforts to identify and change laws, standards, regulations, or policies that may unintentionally run counter to sustainable goals, objectives, and practices.</p> <p>Termoverde has performed an extensive evaluation concerning the laws, regulations, norms, and policies that could create obstacles to the project. In this sense, Termoverde has sought out, identified, and mostly met all of the requirements stipulated by agencies, norms, and laws in order to be able to install the biogas energy plant; examples include the licensing and authorization for groundwater use, and for being categorized as an independent electric power producer, among others. However, according the sponsor no regulations or policies that conflicted with the project's goals and purposes were found to exist. Termoverde meets all of the laws and regulations required for this type of project, and also receives incentives from the official agencies for having the project scope involve alternative renewable sources for grid energy. For example, Termoverde has environmental licensing granted by the environmental institution Companhia Ambiental do Estado de São Paulo (CETESB), and the installation authorization from the national electrical energy agency (ANEEL). As mentioned before, the project may receive governmental incentives, and a 100% discount in rates for using the electric system for transmission and distribution.</p>
		<p><u>Source:</u></p> <p>Diário Oficial da União, "Ato Declaratório Executivo N° 1, de 8 de janeiro de 2015." in <i>Delegacia da Receita Federal do Brasil em Jundiá</i>. 2015.</p> <p>Ministério de Minas e Energia, <i>Portaria n° 293, de 22 de outubro de 2014</i>. 2014, 1-2.</p> <p>Governo do Estado de São Paulo, Decreto N°58.659, de 4 de dezembro de 2012. São Paulo: 2012.</p> <p>Agência Nacional de Energia Elétrica - ANEEL, <i>Resolução Normativa N°77</i>. 2004.</p> <p>Agência Nacional de Energia Elétrica - ANEEL, <i>Resolução Autorizativa N° 4.612</i>. 2014.</p> <p>Governo do Estado de São Paulo, <i>Licença Ambiental de Instalação</i>. Janeiro, 2014.</p> <p>Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>.</p>
		<p><u>RECOMMENDATIONS</u></p> <p>Despite the project team having found regulations and policies that meet the scope of the project and also provides it with incentives, it is important to follow potential changes to laws and regulations that may restrict the performance of the project to some extent, or pose obstacles to the incorporation of new sustainable practices into the project.</p>
LD3.3 Extend	3	Enhanced

<p>Useful Life</p>		<p>It is important that a sustainable project has an extended useful life by being designed in a way that results in a constructed works that is more durable, flexible, and resilient. For this credit, the degree to which project team incorporates full life-cycle thinking in improving the durability, flexibility, and resilience of the project is considered.</p> <p>Termoverde’s activity is based on the lifespan of the landfill, as the energy production is directly associated with the biogas emitted from the decomposition of the solid waste. Therefore, after the end of biogas production, the infrastructure of the thermoelectric plant will be limited for future reutilization. However, according to the sponsor, Termoverde will initiate its operation with 21 generators, and have already considered an expansion of the plant. Additionally, there is the possibility of reconfiguration of the placement and quantity of generator engines after having been placed in the soundproof containers, which are more resilient and can be easily relocated when needed.</p> <p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP. São Paulo: June, 2013. 3-6.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project could consider enhancing the assessment of the possibilities for increased flexibility, durability, and resilience of the materials used during the operation of Termoverde. The team should also consider investment in areas for both short, and long-term payback. Moreover, the project team has a broad latitude to explore ways in which to extend the useful life of the project. Therefore, it is recommended to use that latitude to expand opportunities for adding to the project’s useful life, and for improving its durability, flexibility, and resilience, as well as the ease retrofitting and repair.</p>
<p>LD0.0 Innovate Or Exceed Credit Requirements</p>		<p>N/A</p>
<p>64</p>		

<p>CATEGORY II: CLIMATE AND ENVIRONMENT</p>		
<p>RESOURCE ALLOCATION</p>		
	<p>Score</p>	<p>TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT</p>
<p>RA1.1 Reduce Net Embodied Energy</p>	<p>0</p>	<p>No Score</p> <p>In this credit, it is important to consider developing plans and strategies in order to conserve energy by reducing the net embodied energy of project materials throughout the project’s life. For this assessment, the percentage of reductions in net embodied energy, taken from a life-cycle energy assessment is evaluated.</p> <p>With regards to Termoverde, no evidence was provided by the project sponsor to allow for assessment of the net embodied energy of the materials used in the project. Additionally, in terms of reducing the net embodied energy, the project team did not presented any evidence.</p>

		<p>Source: Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team should consider carrying out a life-cycle assessment (LCA) in order to evaluate the energy consumed by the materials associated with extraction, processing, manufacturing, and transport. This assessment should be carried out by considering all phases of the project’s life.</p>
<p>RA1.2 Support Sustainable Procurement Practices</p>	<p>2</p>	<p>Improved</p> <p>This credit aims to evaluate whether the project seeks to obtain materials and equipment from manufacturers and suppliers who implement sustainable practices. The metric for this assessment is based on the percentage of materials which have been sourced from manufacturers that meet requirements for sustainable practices.</p> <p>According to the sponsor, the project team has aimed to implement a sustainable procurement program, and this was expected to be in the operation manual, which was under development at the time of this evaluation. Although there is not a fully defined program, and it is not possible to know the procurement percentages from the provided documents, Termoverde appears to have procured materials and equipment from sustainable sources. Additionally, according to the provided documentation, the 21 generator engines installed at the biogas energy plant were procured in order to meet international emissions standards. As there is no national standard for defining emissions limits, Termoverde procured generator engines which are aligned with the Gothenberg Protocol and TA Luft (German Technical Instructions on Air Quality Control) references. Although Termoverde has shown some evidence that the project team has sought to purchase materials and equipments from sustainable sources, with the documents presented it was not possible to assess how many of these materials were certified by reputable third-parties, and whether or not the project team intends to qualify the supplier’s integrity.</p> <p><u>Source:</u> Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 12. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. 8-10. (hereafter cited as <i>Licenciamento Ambiental</i>). “Plano de Monitoramento das Emissões Atmosféricas.” in <i>Licenciamento Ambiental</i>. 5.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team should consider defining a sustainable program that determines the criteria for covering all aspects of the triple bottom line. Moreover, it is important to provide documentation of percentage of suppliers that follow sustainable practices, and/or are certified by third-party. This monitoring activity can help to better evaluate whether or not, and to what extent the project seeks to procure materials and equipment from sustainable sources.</p>
<p>RA1.3 Used</p>	<p>2</p>	<p>Improved</p>

<p>Recycled Materials</p>		<p>The goal of this credit is to assess whether the project team has reduced the use of virgin materials and avoided sending useful materials to landfills, by procuring reused materials, including structures, and materials with recycled content. The metric is based on the percentage of project materials that are reused or recycled.</p> <p>In regards to the biogas energy plant, it worth noting that, as the project is located in a landfill, all of the materials which have been used are attributable to CTR Caieiras. Therefore, some aspects of this credit are not applicable to the project. In relation to the extent to which the project team has reused materials, verification is not possible from the documentation which was presented. Additionally, due to a lack of evidence, the percentage of recycled materials incorporated to the project could not be verified. However, according to the information provided by the sponsor, the project team has considered reusing materials and disposing of them correctly during the installation of the thermoelectric plant. The soil which was removed during earthworks was brought to the landfill in order to cover solid waste. Additionally, all the plastic materials that were used for covering the containers were forwarded to GRI, a recycling company owned by the Solví Group. Moreover, some of the polyethylene pipelines (HDPE) installed throughout the project area were also reused for the landfill drainage system. As a final example, during the construction of the substation, the transmission tower was replaced by another one to better account for the needs of the project. However, the previous transmission tower was given back to the energy concession to be used for another project.</p> <p><i>Source:</i> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p>RECOMMENDATIONS</p> <p>Although the project sponsor has indicated that Termoverde incorporates reused materials, and disposed of them correctly during the installation phase, the project team should consider calculating the materials that can be reused by weight or volume. In order to achieve a higher score for this credit, it is important to provide all of the relevant documentation, and an inventory with the materials' specifications.</p>
<p>RA1.4 Use Regional Materials</p>	<p>10</p>	<p>Conserving</p> <p>For this credit, it is important that the project seeks to minimize transportation costs and impacts, as well as to retain regional benefits by procuring from local sources. In this regard, the analysis is based on the percentage of project materials by type/weight/volume which have been sourced from within the required distances.</p> <p>According to the documents provided by the sponsor, the main materials that were used during the construction of the biogas energy plant were purchased by regional sources. A list of the main suppliers were provided, demonstrating that the distance between Termoverde and its suppliers does not exceed 100 km, which is under the minimum distance required by the metric for this credit.</p>

