

Climate Action in Brazil's Water and Wastewater Sector: Adaptation, Mitigation, and Empowerment for Sustainable Development

Evidence of Competence for Submission
to the UNFCCC

December 2024



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1. Introduction

This report documents the **impacts of climate change** on the operations of Brazil’s water and wastewater regional utilities and the **measures they are taking to adapt, mitigate, and empower communities**. Prepared under the coordination of the **Brazilian Association of Regional Water and Wastewater Utilities (“AESBE”)**, it highlights how these utilities are responding to key challenges such as droughts, floods, extreme events, and rising water temperatures—all of which significantly affect water supply, wastewater management, infrastructure, and service continuity.

According to the Greenhouse Gas Emissions and Removals Estimation System (SEEG), **Brazil emitted approximately 2.3 billion tons of carbon dioxide equivalent (CO₂eq), with the treatment of domestic effluent accounting for 1.05% of the country’s total emissions**, or approximately 24.3 million tons of CO₂. In this context, the wastewater sector confronts the task of lowering emissions while also universalizing service by 2030. In a Business as Usual (BAU) scenario, in the absence of new low-carbon technologies in the units’ operating model for treatment, emissions would rise dramatically, particularly due to methane emissions produced while lowering the organic load of the effluent.

In addition to providing operational insights, this report reflects AESBE’s commitment to the goals of the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Sustainable Development Goals (SDGs), particularly those related to climate action (SDG 13), clean water and wastewater (SDG 6), and sustainable energy (SDG 7). The report ensures alignment with international frameworks by documenting relevant activities conducted within the past 12 months as part of the **UNFCCC standard submission process for non-governmental organizations (NGOs)**.

1.1. Adaptation and Mitigation Actions

The water and wastewater sector – henceforth, mentioned just as “water” sector and utilities – is highly vulnerable to climate change. The following impacts pose serious risks to water services across Brazil:

- **Droughts** reduce water availability, increase operational costs, and disrupt water distribution.
- **Floods and extreme weather events** damage infrastructure, contaminate water sources, and hinder service continuity.
- **Rising temperatures** affect water quality, promote the proliferation of harmful microorganisms, and reduce treatment efficiency.

In response to these challenges, water utilities have adopted a range of **climate adaptation and mitigation strategies**. These efforts ensure not only the resilience and continuity of essential services but also **align with Brazil's national climate policies** and global targets set by the **UNFCCC and SDGs**.

The report covers **three primary areas of climate action**:

- **Adaptation Measures** – These include drought management plans, flood control systems, infrastructure reinforcement, improved water resource management, and ecosystem restoration initiatives.
- **Mitigation Measures** – These efforts aim to reduce greenhouse gas emissions through GHG inventories, energy efficiency programs, renewable energy adoption, biogas recovery, and waste management initiatives.
- **Action for Climate Empowerment (ACE)** – These actions empower communities and stakeholders through environmental education, awareness campaigns, partnerships, and capacity-building initiatives, promoting climate-conscious behavior.

1.2. Utilities Covered in This Report

The report examines the climate-related activities of key water utilities across multiple regions in Brazil (Utilities' acronym – State):

- **CAGECE** – Ceará
- **EMBASA** – Bahia
- **CAGEPA** – Paraíba
- **CEDAE** – Rio de Janeiro
- **CESAN** – Espírito Santo
- **CORSAN** – Rio Grande do Sul
- **CASAN** – Santa Catarina
- **SANEPAR** – Paraná
- **SANEAGO** – Goiás
- **CAESB** – Federal District
- **BRK Ambiental** - Tocantins
- **CAER** – Roraima
- **COSANPA** – Pará

1.3. Commitment to Global Climate and Sustainability Goals

This report serves as evidence of AESBE's expertise and leadership in climate-related matters by documenting the utilities' actions to adapt to climate risks, reduce emissions, and promote climate empowerment. These efforts reinforce AESBE's commitment to the UNFCCC framework and contribute directly to achieving the SDGs, particularly in the areas of water management, climate action, and sustainable energy.

Through this submission, AESBE aims to demonstrate its capacity to support the UNFCCC's objectives by advancing sustainable practices in the water sector. The report also strengthens AESBE's eligibility for UNFCCC NGO admission by showcasing activities and initiatives aligned with the global climate agenda.