		<p><u>Source:</u> Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November, 2015, 2.</p>
		<p><u>RECOMMENDATIONS</u> As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this time.</p>
<p>RA1.5 Divert Waste From Landfills</p>	<p>8</p>	<p>Superior</p> <p>This credit to “divert waste from landfills” concentrates on reducing waste and diverting waste streams from disposal to recycling and reuse. This is measured by the percentage of total waste that is diverted from disposal. Identification and evaluation of options for recycling and reuse are the first steps in the development of effective plans for handling, segregation, and storage of materials. It is important to determine which materials must be separated, versus those that can be commingled.</p> <p>As the thermoelectric plant is located on the CTR Caieiras landfill, all of the waste which is produced will be disposed of within it. Although no documentation concerning a waste management plan was provided, the solid waste produced by Termoverde during operations will be limited to cotton use, and waste and cleaning materials, according to the Brazilian Installation Licensing (IL).</p> <p>With a total of 101 ton/year, the lubricating oil will be disposed of, and will be reprocessed by a third-party company that is responsible for recovery. Additionally, according to the IL, all of the domestic waste (not calculated) will be collected daily and diverted to the landfill. Additionally, in the case of an accident, Termoverde will provide for final disposal of the sawdust soaked with lubricating oil into to landfill; at the time of this evaluation, this was planned to be outlined in the operational manual.</p> <p>Due to the specific characteristics of the project, the team has considered the CTR Caieiras landfill as the main destination for the waste produced during operations. For example, the domestic waste will be destined for the landfill in a considerably lower amount than those that are received daily from the cities of Metropolitan Region of São Paulo. According to the sponsor, during the construction phase, 4.2 tons of materials (scrap) were given to a recycling company, GRI (Industrial Waste Management), which is another company owned by the Solví Group and related to the field industrial solutions. The organic waste (5%) is to be channeled to the landfill.</p> <p><u>Source:</u> Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 7. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November 2015, 3. Essencis, <i>Certificado de Manufatura Reversa - CMR</i>. November, 2015.</p> <p><u>RECOMMENDATIONS</u></p>

		<p>In addition to the quantity of waste that is being generated, the project team should also consider the recyclability of the waste stream, as well as its toxicity; one example would be that of the oil used during the operation of the thermoelectric plant.</p>
<p>RA1.6 Reduce Excavated Materials Taken Off Site</p>	<p>6</p>	<p>Conserving</p> <p>A sustainable project needs to consider efforts to minimize the movement of soils and other excavated materials off-site, in order to reduce transportation and environmental impacts. This assessment considers the percentage of excavated materials that are retained on-site.</p> <p>In this regard, according to the sponsor, Termoverde is located in a landfill, and all of the excavated soil that was needed was reused during the earthworks, in order to install the thermoelectric plant. However, the sponsor affirmed that the soil which was not reused in the construction was channeled to the CTR Caieiras landfill to cover solid urban waste. Therefore, considering the specific characteristics of this project, the transporting of soils has been limited to the boundaries of the landfill, while positively contributing to the performance of solid waste landfill.</p> <p><u>Source:</u> Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Solvi Valorização Energética, “Anexo A - Layout da Termelétrica Termoverde Caieiras” in <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 13. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November, 2015, 3. Soethe Cursino, <i>Projeto Executivo de Terraplenagem de Platô Traçado em Planta</i>. 2014. Soethe Cursino, <i>Projeto Executivo de Terraplenagem de Platô Traçado em Planta - Revisão 1</i>. 2014.</p> <p><u>RECOMMENDATIONS</u></p> <p>It is important to register the estimations of excavated materials in order to evaluate how the level of environmental impacts was mitigated.</p>
<p>RA1.7 Provide for Deconstruction & Recycling</p>	<p>8</p>	<p>Superior</p> <p>It is important that a project which is aiming to achieve sustainability incorporates design mechanisms that encourage future recycling, upcycling, and reuse, by designing for ease and efficiency in project disassembly or deconstruction at the end of its useful life. For the performance assessment of this credit, the metric that is used is based on the percentage of components that can be easily separated for disassembly or deconstruction.</p> <p>According to the project sponsor, components and structures cannot be reused when the project reaches the end of its useful life. The only component that has been featured as being possible to be reused is the generator engines. As they are installed within containers, it is possible to replace them without constraint. In a text message to the author on December 4, 2015, the sponsor indicated that this equipment represents 60% of the total investment costs of the project.</p>

		<p><u>Source:</u> Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. Termoverde Caieiras, <i>Justificativas e Esclarecimentos do Projeto UTE Termoverde Caieiras</i>. November, 2015, 3. Essencis, <i>Certificado de Manufatura Reversa - CMR</i>. November, 2015.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team should considerer expanding the scope of the project to include more materials (pipes, bricks, stone, plastic, etc.) that can easily be disassembled and deconstructed at the end of the project’s life to be reused or recycled. For example, the project team could evaluate whether or not it is possible to recycle or reuse the biogas treatment structure in other Solví Group projects (present or future).</p>
<p>RA2.1 Reduce Energy Consumption</p>	<p>7</p>	<p>Enhanced</p> <p>To reduce energy consumption, infrastructure projects can conserve energy by reducing overall operations and maintenance energy consumption throughout the life of the project. This is strictly measured by the percentage of reductions that have been achieved.</p> <p>According to the sponsor, the project has been designed in order to reduce energy consumption. This has been achieved through the adoption of a technology that is based on biogas treatment and generator engines. According to the documents, a chiller (three units with 225 kW of capacity) to treat the biogas, in order to reduce energy consumption, will be incorporated into the executive project. Moreover, the application of this technology that is composed of generator engines, and the motoring control system for their performance, represents 39.8% energetic efficiency, according the Previous Licensing (PL). Both systems consume 5% of the total energy produced by the thermoelectric plant.</p> <p><u>Source:</u> Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 11. “Balanço de Emissões” in <i>Licenciamento Ambiental</i>. 13. CNEC, <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team should take a “whole systems” design approach when considering options. Therefore, Termoverde should not only look for obvious single-energy and emissions savings, but also consider what multiple benefits may be achieved from a single investment. It is always relevant to look at the management of the project through a holistic perspective by seeking ways to save in all aspects of the project.</p>
<p>RA2.2 Use</p>	<p>20</p>	<p>Restorative</p>

<p>Renewable Energy</p>		<p>Sustainable infrastructure must try to meet energy needs through renewable energy sources. This effort is measured by the extent to which renewable energy sources are incorporated into the project.</p> <p>The thermoelectric generator engines operate by using biogas, which is considered a renewable resource, and produces energy capable of providing for both the grid operator and in order to maintain Termoverde operations. The generator engines are specifically designed to run with biogas and not by diesel. A document from the supplier of the generator engines has confirmed that there needs to be a methane concentration of 40% (air free) in order to ensure stable combustion within the engines.</p> <p>Moreover, an estimation of the biogas produced in CTR Caieiras which will be used as fuel for the Termoverde operation from 2014 to 2034 has been provided. As mentioned before, the energy produced will be used for the Termoverde operation, as well as to provide for the transmission line.</p> <p><i>Source:</i> GE Distributed Power, Declaração do fornecedor quanto à emissão do motorizador. 2013. “Balanço de Emissões” in <i>Licenciamento Ambiental</i>. 5. Agência Nacional de Energia Elétrica - ANEEL, “Parte II Fontes renováveis Biomassa” in <i>Atlas de Energia Elétrica do Brasil</i>. 71.</p> <p><u>RECOMMENDATIONS</u></p> <p>As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
<p>RA 2.3 Commission & Monitor Energy Systems</p>	<p>11</p>	<p>Conserving</p> <p>Energy systems performance can help to ensure efficient functioning and extend useful life by specifying the commissioning and monitoring of the performance of energy systems. The assessment looks for third-party commissioning of electrical/mechanical systems, and documentation of system monitoring equipment in the design.</p> <p>The project sponsor has stated that the commissioning and monitoring systems is run by a third-party to ensure better performance of the project’s operation. Commissioning is carried out by an independent company that is responsible for monitoring, in order to provide data and verify whether the project is achieving and maintaining expected performance levels. According to the sponsor, the project team and the operations and maintenance employees will work together. Therefore, all of the operational needs of the project have been attended since the initial phase of the project. The documents which were provided by the sponsor show that the necessary training was carried out for the maintenance of the generators. The thermoelectric has an efficient system of measurement, control, and electrical protection. Moreover, according to the project sponsor, the thermoelectric plant has incorporated individual energy meters for the consumption and generation of energy produced by each of the 21 generator engines. Additionally, the system has a production energy meter located in the substation bay.</p>

		<p><i>Source:</i> Solvi Valorização Energética, <i>Cronograma Contrato EPC AB Energy</i>. GE Power & Water Distributed Power, <i>Confirmation of Participation OPT - Operator Training</i>. 2014. GE Power & Water Distributed Power, <i>Confirmation of Participation TJE - Training on the Job - Extended Access to DIA.NE XT</i>. 2014. “Balanco de Emissões.” in <i>Licenciamento Ambiental</i>. 13.</p>
		<p>RECOMMENDATIONS</p> <p>As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
<p>RA3.1 Protect Fresh Water Availability</p>	<p>2</p>	<p>Improved</p> <p>“Protect fresh water availability” is to reduce the net negative impact of the availability, quantity, and quality of fresh water. This is measured by the extent to which the project has considered availability and replenishment of freshwater resources.</p> <p>As the Termoverde project is located in a landfill, the first water assessment analysis was carried out by CTR Caieiras in the environmental impact assessment (EIA). According to the provided documentation, Termoverde has also conducted a water availability assessment in order to use groundwater for sanitary and industrial purposes. This water evaluated is part of licensing process of Department of Water and Electrical energy (DAAE). The assessment states that groundwater harvesting will be performed by using a well located on the landfill, in addition to the aim to explore the aquifer of the Alto Tietê watershed. According to the document, water availability on the site varies from 4 m³/h to 10 m³/h. The project team has assessed the water requirements for the project, and outlined the water supply design that will be needed during operations. Water consumption has been calculated to be 25 m³/day, of which 20.8 m³ is for industrial use and 4.2 m³ is for sanitary uses. In regards to the volume of freshwater that is discharged after use, 23.6 m³ will be directed to the leachate collection system that is located on the landfill, and 1.8 m³ will be directed towards the septic tank.</p> <p>Moreover, the sponsor states that the technology that was adopted by the project has accounted for low water consumption by the cooling system that is linked to the generators. This effort demonstrates that Termoverde has implemented prudent water management by fostering the adoption of a technology that can assure a reduced use of groundwater during operations of the system. With regards to CTR Caieiras, it is also important to mention that the leachate produced by the solid waste in the landfill is directed for treatment by Sabesp (a Brazilian water and waste management company owned by São Paulo State).</p>

	<p><u>Source:</u> Solvi Valorização Energética, <i>Relatório Outorga Poço</i>. 2014, 3-6. Secretaria de Saneamento e Recursos Hídricos, Departamento de Águas e Energia Elétrica, <i>Outorga Uso D'água - UTE Caieiras</i>. 2014. Solvi Valorização Energética, <i>Balanco Hídrico</i>. Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 17-18. CEPOLLINA Engenheiros Consultores, "Pré-dimensionamento conceitual do sistema de drenagem superficial - planta de sub-bacias de contribuição." in <i>Área de instalação da Usina Termelétrica</i>, 2014. CEPOLLINA Engenheiros Consultores, "Pré-dimensionamento conceitual do sistema de drenagem superficial - planta e detalhes." in <i>Área de instalação da Usina Termelétrica</i>, 2014. CEPOLLINA Engenheiros Consultores, "Pré-dimensionamento conceitual do sistema de drenagem superficial provisório - planta de sub-bacias de contribuição." in <i>Área de instalação da Usina Termelétrica</i>. 2015. ENGEVIX Planservi Engenharia, <i>Projeto Padrão – Dispositivo e Drenagem Descida d'Água em Corte Tipo Escada</i>. 2006.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team could consider incorporating a plan that aims to have a positive impact on replenishing the quantity and quality of freshwater used from groundwater. This can be done by repurposing the water from the leachate treatment. For a better sustainability performance, the team should have a calculation that shows that the project has a long-term net positive impact. Better scores restore and replenish the quantity and quality of freshwater, surface water, and groundwater supplies to an agreed upon pre-development, natural ecological condition. Additionally, discharges into surface waters of fresh water after use should meet historical, pre-development seasonal cycles of quality and quantity (including temperature).</p>
<p>RA3.2 Reduce Potable Water Consumption</p>	<p>0</p> <p>No Score</p> <p>This credit evaluates efforts to reduce overall potable water consumption, and encourage the use of greywater, recycled water, and stormwater to meet water needs. This credit is measured through the percentage of reductions in water use.</p> <p>The project team has considered adopting proper equipment and technologies in order to reduce potable water consumption. The water consumption for the project is low, having been calculated to be 750 m3 per month. However, it was not possible to assess whether alternatives such as stormwater or non-potable water have been studied to be incorporated into the operations and maintenance of the project. Moreover, according to the project sponsor, there is no evidence as to whether the project results in a positive generation of water or up-cycling.</p> <p><u>Source:</u> Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 8. Solvi Valorização Energética, <i>Relatório Outorga Poço</i>. 2014, 5-6.</p> <p><u>RECOMMENDATIONS</u></p>

		<p>The use of nonpotable water and the reuse of stormwater should be incorporated into the operations and maintenance of the project. Therefore, the project team could consider using harvested stormwater as an alternative to be used for sanitary purposes. To score in this credit, the design team must focus on reducing potable water use by at least 25%; a reduction level that has been estimated above industry norms. Moreover, the team should consider the use of treated leachate from the CTR Caieiras landfill for Termoverde’s operations.</p>
<p>RA3.3 Monitor Water Systems</p>	<p>3</p>	<p>Enhanced</p> <p>This credit evaluated efforts to implement programs to monitor the performance of water systems, and their impact on receiving waters. According to the project sponsor, an initial commissioning will be carried out by a specialized contractor to monitor the water systems. Once this is done, reports will be forwarded to Department of Water and Electrical Energy (DAAE). However, the sponsor did not present any documentation detailing these efforts. The initial commissioning should allow for more detailed monitoring of performance.</p> <p>Moreover, according to the documentation which was provided, the project has included monitoring goals in order to evaluate the performance of the water system during operations. The monitoring has included water quality collection points, leak detection, and levels of water flows consumption. The project will follow the norms which have been established by DAAE and water use license, in order to maintain the well and water performance. It can be noted that performance is limited to industry norms and legal requirements. No details were provided regarding how the project will integrate impact monitoring and operations in order to mitigate negative impacts and improve efficiency.</p> <p><i>Source:</i> Solví Valorização Energética, <i>Relatório Outorga Poço</i>. 2014, 6-7.</p> <p>RECOMMENDATIONS</p> <p>For a better level of achievement, the project should consider integrating the monitoring activities into operations, and also allow the operator make the necessary adjustments in operations, in order to reduce negative impacts and improve the efficiency of the system. Better performances hinge upon long-term monitoring goals and responsive monitoring; where the project integrates impact monitoring and operational monitoring in order to allow for responsive management, and thereby improving efficiency, reducing negative impacts, and conserving both the quantity and quality of water resources.</p>
<p>RA 0.0 Innovate Or Exceed Credit Requirements</p>		<p>N/A</p>
	<p>79</p>	

NATURAL WORLD		
	Score	TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT
NW1.1 Preserve Prime Habitat	18	<p>Restorative</p> <p>This credit looks to avoid placing the project and the site compound or temporary works on land that has been identified as being of high ecological value or as having species of high value. This credit is measured through the avoidance of high ecological value sites and the establishment of protective buffer zones. It is important to consider the environmental impact assessment (EIA) which was carried out by the CTR Caieiras landfill where Termoverde will operate.</p> <p>The more than 250 ha site area is not considered to be prime habitat. According to the EIA, the landfill is located on an area judged by the municipal law as an “Zone for Environmental Sanitation Services and Primary Sector Industry;” therefore activities associated with the management, treatment, and recycling of urban, industrial, and hospital solid waste were authorized. Additionally, in the EIA the project established the limit of the intervention area by considering implementation, as well as a vegetation recovery area surrounding the site, with an area of 162 ha that has been allocated for reforestation. For this initiative, maps and cartographic methodologies were taken into account, in order to represent all of the geographical aspects of the site.</p> <p>This restoration of vegetation is a measure to compensate for the impacts caused by the project activities (deforestation, replacement of soils, drainage of headwaters) in the area, as well as habitat alteration. The complete reforestation program was included in the EIA, which included the methodology and the species to be planted (eucalyptus). The team chose eucalyptus because this species was already present on the site before the implementation of the landfill. The site previously belonged to a cellulose company, Melhoramentos. It is important to note that this compensation measure also aims to improve the atmospheric conditions by minimizing odors from hydrogen sulfide (H₂S), and decreasing the noise that spills into the site’s surroundings.</p> <p><i>Source:</i> CNEC, “Análise das Alternativas: Justificativa da Alternativa Locacional Escolhida.” in <i>Estudo de Impacto Ambiental - EIA/RIMA</i>. 1998, 14. (hereafter cited as EIA/RIMA). “Definição das Áreas de Estudo: Área de Intervenção.” in <i>EIA/RIMA</i>, 2-4. “Avaliação dos Impactos Ambientais.” in <i>EIA/RIMA</i>, 52-54. “Proposição de Programas Ambientais: Programa de Recuperação da Faixa de Transição com Floresta Nativa.” in <i>EIA/RIMA</i>, 2-4.</p>
		<p>RECOMMENDATIONS</p> <p>As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
		<p>Improved</p> <p>In order to preserve wetlands and surface water, it is necessary to protect, buffer, enhance, and restore areas that have been designated as wetlands, shorelines, and water bodies, by providing natural buffer zones, vegetation, and soil-protection zones. The effort to preserve these areas is measured by the size of natural buffer zones established around all wetlands, shorelines, and water bodies.</p> <p>In this regard, according to the project sponsor and inference from the location map, the thermoelectric plant is located more than 300 ft away from wetlands, waterbodies,</p>
NW1.2 Preserve Wetlands and Surface Water	1	<p>Improved</p> <p>In order to preserve wetlands and surface water, it is necessary to protect, buffer, enhance, and restore areas that have been designated as wetlands, shorelines, and water bodies, by providing natural buffer zones, vegetation, and soil-protection zones. The effort to preserve these areas is measured by the size of natural buffer zones established around all wetlands, shorelines, and water bodies.</p> <p>In this regard, according to the project sponsor and inference from the location map, the thermoelectric plant is located more than 300 ft away from wetlands, waterbodies,</p>

and riparian zones. Therefore, the project does not impact any buffer zones. However, it is important for the project team to consider improving the buffer zone which has suffered negative impacts from the CTR Caieiras landfill project (once the thermoelectric is located on the site). According to the EIA, direct impacts were expected to surface water availability with the implementation and operation of CRT Caieiras. In this sense, the project considered implementing a drainage system to divert water out of the landfill, as well as to minimize leachate. This diversion of the surface water results in a decrease of 50% of the the "Stream I" flow. Thus, the EIA/RIMA demonstrates that "Stream I" would suffer from negatives impacts due to the project's activities. For this reason, a surface water quality study was performed by analysing the stream alternatives; the goal was to determine the best location for release, and to what extent the stream supports the treated effluent concentration. Additionally, according to the EIA, CTR Caieiras impacts the buffer zone ("Permanent Preservation Areas"). There are 14 headwaters in the implementation area, of which 9 are located in the intervention area, and 5 are in the area designated for the green belt. The green belt is a result of the revegetation program that was carried out by the landfill in order to compensate for the impact to the buffer zone. It is important to mention that officials from organizations such as the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA), and the state's Department for the Protection of Natural Resources (DEPRN) have stated that the impact caused by the removal of vegetation in the buffer zone would be minimal.