The Northeastern Region of Brazil

2. Companhia de Água e Esgoto do Estado do Ceará (CAGECE)

The water provider for the State of Ceará (CAGECE) is a public mixed-capital corporation, whose majority shareholder is the Government of the State of Ceará. The utility is responsible for water supply services, wastewater collection and treatment, operating in 152 municipalities of Ceará, and benefiting approximately 5.6 million residents.

2.1. Adaptation Measures

CAGECE operates in a semi-arid climate, which directly affects water supply due to irregular rainfall. Climate change exacerbates these challenges, altering the region's typical characteristics and intensifying drought periods.

To manage these risks, CAGECE mobilizes large **water security projects** such as the São Francisco River Transposition, the Water Belt, and a Desalination Plant. Additionally, it partners with universities and research centers to develop technological innovations. These initiatives aim to ensure continuous water supply even during critical drought periods.

In addition to these large projects, the utility undertakes daily **actions to combat water losses**. One of the most relevant projects for reducing losses at CAGECE is the implementation of Measurement and Control Districts (MCDs), which subdivide hydraulic sectors into smaller areas for more precise management of pressure and water flow. This allows for quick detection of problems and efficient consumption control, resulting in a significant reduction in water losses. The project is considered one of the best practices in loss management in the Brazilian water sector.

Reducing water losses is a strategic priority for CAGECE. The short-term goal is to reduce losses to 31.38% by 2026, with investments of 1.1 billion reais. By 2034, the utility aims to achieve a rate of 25%, in line with the guidelines of the Ministry of Regional Development, representing a significant reduction in water losses in the state.

2.2. Mitigation Measures

2.2.1 Greenhouse Gas (GHG) Emissions Inventory

Committed to sustainability, CAGECE prepares its Greenhouse Gas (GHG) Emissions Inventory, covering the operations of its administrative headquarters and 274 Wastewater Treatment Plants (WWTPs), using the guidelines of the Brazilian GHG Protocol Program and ISO 14064-1. This strategic tool enables the utility to monitor its emissions, identify opportunities for mitigating climate impacts, and set corporate sustainability goals, ensuring more efficient management of environmental risks.

2.2.2. Energy and Energy Efficiency

CAGECE adopts a diversified energy matrix, aligned with the Sustainable Development Goals (SDGs). In 2022, the utility purchased **40% of its energy from renewable sources** in the Free Energy Market, generating savings of 16 million reais. Additionally, the utility has a solar plant that meets the administrative headquarters' demands.

Renewable energy, such as solar, is expanding, with the goal of reaching 20% of total consumption by 2024. CAGECE is also investing in biogas projects generated from the sludge of the Wastewater Treatment Plants (WWTPs) and plans to implement electric vehicles in its fleet, reinforcing its commitment to clean energy use.

2.2.3. Waste Management

CAGECE follows the guidelines of the National Solid Waste Plan (PNRS), with actions such as selective waste collection, reverse logistics, and support for waste picker cooperatives.

In this context, it is important to note that the sludge generated in Wastewater Treatment Plants (WWTPs) is a source of methane, a highly polluting greenhouse gas (GHG). Therefore, CAGECE has invested in initiatives to give this waste a more sustainable destination. One prominent project is the Biogas and Sludge Energy Beneficiation Model Plant, in partnership with the Federal University of Ceará (UFC), which will **use sludge from wastewater treatment to generate biogas**, increasing the share of renewable energy in CAGECE's energy matrix. The utility is also developing research in partnership with the State University of Ceará (UECE) on using sludge as biomass in the production of bio-oil and sustainable energy, contributing to the diversification of the utility's energy matrix and reducing pollutant emissions.

2.3. Climate Empowerment Actions

CAGECE’s strategy is based on innovation and sustainability, with actions aligned with the Sustainable Development Goals (SDGs), particularly SDG 06 – Clean Water and Wastewater treatment for all. In 2022, the utility created the ESG Committee to manage sustainable projects and policies. The new Environmental Policy, also from 2022, focuses on seven main areas, including waste management, efficient use of water and energy, and the reduction of GHG emissions.

CAGECE actively participates in committees, councils, and associations and is a member of 17 councils and committees for the management of Environmental Protection Areas in Ceará, contributing to discussions and projects focused on sustainability. The utility was recognized with the Green Seal for Socio-environmental Action and the Chico Mendes Socio-environmental Award, a certification granted by the Chico Mendes Institute through the Reciclocidades program, a project that provides training to citizens to turn recyclable materials into marketable products. CAGECE also runs environmental education projects such as the “Puppet Theater,” which focuses on raising children’s awareness of environmental causes. Additionally, the utility is a **signatory of the UN Global Compact**.