Moreover, a monitoring program of surface water quality was considered in the EIA, and is based on methodologies such as the "19th Edition of Standard Methods for the Examination of Water and Wastewater," a joint publication from the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF).

Source:

"Legislação Ambiental: Justificativa da Alternativa Locacional Escolhida." in *EIA/RIMA*. 16.

"Meio Biótico: Caracterização da Vegetação da Área de Intervenção." in *EIA/RIMA*. 113-114.

"Avaliação dos Impactos Ambientais: Alteração da Disponibilidade Hídrica." in *EIA/RIMA*. 23-25.

"Avaliação dos Impactos Ambientais: Perda de Vegetação em Áreas Protegidas." in *EIA/RIMA*. 52-54.

"Avaliação dos Impactos Ambientais: Estudo da Qualidade das Águas Superficiais." in *EIA/RIMA*. 29, 34.

"Monitoramento da Qualidade das Águas Superficiais." in *EIA/RIMA*. 17.

Termoverde Caieiras, *Planta de Localização e Acessos a UTE Termoverde Caieiras*. 2013.

RECOMMENDATIONS

As CRT Caieiras has already impacted surface waters with the installation of the solid waste treatment facility, the project team should focus on the restoration and preservation of the vegetation area by seeking strategies to protect the area. For example, the restoration plan should include a site map that outlines locations of restoration, and the stabilization of stream channels or shorelines. Bulkheads are not an acceptable stabilization measure for this objective. Stream channel restoration must also include a geomorphic analysis of the reach, and planning for dynamic stable stream banks, based on channel dynamics and sediment transportation. In this regard, Termoverde could also improve the impacts caused to "Stream I," as the project is also

		located on the landfill site.
NW1.3 Preserve Prime Farmland	12	Conserving This credit has the purpose to identify and protect soils that have been designated as prime farmland, unique farmland, or farmland of statewide importance. It is measured through the percentage of prime farmland avoided during development. Termoverde is located within a landfill, which does not qualify as “prime farmland.” According to the environmental impact assessment (EIA) carried out by CTR Caieiras, the site is considered to be an “Environmental Sanitation Services and Primary Sector Industry Zone,” prohibited from residential and commercial settlement. In this regard, it can be noted that CTR Caieiras’s activities fall within the zone characteristics as determined by municipal law. Therefore, the project is not developed on a prime farmland by operating within the boundaries of the landfill.
		Additionally, it is important to note that CTR Caieiras has evaluated seven potential sites for the solid waste treatment project, and considered relevant aspects such as hydrology, geology, topography, soil use, and vegetation, among others. CTR Caieiras has appeared to have used the most adequate type of site for the implementation project. As this site is not considered to be prime farmland, no restoration initiatives were applicable for this project.
		<u>Source:</u> “Legislação Ambiental: Da Localização do Empreendimento.” in <i>EIA/RIMA</i> . 16. “Análise das Alternativas: Alternativas Locacionais.” in <i>EIA/RIM</i> . 2, 8-10.
		<u>RECOMMENDATIONS</u> A higher level of achievement would require the restoration of prime farmland. For example, previously developed areas that have are deemed to be prime farmland should be restored to a productive state, which is considered to be beyond the capabilities of this project.
NW1.4 Avoid Adverse Geology	3	Superior This credit evaluates efforts to avoid development on adverse geological formations, and safeguard aquifers to reduce the risks of natural hazards, and preserve high-quality groundwater resources. The metric used for this credit is the degree to which natural hazards and sensitive aquifers are avoided, and geological functions are maintained.
		According to the environmental impact assessment (EIA) carried out by CTR Caieiras, after analysing seven potential sites for the solid waste treatment project by considering all of these aspects, the ultimate site that was chosen had shown to be the best choice. Therefore, a complete and extensive geological, hydrological, and geotechnical assessment of the site was performed. It has been indicated that the area of intervention of the site is located on a stable region with low incidence of earthquakes and proper geological features. However, the study highlights that the operation of CTR Caieiras can contaminate aquifers from the leachate produced by the disposal of solid waste. In order to avoid this type of risk, CTR Caieiras has established strategies to reduce the risk of spills by implementing a waterproofing system on the landfill bed, consisting of clay and plastic liner (HDPE). The project has also incorporated a drainage system to avoid erosion from rain.
		In regards to the Termoverde project, according to the provided documentation, a standard penetration test (STP) was performed, and showed the soil properties where

	<p>the thermoelectric plant was to be installed. This study has shown the properties of the soil, which qualifies as “compact soil.” Additionally, the biogas energy plant has also conducted a water assessment in order to use groundwater for the project’s activities. In receiving licensing for use from the Department of Water and Electrical Energy (DAAE), Termoverde has demonstrated the quantity of water consumption required for the project, and also the constructed runoff system for diverting stormwater and water that has been used for activities.</p> <p><u>Source:</u> “Avaliação dos Impactos Ambientais: Risco de Alteração da Qualidade das Águas Subterrâneas” in <i>EIA/RIMA</i>. 45. “Diagnóstico Ambiental: Geologia Local.” in <i>EIA/RIMA</i>, 41 Solvi Valorização Energética, <i>Relatório Outorga Poço</i>. June 2014, 6-8. CEPOLLINA Engenheiros Consultores, “Pré-dimensionamento conceitual do sistema de drenagem superficial - planta de sub-bacias de contribuição.” in <i>Área de instalação da Usina Termelétrica</i>. 2014. CEPOLLINA Engenheiros Consultores, “Pré-dimensionamento conceitual do sistema de drenagem superficial - planta e detalhes.” in <i>Área de instalação da Usina Termelétrica</i>. 2014. CEPOLLINA Engenheiros Consultores, “Pré-dimensionamento conceitual do sistema de drenagem superficial provisório - planta de sub-bacias de contribuição.” in <i>Área de instalação da Usina Termelétrica</i>. 2015. Secretaria de Saneamento e Recursos Hídrico; Departamento de Água e Energia Elétrica, <i>Outorga Uso D'água - UTE Caieiras</i>. 2014. ENGEVIX Planservi Engenharia, Projeto Padrão – Dispositivo e Drenagem Descida d’Água em Corte Tipo Escada. 2006.</p> <p><u>RECOMMENDATIONS</u></p> <p>Although CTR Caieiras has conducted a complete EIA, it is important that Termoverde consider risk management during the operations phase; concerning the impacts of its activities on the underlying aquifers. Higher levels of achievement will require the total avoidance of risky areas, and that the owner and project team site the project in a safe area that has no adverse geological features, as well as no negative effects on aquifers.</p>
<p>NW1.5 Preserve Floodplain Functions</p>	<p>2</p> <p>Improved</p> <p>This credit evaluates efforts to preserve floodplain functions by limiting development and the impacts of development, in order to maintain water management capacities and capabilities. This is measured by efforts to avoid floodplains, or maintain predevelopment floodplain functions.</p> <p>The CTR Caieiras project depends upon the site’s waterways due to the need for releasing the treated effluents into the streams. Amongst the three main streams (Stream I, Nhá Zinha Stream, and Tanque Velho Stream), only Stream I will be affected by the project’s implementation and operations. In order to verify these impacts, the project has analysed the possibilities for the incidence of flooding by considering the topography and the watershed. The results showed that the watershed of the Stream I has a low incidence of flooding, because it is a stretched watershed with thin channels. Additionally, CTR Caieiras has considered a program for the restoration of vegetation over the final cover of the landfill, after the operations phase. This program aims to create a green area on the landfill’s surface for leisure and entertainment for the surrounding communities.</p> <p>Efficient stormwater runoff and a good quality of soil have been considered as crucial</p>

	<p>aspects for the project. The extension of flat areas will enhance the surface infiltration of the stormwater, and minimize flood effects on the riparians zone. A monitoring program has also been implemented in order to track the stormwater drainage system; mapping is expected to be used to survey and maintain the drainage system, and to avoid erosion and sliding, as well as to enhance infiltration. However, it was not possible to assess whether the project will maintain riparian and aquatic habitat after the water bodies begin to be affected by project implementation. Additionally, despite having planned a monitoring plan, no evidence demonstrates that a flood emergency plan was performed, nor a plan for enhancing aquatic habitat connectivity. With regards to the Termoverde project, according to sponsor and inferenced from the aerial map view of the location, the thermoelectric plant is developed far away from a floodplain.</p> <p><u>Source:</u> “Diagnóstico Ambiental: Diagnóstico do Meio Físico.” in <i>EIA/RIMA</i>. 75. “Proposições de Programas Ambientais: Programa de Revegetação da Cobertura Final dos Aterros.” in <i>EIA/RIMA</i>. 25-26. “Programa de monitoramento: Programa de Monitoramento do Sistema de Drenagem das Águas Pluviais.” in <i>EIA/RIMA</i>. 5-6. “Avaliação dos Impactos Ambientais: Alteração da Disponibilidade Hídrica.” in <i>EIA/RIMA</i>, 23. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p><u>RECOMMENDATIONS</u></p> <p>CTR Caieiras should consider strategies to enhance riparian and aquatic habitat in order to support endangered and threatened species. Additionally, it is important to carry out a flood emergency plan to address potential damage to the infrastructure.</p>
<p>NW1.6 Avoid Unsuitable Development on Steep Slopes</p>	<p>6</p> <p>Conserving</p> <p>This credit evaluates efforts to protect steep slopes and hillsides from inappropriate and unsuitable development, in order to avoid exposures and risks from erosion, landslides, and other natural hazards. This is measured by the degree to which development on steep slopes is avoided, or to which erosion control and other measures are used to protect the completed project, as well as other down-slope structures.</p> <p>CTR Caieiras evaluated seven potential sites during the planning phase, of which only the Caieiras site had an adequate topography for the project’s purposes. Many spots in the site were found that are capable of receiving high amounts of solid waste, and the topography is characterized as flat with low gradients. The environmental impact assessment (EIA) includes a control plan to minimize the incidence of erosion caused by stormwater in the operating area. Therefore, the program aims to survey the risk prone areas and adopt control and prevention measures through the monitoring of soil movements, and micro slopes, among other efforts. Moreover, the coverage of surface vegetation is monitored equally, in order to avoid potential erosion points. In regards to the Termoverde project, according to documents provided, design plans were developed that presented earthworks and slope works on the site for the implementation of the biogas energy plant.</p> <p><u>Source:</u> “Programa de monitoramento: Programa de Controle dos Processos Erosivos e Movimentos de Massa.” in <i>EIA/RIMA</i>. 1-3. “Análise das Alternativas: Alternativas Locacionais.” in <i>EIA/RIMA</i>. 8-10, 13. Soethe Cursino, <i>Projeto Executivo de Terraplenagem de Platô Traçado em Planta</i>. 2014. Soethe Cursino, <i>Projeto Executivo de Terraplenagem de Platô Traçado em Planta</i> -</p>

		<p><i>Revisão 1. 2014.</i> ENGEDAT Consultoria e Projetos de Geotecnia, <i>Planta de locação da contenção.</i> 2015. ENGEDAT Consultoria e Projetos de Geotecnia, <i>Planta de escavação.</i> 2015.</p> <p><u>RECOMMENDATIONS</u></p> <p>As the maximum level of achievement was awarded for this credit, no further recommendation are provided at this stage.</p>
NW1.7 Preserve Greenfields	15	<p>Conserving</p> <p>The intent of the credit is to conserve undeveloped land by locating projects on previously developed greyfields, and/or sites that are classified as brownfields. Metrics for the credit consist of the percentage of area that is a greyfield, or the use and cleanup of a site which has been classified as a brownfield.</p> <p>Termoverde is located on the CTR Caieiras landfill, which has been used for the disposal of solid urban waste since 2002. For this reason, the landfill where Termoverde will operate was previously managed by Essencis Soluções, a company owned by the same group as Termoverde. This area cannot be used for commercial or domestic development purposes. Therefore, it can be inferred that the installation of the thermoelectric plant will allow for the site characteristics to be taken advantage of, by mainly using it for industrial purposes, such as electrical energy production.</p> <p>Moreover, according to environmental impact assessment (EIA) carried out by CTR Caieiras, the use and occupation of the soil is considered to be on an area destined for industrial purposes by municipal law; mainly for projects associated with waste treatment systems, recycling, and final disposal of urban solid waste. In this regard, it can be concluded that Termoverde site is entirely installed on a previously developed area, being located on a greyfield.</p> <p><u>Source:</u> “Legislação Ambiental: Da Localização do Empreendimento.” in <i>EIA/RIMA</i>. 1-2.</p> <p><u>RECOMMENDATIONS</u></p> <p>As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
NW2.1 Manage Stormwater	0	<p>No Score</p> <p>This credit evaluates efforts to minimize the impact of infrastructure on the quantity and quality of stormwater runoff. This is measured through the infiltration and evapotranspiration capacity of the site, and a return to pre-development capacities.</p> <p>As CTR Caieiras uses the site for the treatment of solid urban waste, it is highly important to consider the effects of stormwater on the landfill. According with the environmental impact assessment (EIA) of the project, two monitoring programs have been implemented that consider this issue. The monitoring plan related to the stormwater drainage system aims to protect areas from flooding and erosion, promote infiltration, and avoid sedimentation on the base flow. Additionally, the monitoring program for erosion control seeks to reduce the sedimentation deposited on the base flow due to stormwater, as well as to avoid the incidence of landslides. However, no information about the percentage of storage capacity was provided. In regards to the Termoverde project, as stated in the installation license provided by Solvi, the stormwater that accumulates on the roof and ground of the thermoelectric plant does not need treatment. The stormwater will be managed by being directed into pipes and</p>

	<p>released into a gravel layer, in order to avoid land surface erosion. Therefore, the project will not impact or increased stormwater storage capacity.</p> <p><u>Source:</u> “Programa de monitoramento: Programa de Controle dos Processos Erosivos e Movimentos de Massa.” in <i>EIA/RIMA</i>. 1-3. “Programa de monitoramento: Programa do Sistema de Drenagem das Águas Pluviais.” in <i>EIA/RIMA</i>. 5-6. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 8. ENGEVIX Planservi Engenharia, <i>Projeto Padrão – Dispositivo e Drenagem Descida d’Água em Corte Tipo Escada</i>. 2006.</p> <p><u>RECOMMENDATIONS</u></p> <p>Although the Termoverde has designed a drainage system for stormwater runoff, it would be of interest to work on a monitoring plan for water quality and the storage capacity of such. Additionally, the project team could design and incorporate strategies for stormwater treatment and its reuse for operations and maintenance needs.</p>
<p>NW2.2 Reduce Pesticides and Fertilizer Impacts</p>	<p>5</p> <p>Superior</p> <p>This credit evaluates efforts to reduce non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers. This is measured through the efforts that have been taken to reduce the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers used on-site; including the selection of plant species and the use of integrated pest management techniques. In the case of the landfill, a compensatory measure was carried out in order to recover a vegetation area. For this measure, CTR Caieiras has implemented a methodology, including the application of organic (manure) and chemical (nitrogen, phosphorus, and potassium) fertilization with limited and specific use. Moreover, the landfill has also planned to recover the area by planting eucalyptus seedlings, and also the plant species that will attract pollinators.</p> <p><u>Source:</u> Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 7. Ambconsult Estudos e Projetos Ambientais, <i>Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP</i>. São Paulo: June, 2013. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013. “Metodologia de Recuperação das Áreas Degradadas: Escolha e Descrição das Atividades de Recomposição.” in <i>EIA/RIMA</i>. 121-136. “Proposição de Programas Ambientais: Programa de Recuperação da Faixa de Transição com Floresta Nativa.” in <i>EIA/RIMA</i>. 2-5. “Proposição de Programas Ambientais: Programa de Monitoramento Faunístico.” in <i>EIA/RIMA</i>. 5-7.</p>