Images: Puppet Theater and Reciclocidades Project - Source: CAGECE Website

3. Empresa Baiana de Águas e Saneamento S.A (EMBASA)

The Water Utility of the State of Bahia (EMBASA) is a mixed-capital corporation, whose majority shareholder is the Government of the State of Bahia. The utility operates in 368 out of 417 municipalities in Bahia, serving about 9.7 million people.

3.1. Adaptation Measures

Bahia has been severely impacted by the climate crisis, with extreme events such as heavy rains and historic droughts. In response to this scenario, EMBASA shows its commitment to addressing climate change and environmental preservation by developing initiatives that can be classified into mitigation actions, adaptation actions, and other climate empowerment actions.

3.1.1. Addressing Floods

In 2022, 165 municipalities declared a state of emergency due to floods that caused small dams to break. EMBASA took immediate measures, such as installing emergency pumps, initiating new water capture projects, and redirecting water from affected rivers.

3.1.2. Addressing Droughts

During drought periods, adaptations were implemented, such as replacing damaged equipment, using water trucks, and adjusting water treatment processes. In addition, the protection of water sources is an important focus, leading to the implementation of a **Water Source Protection Plan** to ensure the security of water resources.

In 2022, a comprehensive study was conducted on the hydrological situation of surface water sources, assessing drainage basins and hydrological monitoring networks, which enables better **planning to face extreme events like droughts and floods**.

EMBASA also works to **minimize water loss and ensure efficient supply**. Through the Corporate Water Loss Reduction and Control Program (PRCP), the utility replaced old water meters and intensified the management of pressure and leaks in the distribution network, preventing waste and reducing environmental impact. Finally, EMBASA has an Emergency and Contingency Plan (PEC) and Guidelines for Developing Contingency Plans for climate crises.

3.2. Mitigation Measures

3.2.1. GHG Emissions Inventory

The utility conducts an annual emissions inventory using the GHG Protocol methodology, aiming to identify and monitor its emissions and implement corrective actions.

3.2.2. Energy and Energy Efficiency

In 2022, EMBASA reached **20% renewable energy consumption**. Starting in 2024, EMBASA will operate with 60% of its energy consumption coming from renewable sources, with the **goal of reaching 100% by 2026**. This commitment ensures the utility's energy sustainability and contributes significantly to reducing greenhouse gas (GHG) emissions associated with energy consumption. It is important to note that the transition to the Free Energy Market generated savings of 50.4 million reais, in addition to directly contributing to climate impact mitigation.

3.2.3. Waste Management

As part of its Socio-environmental Management Program, EMBASA has implemented a Solid Waste Management Plan (PGRS) focused on sustainable waste management. For example, the **sludge generated from effluent treatment is recycled** to re-enter the economic cycle. Although regulations require sludge to be sent to licensed landfills, effective management enables the reuse of water extracted during the drying process for irrigation. Additionally, the sludge can be applied as fertilizer, promoting a circular economy and **reducing greenhouse gas (GHG) emissions, such as methane**.

3.3. Climate Empowerment Actions

In 2022, EMBASA promoted **environmental education** initiatives that **involved 43,421 people** in 29 municipalities, through collaboration with Civil Society Organizations (CSOs) and community leaders. The Environmental Education Program (PEA) focused on raising community awareness and involving society in natural resource management.

Another highly relevant program is “Se Ligue no Óleo”, which aims to prevent the improper disposal of cooking oil into the wastewater system, preventing blockages and contamination of water bodies. The program, launched in 2011, promotes the collection and reuse of oil in low-income communities, turning it into soap and biofuel, contributing to income generation and environmental preservation.

EMBASA contributes to the strengthening of public policies by actively participating in the **State Water Resources Council**, as well as in two federal basin committees, with emphasis on the São Francisco River Basin Committee, and in 14 **Water Basin Committees** across the state of Bahia.

These collaborations are essential for the governance and sustainable management of water resources, ensuring the preservation of water sources and the sustainability of water supply and wastewater treatment services.