	<p><u>RECOMMENDATIONS</u></p> <p>CTR Caieiras should consider composting to avoid the use of pesticides, herbicides, and fertilizers. Moreover, as Termoverde is located on the same site, it is important that the project team be involved in the conservation of the greenbelt area.</p>
<p>NW2.3 Prevent Surface and Groundwater Contamination</p>	<p>9</p> <p>Superior</p> <p>This credit evaluates efforts to preserve freshwater resources by incorporating measures to prevent pollutants from contaminating surface and groundwater, as well as to monitor impacts throughout operations. This is measured by the designs, plans, and programs that have been instituted in order to prevent and monitor surface and groundwater contamination.</p> <p>According to the environmental assessment of CTR Caieiras, hydrogeologic delineation studies have been conducted on the implementation of the project in the site. For this, geophysical investigation and sounding methods were carried out in order to analyse the on-site aquifers. However, due to the scope of the project, it is important to note that during the implementation phase, it would have an impact to the wellheads located on-site. Therefore, in order to implement the landfill, the project team had to drain the wellheads, thus contributing to changes of the local and regional landscapes. Additionally, studies based on methodologies were performed in order to assess and the impacts on the quality of surface and groundwater. These investigations contributed to the development of monitoring programs outlined in the environmental impact assessment (EIA). These programs aim to analyse water samples and investigate the impacts of the solid waste pollutants on groundwater. It is relevant to state that the Termoverde project did not reduce or eliminate potential polluting substances due to the scope of the project. However, a leak prevention plan has been designed to lead the contaminated water, leakage, and stormwater towards treatment system of CTR Caieiras.</p> <p>According to the project sponsor, Termoverde has incorporated prevention and monitoring systems in order to avoid oil leakage. The oil that is used in the generator engines can be a factor for on-site soil contamination and infiltration. In this regard, the project aims to prevent leakage by installing all of the equipment that requires oil on top of a properly designed watertight containment basin.</p> <p>The project also has also planned procedures to be followed in cases of oil leakage, which will be located in the operations manual for the project. It is important to mention that all of the oil that is used in the generator engines will be given to Essencis Soluções Ambientais for recovery. However, there is no evidence as to whether the project aims to reduce future contamination or restore groundwater infiltration patterns.</p> <p><u>Source:</u> “Diagnóstico Ambiental: Diagnóstico do Meio Físico.” in <i>EIA/RIMA</i>. 60-62. . “Avaliação dos Impactos Ambientais: Metodologia.” in <i>EIA/RIMA</i>. 3. “Avaliação dos Impactos Ambientais: Alteração da Paisagem Local e Regional.” in <i>EIA/RIMA</i>. 69. “Avaliação dos Impactos Ambientais: Estudo da Qualidade das Águas Superficiais.” in <i>EIA/RIMA</i>. 29. “Avaliação dos Impactos Ambientais: Riscos de Alteração da Qualidade das Águas Subterrâneas.” in <i>EIA/RIMA</i>. 44-45. “Programas de Monitoramento: Monitoramento da Qualidade das Águas Superficiais.”</p>

	<p>in <i>EIA/RIMA</i>. 14-15. “Programas de Monitoramento: Monitoramento das Águas Subterrâneas.” in <i>EIA/RIMA</i>. 20-26. “Programas de Monitoramento: Monitoramento da Qualidade das Águas Superficiais.” in <i>EIA/RIMA</i>. 14-15. Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 18.</p> <p><u>RECOMMENDATIONS</u></p> <p>The project team should include a plan to reduce future contamination by designing for source elimination, as well as strategies for restoring groundwater infiltration in cases of oil leakage. For example, Termoverde could prevent future contamination by cleaning up previously contaminated land, restoring wellhead protection, and installing land use controls. Restoration could also be incorporated by removing storage piles, rerouting surface runoff, or restoring groundwater infiltration patterns.</p>
<p>NW3.1 Preserve Species Biodiversity</p>	<p>2</p> <p>Improved</p> <p>This credit evaluates efforts to protect biodiversity by preserving and restoring species and habitats. It is measured by the degree of habitat protection. CTR Caieiras has performed assessments to identify and protect habitat on or near the project site, in collaboration with state and local agencies. Higher scores will depend on mitigation measures to maintain the net habitat quality and area, as well as to provide a means for animals to access pre-development habitat, after the project development is complete.</p> <p>It is important to consider CTR Caieiras’ environmental impact assessment (EIA) for evaluation. According to the survey, the area is 98.6% covered by eucalyptus, and 1.4% native forest. Additionally, an evaluation of the local fauna was also performed by considering a sampling of animals, their current situation, and a description of their habitat on the landfill. Endangered species were also found, such as the otter and wildcat. However, as stated by the EIA, the project team did negatively interfere with the site, having caused damage to local biodiversity during the mobilization and implementation of the project. In order to compensate for the losses and changes to the affected habitats, CTR Caieiras has carried out a conservation measure for local fauna, situated on the 200 m wide greenbelt around the site. Therefore, a monitoring plan for fauna has also been integrated into the project design; this was developed by taking a census of the avifauna of site, as birds are deemed to be a robust ecological indicator. However, the project team did not consider development alternatives in order provide for new connections, and expand wildlife corridors. Although there is a restoration program for the vegetation area, problems caused by human presence and activities were not considered in the monitoring and prevention programs. For example, vehicle movements through the vegetation recovery area affect the fauna, such as by being struck by vehicles and fleeing the area due to disturbance.</p> <p>In regards to Termoverde, as the project will be installed on the CTR Caieiras landfill, and the impacts of its activities will be limited on this area, the natural habitat will not be affected by the project itself. Additionally, according to the installation license (IL), the area where the thermoelectric plant will be installed is covered by reforested eucalyptus, thereby having low negative impacts. However, no additional documentation was provided in order to better assess the directly impacts related to the installation of the project.</p>

	<p><u>Source:</u> Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 6, 10. “Meio Biótico: Caracterização da Vegetação na Área de Intervenção.” in <i>EIA/RIMA</i>. 113. “Meio Biótico: Caracterização da Vegetação na Área da Fauna.” in <i>EIA/RIMA</i>. 137, 149-150. “Avaliação dos Impactos Ambientais: Eliminação da Cobertura Vegetal com Perda E/OU Alteração de Habitats.” in <i>EIA/RIMA</i>. 52-53. “Proposição de Programas Ambientais: Programa de Monitoramento Faunístico.” in <i>EIA/RIMA</i>. 5-7. “Avaliação dos Impactos Ambientais: Perda de Vegetação em Área Protegidas.” in <i>EIA/RIMA</i>. 54.</p> <hr/> <p><u>RECOMMENDATIONS</u></p> <p>CRT Caieiras should consider the negative impacts caused by the movement of vehicles which pass through the vegetation area that has been allocated for recovery. As this area is dedicated for reforestation purposes, it is highly recommended that the project team develop strategies to cope with accidents where animals are struck that is caused by the operation work. Additionally, the project should consider efforts to facilitate movement between habitats and provide for new connections.</p>
<p>NW 3.2 Control Invasive Species</p>	<p>11</p> <p>Restorative</p> <p>The intent of this credit is to encourage the use of appropriate noninvasive species, and control or eliminate existing invasive species; this is measured by the degree to which invasive species have been reduced or eliminated.</p> <p>CTR Caieiras has identified and listed all of the plant species found on the site, which included some invasives. Methodologies, procedures, scientific work, and the collection of species from the field were all considered in order to map the flora of the site. Additionally, methodologies were applied in order to recover the ecosystem by deciding which species would be planted on-site. In this regard, the project team has identified and eliminated noxious plants, liana, and grass (which represented a menace for the seedlings), and the team has also considered plant seedling species that attract pollinator insects and animals. It is important to note that as the CTR Caieiras receives 10,000 tons of solid waste daily, including organic waste, the landfill itself is the main focus for invasive species, such as rats, cockroaches, and flies. These invasive species also represent a menace to human health. Therefore, according to the environmental impact assessment (EIA), operational and maintenance procedures have been planned in order to prevent potential invasive species; this includes the daily depositing of soil on top of the waste. Additionally, a monitoring plan has been included in the scope of the project, and is based on periodically checking the surroundings to assess the presence of disease vectors (e.g. rats and cockroaches), and also the morbidity index that they carry. This evaluation is carried out monthly with public health organizations from Caieiras and Franco da Rocha.</p> <hr/> <p><u>Source:</u> “Meio Biótico: Vegetação” in <i>EIA/RIMA</i>. 103, 115-117. “Metodologia de Recuperação das Áreas Degradadas: Escolha e Descrição das Atividades de Recomposição.” in <i>EIA/RIMA</i>. 127, 131. “Avaliação dos Impactos Ambientais: Proliferação de Vetores de Doenças.” in <i>EIA/RIMA</i>. 55-56. “Proposição de Medidas Mitigadoras: Procedimentos Operacionais e de Manutenção.” in <i>EIA/RIMA</i>. 6-7.</p>

		<p>“Proposição de Programas Ambientais: Programa de Monitoramento das Condições de Saúde.” in <i>EIA/RIMA</i>. 6-7.</p> <p><u>RECOMMENDATIONS</u></p> <p>As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
<p>NW3.3 Restore Disturbed Soils</p>	<p>10</p>	<p>Restorative</p> <p>The intent of this credit is to restore soils that have been disturbed during construction and previous development, in order to bring back ecological and hydrological functions. This is measured through the percentage of disturbed soils that have been restored.</p> <p>The CTR Caieiras project has a high level of impact on the soil where the waste treatment operations occur. It has been necessary to excavate the land in order to deposit the solid waste daily; this procedure alters the landscape and the soil quality. However, through prevention and control plans and operational procedures, the landfill seeks to restore the soil by mitigating contamination, and using the excavated soil for coverage purposes. Additionally, the landfill has conducted a revegetation program as a compensatory activity.</p> <p>In regards to the Termoverde project, according to the sponsor, the soil that was removed for the installation of the plant was used in the CTR Caieiras landfill as coverage for disposed solid waste. Moreover, the topography had incurred some small changes, mainly caused by the construction of retaining walls.</p>
		<p><u>Source:</u></p> <p>“Legislação Ambiental: Normas de Proteção contra a Poluição.” in <i>EIA/RIMA</i>. 11.</p> <p>“Proposição de Medidas Mitigadoras: Procedimentos Operacionais de Manutenção.” in <i>EIA/RIMA</i>. 7.</p> <p>“Programa de Monitoramento: Monitoramento dos Constituintes do Aterro.” in <i>EIA/RIMA</i>. 1-2.</p> <p>“Programa de Monitoramento: Programa de Prevenção de Acidentes no Depósito de Estocagem Temporária de Resíduos.” in <i>EIA/RIMA</i>. 1-2.</p> <p>ENGEDAT Consultoria e Projetos de Geotecnia, <i>Planta de locação da contenção</i>. 2015.</p> <p>ENGEDAT Consultoria e Projetos de Geotecnia, <i>Planta de escavação</i>. 2015.</p> <p><u>RECOMMENDATIONS</u></p> <p>As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
<p>NW3.4</p>	<p>9</p>	<p>Superior</p>

<p>Maintain wetland and surface water functions.</p>	<p>This credit intends to maintain and restore the ecosystem functions of streams, wetlands, waterbodies, as well as their riparian areas. It is measured by the number of functions maintained and restored. There are four main ways to improve ecosystem functions, which are to maintain or enhance hydrological connections, water quality, habitats, and sediment transport.</p> <p>CTR Caieiras maintains or enhances three ecosystem functions; hydrologic connections, water quality, and sediment transport. As the CTR Caieiras project had impacts on the surface water, due to its implementation and operations, monitoring plans have been considered. In this regard, according to the environmental impact assessment (EIA), the project seeks to monitor the drainage system to divert stormwater in order to not infiltrate into the solid waste. CTR Caieiras has performed a study of the hydrologic resources, as well as the on-site water quality. However, as the landfill activities impact the waterways, streams, and water bodies, a monitoring plan regarding the surface water quality was also considered. In relation to efforts to protect the habitat of water bodies, a survey was conducted listing all of the animals that are found on the site and in the riparian areas (e.g. the crab-eating raccoon and the otter). However, no evidence was found in the EIA that CTR Caieiras would conduct a mitigation or monitoring plan for the riparian species' habitat.</p> <p>Moreover, according to the EIA, the project aims to monitor slope stability in order to avoid sediment deposition on the landfill, or the silting of waterways. Additionally, this program incorporates the reduction of transported sediments through the drainage system, in order to minimize the impacts to "Stream I." However, no reports about the maintenance of the slope, or the transport of sedimentation were provided. Therefore, it can be inferred that the project does not achieve to maintain all of the ecosystem functions of hydrologic connections, water quality, habitat, and sediment transport. No information was provided regarding efforts for enhancing or maintaining the habitat of water bodies in the EIA.</p> <p>Regarding the Termoverde project itself, it is located on the landfill, far away from wetlands and surface waters. Therefore its operation will maintain hydrologic connections.</p> <p><u>Source:</u> "Programa de Monitoramento: Programa de Monitoramento da Estabilidade dos Aterros." in <i>EIA/RIMA</i>. 4. "Avaliação dos Impactos Ambientais: Alteração da Disponibilidade Hídrica." in <i>EIA/RIMA</i>. 23-27. "Diagnóstico Ambiental: Diagnóstico do Meio Físico." in <i>EIA/RIMA</i>. 60-66. "Diagnóstico Ambiental: Recursos Hídricos Qualidade da Água." in <i>EIA/RIMA</i>. 81-93. "Programa de Monitoramento: Monitoramento da Qualidade das Águas Superficiais." in <i>EIA/RIMA</i>. 14-20. "Meio Biótico Fauna." in <i>EIA/RIMA</i>. 148. "Programa de Monitoramento: Monitoramento dos Constituintes do Aterro." in <i>EIA/RIMA</i>. 1-2. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p><u>RECOMMENDATIONS</u> CTR Caieiras should consider carrying out a monitoring plan that focuses on aquatic habitat, and establish strategies for restoring ecosystems functions.</p>
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NW 0.0 Innovate Or Exceed Credit Requirements		N/A
	103	

CLIMATE AND RISK		
	Score	TERMOVERDE CAIEIRAS - BIOGAS THERMOELECTRIC PLANT
CR1.1 Reduce Greenhouse Gas Emissions	25	<p>Restorative</p> <p>The intent of this credit is to conduct a comprehensive life-cycle carbon analysis, and use this assessment to reduce the anticipated amount of net greenhouse gas emissions during the life cycle of the project, thus reducing the project’s contribution to climate change. The metric for this credit is the reduction of net life-cycle carbon dioxide equivalent emissions.</p> <p>Termoverde Caieiras’s operations will be directly aligned with the reduction of greenhouse emissions when the plant will begin to use the biogas emitted from the CTR Caieiras landfill as fuel for energy generation. CTR Caieiras qualifies under the UNFCCC Clean Development Mechanism framework, as its main goal is to reduce gas emissions. Therefore, through a controlled collection of biogas and its combustion via flaring, CTR Caieiras promotes measurable GHG reductions; this qualifies under the “Clean Development Mechanism – Project Design Document – PDD and also the ACM0001 Version 15.0 Flaring or use of landfill gas” methodology.</p> <p>According to the Termoverde sponsor, the thermoelectric biogas plant will be included within the CDM project that is performed by CTR Caieiras. Therefore, the production of carbon credits (CERs) in 2016 is estimated to be approximately of 300,000 for Termoverde and 574,000 for CTR Caieiras. Therefore, the project brings an alternative energy recovery solution for the biogas produced from solid urban waste deposited in the landfill. It is important to mention that according to the document provided by Solvi, the project generated methane is considered to be 21 times more polluting than CO₂, and will be 99.5% burned by the motor generators that have been installed by Termoverde,. Moreover, in 2016 Termoverde is forecasted to process 19,143 Nm³/h of biogas and 7,849 Nm³/h of methane that will be provided by CTR Caieiras.</p>

	<p><u>Source:</u> UNFCCC Project Design Document Form for CDM Project Activities, <i>Caieiras landfill gas emission reduction</i>. 2013, 7. Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. 4,8. Ibid., 11. UNFCCC, "Glossary of climate change acronyms." Accessed December, 2015. http://unfccc.int/essential_background/glossary/items/3666.php Ambconsult Estudos e Projetos Ambientais, "Balanço de Emissões." Licenciamento Ambiental Atendimento a Exigências Técnicas, Termelétrica a Biogás, Caieiras SP. São Paulo: June, 2013, 5. (hereafter cited as Licenciamento Ambiental). Solvi Valorização Energética, Respostas Questionário Termoverde Caieiras Protocolo Climático. 2015.</p>
	<p><u>RECOMMENDATIONS</u> As the maximum level of achievement was awarded for this credit, no further recommendations are provided at this stage.</p>
<p>CR1.2 Reduce Air Pollutant Emissions</p>	<p>No Score</p> <p>This credit looks into reducing the emission of six criteria pollutants and noxious odors; the six pollutants include particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. The metric used for this credit is the measurements of air pollutants compared to chosen standards.</p> <p>The Termoverde Caieiras project does not follow the California Ambient Air Quality Standards (CAAQS), nor does it follow South Coast Air Quality Management (SCAQM). However, according to the document provided by Solvi, the project is designed to reduce odor emissions into the atmosphere and noticeable outside of the boundaries of the project. The internal combustion process itself promotes reductions of odor emissions, meeting the requirement stipulated by the Previous Licensing (LP). Considering the six criteria pollutants stated for this credit, nitrogen oxides is considered to be the main pollutant emitted into atmosphere from the thermoelectric operation. The combustion of biogas in the motor generators releases 350.4 tNOx/yr into the atmosphere, which is significantly higher than the required level (40 tNOx/yr) Therefore, Termoverde exceeds the NOx levels permitted by law. According to Termoverde's project sponsor, there was no legal limit established in Brazil related to emissions of nitrogen oxide released by landfill biogas. At the time of the Installation License request, the newly adopted air quality standards for Sao Paulo State (PREFE in portuguese) were not yet published by the environmental institution Companhia Ambiental do Estado de São Paulo (CETESB). The PREFE establishes a reduction of 5 372t/y of NOX for the region. A mitigation plan should consider adapting to the newly adopted standards. A mitigation plan has not been yet developed by the project team, which also argues that it is necessary to begin operations in order to develop a mitigation plan.</p> <p>It is worth mentioning that the PREFE is similar to CAAQS. It refers to the new air quality standards establishing the emission reductions levels for air pollutants released by different regions in Sao Paulo State.</p> <p>In addition, the generators engines (GE Jenbacher) were procured in order to meet</p>