4. Companhia de Água e Esgotos da Paraíba (CAGEPA)

The Water Utility of the State of Paraíba (CAGEPA) is a mixed-capital corporation that operates in the state of Paraíba, serving 224 locations, including 200 municipalities and 24 districts and villages. Currently, it serves an urban population of 2,789,463 people with water supply services and 1,177,816 with wastewater services.

The utility has jurisdiction over two distinct biomes in the state: the semi-arid Caatinga and the Atlantic Forest. Most of the territory, especially in semi-arid areas, is located in the Caatinga, while the coast is part of the Atlantic Forest. CAGEPA plays an important role in the management and conservation of water resources, operating several water and wastewater treatment plants, and partnering with local and federal agencies to ensure environmental sustainability and meet the population's demands.



Image: Cagepa — Foto: Érica Ribeiro/G1

4.1. Adaptation Measures

4.1.1. Water Resource Management

CAGEPA's participation in River Basin Committees and the State Water Resources Council is essential to ensuring collaborative and strategic management of water sources, especially in the semi-arid regions of Paraíba,

where **water scarcity is a constant concern**. These committees facilitate interaction between different sectors, such as the government, users, and organized civil society, promoting an **integrated approach to water resource management**. The utility also continuously monitors river basins in partnership with these agencies, focusing on both the quantity and quality of water.

CAGEPA continuously implements **measures to combat water losses**, focusing on the identification, control, and reduction of leaks and fraud. This control is especially important in semi-arid regions, where water scarcity is one of the major challenges faced by the population, and the region is becoming definitively arid due to the effects of climate change.

The utility conducts regular inspections of networks and pipelines to quickly identify and repair leaks, using specialized equipment such as continuous pressure meters. In 2021, the utility acquired 200 such pieces of equipment, with plans to expand this infrastructure in 2022, with the purchase of an additional 1,000 units. Furthermore, to contribute to reducing the water loss rate, the utility constantly updates its fleet of water meters and conducts studies to acquire new technologies aimed at modernizing the reading and inspection system.

Additionally, the automation of distribution networks plays a crucial role in the efficiency of the water supply system. By using drones and other remote monitoring technologies, CAGEPA can identify critical areas and optimize repairs and maintenance. The utility also uses performance contracts to combat commercial losses, especially in the metropolitan region of João Pessoa, encouraging the achievement of water loss reduction targets and the improvement of service quality.

All these initiatives and investments are directly reflected in the pursuit of better use of water resources in the current climate change scenario, aligning with the Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Wastewater) and SDG 13 (Climate Action).

4.1.2. Automation and Technological Innovation

The automation of water supply and wastewater systems is another important measure adopted by CAGEPA to mitigate the effects of climate change. The utility has been implementing Supervisory Control and Data Acquisition (SCADA) systems to monitor the operations of treatment plants and distribution networks in real time. This technology, in addition to reducing water waste, improves energy efficiency and ensures that water services are carried out more sustainably and economically.

Moreover, the use of drones to monitor hard-to-reach areas, such as aqueducts and treatment plants, allows the utility to identify problems before they become critical, thus reducing response time and operational costs. Automation also facilitates the collection of accurate data, which is essential for effective water resource management and strategic decision-making in mitigating environmental impacts.

4.1.3. Expansion and Modernization of the Wastewater Systems

CAGEPA is constantly investing in the modernization and expansion of its wastewater infrastructure. These works are essential to reduce the pollution of water bodies and mitigate the environmental impacts in urban areas. Recently, the utility implemented improvements in wastewater networks in cities such as João Pessoa, Campina Grande, and Monteiro, among others. This process includes the reorganization of wastewater transportation and the expansion of treatment plants, ensuring greater efficiency in wastewater treatment.

These improvements also reflect the utility's commitment to environmental protection, as proper wastewater treatment prevents the contamination of rivers and streams by organic and pathogenic waste. Furthermore, CAGEPA strictly follows the quality parameters established by environmental legislation to ensure that treated wastewater can be used sustainably, including in agricultural practices.

4.2. Mitigation Measures

4.2.1. Energy Transition and Energy Efficiency

The transition to the Free Energy Market, a recent initiative by CAGEPA, already covers **66% of the total energy consumed coming from renewable sources**. By 2025, the utility aims to expand this model to an additional 60 units, making energy consumption even more sustainable. Additionally, the utility has built five solar power plants at its main energy-consuming units, representing significant progress in reducing its carbon footprint. Furthermore, investment in replacing old and inefficient equipment has increased CAGEPA's energy efficiency, reducing waste and optimizing resource use. The adoption of automation practices in water and wastewater distribution systems also plays a crucial role in improving the utility's operational efficiency.