	<p>international emissions standards. As there is no national standard for defining emission limits for the generator engines, Termoverde procured motors aligned with the Gothenberg Protocol and TA Luft (German Technical Instructions on Air Quality Control) references, and followed the restrictive limit for biogas emissions of 500 mg/Nm³ of NO_x. In the documentation provided, a table was provided comparing the emission restriction levels among six countries (USA, Germany, Italy, France and Denmark). In order to evaluate the nitrogen oxide emissions, Termoverde has incorporated a monitoring plan detailed in the provided documentation.</p> <p>In regards to CTR Caieiras, it is important to state that it also conducts a monitoring plan to control the odors released by the solid waste, through the installation of a meteorological station. Additionally, operational and maintenance procedures have been planned out in the environmental impact assessment (EIA), such as the daily coverage of waste with a layer of soil.</p> <p><u>Source:</u> UNFCCC Project Design Document Form for CDM Project Activities, <i>Caieiras landfill gas emission reduction</i>. 2013, 7. <i>Licenciamento Ambiental Atendimento</i>, 3-9. “Balanço de Emissões.” in <i>Licenciamento Ambiental</i>. 15,17. “Programa de Monitoramento: Programa de Monitoramento Climático.” in EIA/RIMA. 10-12. “Proposição de Medidas Mitigadoras: Procedimentos Operacionais e de Manutenção.” EIA/RIMA. 6-8. CETESB. <i>Plano de Redução de Emissão de Fontes Estacionárias – PREFE</i>, 120.</p> <p><u>RECOMMENDATIONS</u> Termoverde should consider adopting the new air quality standards (PREFE) of Sao Paulo State published by CETESB in 2014 in their operations and mitigation plans. The amount of NO_x per year that will be emitted by the thermoelectric and flaring operations surpasses the newly established required level. Although the monitoring plan is highly relevant for the project team to assess the NO_x emissions into the atmosphere, it is important to present a compensation plan.</p>
<p>CR2.1 Assess Climate Threat</p>	<p>No Score</p> <p>0</p> <p>For this credit, it is important to perform a comprehensive climate impact evaluation, develop an adaptation plan, and be prepared for climate variation and natural hazards. Performance in this credit is measured through the summary of steps taken to prepare for climate variation and natural hazards. According to Envision, while the exact effects of climate change remain uncertain, most anticipated impacts fall into the the four categories of; changes in long-term weather patterns (precipitation, temperature, etc.); changes in extreme weather events and natural hazards; increased sea levels; and increased desertification. These changes are important factors in infrastructure design. Projects may be directly threatened by rising sea levels or extreme weather events. Gradual increases in temperature, or decreases in precipitation may increase pressures on energy or water systems. Communities rely on infrastructure projects; therefore the failure of systems can cause devastating consequences. Consequently, understanding potential impacts of climate change is critical to ensuring that designs can be resilient to future conditions.</p> <p>In this regard, the sponsor has indicated that the Termoverde project may eventually be affected by reductions of biogas production due to extended droughts. This could affect</p>

		<p>the project in terms of preventing the expansion of the thermoelectric plant, which is directly linked to an increase of biogas production. However, no documentation was provided in order to verify whether an impact assessment or adaptation plan has been developed.</p> <p><i>Source:</i> Licenciamento Ambiental. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. EIA/RIMA. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p>RECOMMENDATIONS</p> <p>The project team should consider developing a climate impact assessment, as well as an adaptation plan in order to prevent the negative impacts of climate change on the project. Moreover, this assessment should take into account vulnerability, risk, and adaptation assessments, in addition to collaboration with the local community and local emergency management departments.</p>
<p>CR2.2 Avoid Traps And Vulnerabilities</p>	<p>0</p>	<p>No Score</p> <p>This credit evaluates efforts to avoid traps and vulnerabilities that could create high long-term costs and risks for the affected communities. The metric that is used is in having an assessment of potential long-term traps, vulnerabilities, and risks caused by long-term changes, such as climate change and the degree to which these were addressed in the project design, and community design criteria. It was not possible to determine whether an assessment of possible changes was performed for key engineering designs as a result of climate change considerations.</p> <p><i>Source:</i> "Programa de Monitoramento de Ruído." in <i>Licenciamento Ambiental</i>. 1-5. Solví Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. EIA/RIMA. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p>RECOMMENDATIONS</p> <p>The project team should consider developing a plan to evaluate traps and vulnerabilities, as well as costs and risks caused by environmental changes. Additionally, it is important to design strategies to reduce the identified risks and traps. The project team should also consider working with the local community as a foundation for making changes to the project design and operations protocols.</p>
<p>CR2.3 Prepare</p>	<p>0</p>	<p>No Score</p>

<p>For Long-Term Adaptability</p>	<p>This credit evaluates efforts to prepare infrastructure systems to be resilient to the consequences of long-term climate change, perform adequately under altered climate conditions, or adapt to other long-term change scenarios. This is measured by the degree to which the project has been designed for long-term resilience and adaptation. Infrastructure projects that are designed for today's conditions may not be able to function adequately under altered conditions in the future. Climate change will likely lead to changes in weather patterns and sea levels. Projects should be designed to withstand a range of conditions which may result from climate change, such as changes in temperatures, humidity, precipitation, seasonal hydrology, flooding, and increased sea levels, among others.</p> <p>Despite the project sponsor having indicated that Termoverde would not be fully affected by climate change, by only being limited by a decrease in biogas production, no documentation was provided in order to support this notion.</p> <p><u>Source:</u> Licenciamento Ambiental. Solvi Valorização Energética, <i>Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação</i>. EIA/RIMA. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <p><u>RECOMMENDATIONS</u></p> <p>The team should analyze the potential impacts of climate change on the project by considering the preparation of strategies for long-term recovery and adaptation. Furthermore, it was not possible to identify whether the project team has considered plans and design strategies for long-term adaptability. Some strategies for managing long-term changes that Termoverde may include, structural changes (expand the range of conditions in which the project's system can function), the use of decentralized systems (the project may depend on many small facilities instead of a single large facility, as distributed networks hedge risks), the identification of alternative supply options (identify alternative methods or locations for resources that are important to the infrastructure project, such as water sources), and adaptive capabilities (include ways for the system to adapt or change over time in order to be more prepared to deal with altered conditions).</p>
<p>CR2.4 Prepare For Short-Term Hazards</p>	<p>0</p> <p>No Score</p> <p>This aspect evaluates whether the project has increased resilience and long-term recovery prospects, for both the project itself and the site, from natural and human induced short-term hazards. The measures which have been taken may go beyond the existing regulations. In addition to long-term climate-related hazards, many infrastructure systems are subject to short-term hazards, such as earthquakes, flooding, and fires, which may be related to climate change, or may have other risk factors. Urban areas are also increasingly vulnerable to human-induced hazards, such as hazardous material spills, terrorist attacks, epidemics, and biohazards. Managing and preparing for short-term hazards helps to secure the longevity of infrastructure projects, protect investments, and secure the wellbeing of the surrounding community.</p> <p>In this regard, the project sponsor does not consider threats to exist from natural hazards in the project area. However, from the documentation that was submitted, it was not possible to evaluate whether the project has included strategies to prevent and mitigate short-term impacts from natural hazards and manmade disasters.</p>

	<p><u>Source:</u> Licenciamento Ambiental. Solví Valorização Energética, Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação. EIA/RIMA. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <hr/> <p><u>RECOMMENDATIONS</u></p> <p>A study that identifies the natural and manmade hazards that the project could face should be considered by the project team, in addition to designing alternatives to protect against natural disasters. For example, the project could consider preparing strategies by evaluating the stormwater harvest system capacity would be adequate for extreme situations, such as droughts.</p> <p>Better performance is reflected by a movement from assessment to action. Therefore, the team implement strategies that prepare for or mitigate against long-term changes. For example, the project team could prepare plans and designs that have been created and implemented in order to prepare for short-term hazards that have a 1/100 yr or higher chance of occurring; both direct and indirect impacts should be included. Designs may limit the hazard itself, fortify against the hazard, or allow for the project to adapt to the hazard.</p>
<p>CR2.5 Manage Heat Island Effects</p>	<p>No Score</p> <p>It is important for the project to develop plans in order to minimize surfaces with a high solar reflectance index (SRI), in order to reduce localized heat accumulation and manage microclimates. This credit is measured by the percentage of the site area that meets solar reflective index criteria.</p> <p>The Termoverde project is installed on an industrial site, far away from urban areas. The project has 395 m² of constructed area, within in a total area of 13,000 m² dedicated to the the biogas thermoelectric plant. Moreover, it is important to highlight that the Termoverde is located within the CTR Caieiras landfill, which has 3.5 million m² of total area. Therefore, in terms of heat islands, the impact of the Termoverde project will mainly affect the landfill site. However, based on the submitted documentation, it was not possible to assess the extent to which the project meets heat island requirements.</p> <p>0</p> <p><u>Source:</u> Licenciamento Ambiental. Solví Valorização Energética, Anexo do Memorial de Caracterização do Empreendimento MCE de Licença de Instalação. EIA/RIMA. Termoverde Caieiras, <i>Planta de Localização e Acessos a UTE Termoverde Caieiras</i>. 2013.</p> <hr/> <p><u>RECOMMENDATIONS</u></p>

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		<p>Termoverde should consider design strategies in order to minimize heat island effects from the thermoelectric plant. Although the impacts will be limited to the landfill area, it is highly important to consider alternatives for mitigating heat islands, such as the use of materials on surfaces and rooftops with a high solar reflectance index (SRI).</p> <p>Urban heat island effects can be minimized and managed for this credit through the use of materials with a high solar reflectance index (SRI), or through increased vegetation, which provides cooling via evapotranspiration, and increased shading. Shading can be created through structures, such as shade panels that meet the SRI requirements or trees that provide shade within 5 years of planting (all are as if measured at noon on the summer solstice). Better performance hinges upon improvements in heat island reductive actions, and an improved microclimate.</p>
CR0.0 Innovate Or Exceed Credit Requirements		N/A
	25	

OVERALL:

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APPENDIX E: SOURCES

DOCUMENTATION PROVIDED	
General Information.	
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