4.3. Climate Empowerment Actions

4.3.1. Environmental Education and Awareness

CAGEPA develops a series of educational initiatives aimed at raising public awareness about the importance of preserving natural resources and the conscious use of water. These initiatives include lectures in schools,

recycling and composting workshops, and awareness campaigns such as the “Verão CAGEPA” project, which encourages responsible water use during periods of higher consumption. The utility is also implementing custom vans equipped with interactive tools to support environmental education throughout the state.

These activities are not only aimed at the external public but also at CAGEPA employees, who act as multipliers of sustainability concepts within their communities.

4.3.2. Riparian Forest Recovery Program

CAGEPA has a nursery that directly contributes to the recovery of riparian vegetation in areas surrounding water sources. This program not only helps preserve water bodies but also plays an important role in restoring degraded ecosystems. Riparian forests are essential for protecting water sources, as they help prevent erosion and improve water infiltration into the soil, ensuring aquifer recharge.

The production of seedlings is a continuous and strategic action to combat the effects of environmental degradation and climate change. In Campina Grande, the utility’s forest nursery produced up to **1,200 seedlings per month**, with most destined for the reforestation of the riparian forest of the Boqueirão Reservoir. In addition to supplying seedlings for vegetation restoration, the “Oito Verde” environmental project contributes to preserving local biodiversity and maintaining the quality of water supplied by CAGEPA.

4.3.3. Networks and Partnerships for Climate Change

CAGEPA participates in several networks and councils focused on the sustainable management of water resources. CAGEPA is an active member of **River Basin Committees**, where important actions for the state’s water security are discussed and deliberated. These committees include representatives from the government, organized civil society, and water resource users, promoting collaborative management of water sources. The utility also participates in the **State Water Resources Council**, which is responsible for deliberating on policies and strategies to combat scarcity, focusing on the preservation of water sources.

Moreover, CAGEPA collaborates with other institutions, such as the Executive Water Management Agency (AESAs) and the National Water Agency (ANA), for the strategic management of Paraíba’s water resources. These partnerships enable an integrated and effective approach to managing water sources, especially in regions of the state affected by extreme climate conditions, such as severe droughts.

The Southeastern Region of Brazil

5. Companhia Estadual de Águas e Esgotos do Rio de Janeiro (CEDAE)

The Water Utility of the State of Rio de Janeiro (CEDAE) is the main responsible for the water supply of the State of Rio de Janeiro, serving a population of approximately 9 million people. The utility stands out for its commitment to environmental preservation and addressing climate change, developing projects focused on sustainability, with an emphasis on efficient water resource management, reducing greenhouse gas emissions, and environmental recovery initiatives.

5.1. Adaptation Measures

The climate crisis has caused significant impacts on CEDAE's operations, affecting water quality and availability. The main challenges include the emergence of cyanobacteria caused by elevated water temperatures, compromising its quality; torrential rains that cause water treatment plants to be interrupted due to increased water turbidity; and prolonged droughts, which directly affect water capture and distribution to the population.

To address these challenges, CEDAE has adopted several adaptation measures, such as implementing new water capture methods using floating structures with barges, installing new pumping structures to ensure supply during drought periods, and using chemical products to control cyanobacteria at water sources. Additionally, the utility is planning to create an **Adaptation Plan** to proactively deal with the challenges posed by climate change.

5.2. Mitigation Measures

5.2.1. Energy and Energy Efficiency

At the end of 2022, CEDAE transitioned to the Free Energy Market, seeking cleaner and **renewable energy sources**. This transition aims to reduce energy costs and greenhouse gas (GHG) emissions, aligning with best sustainability and energy efficiency practices.

5.2.2. Waste Management

CEDAE has invested in sustainable waste management, focusing on the Wastewater Sludge Forest Recycling Project, which promotes the **use of treated wastewater sludge for forest recovery purposes**. This initiative

contributes to responsible sludge management, reducing environmental impact, and integrating the waste sustainably into the economic cycle, while minimizing the generation of pollutants, such as methane. This project was a finalist in the 9th edition of the Green Awards, the largest socio-environmental award in Ibero-America, held in partnership with the United Nations Development Programme (UNDP).

5.3. Climate Empowerment Actions

CEDAE invests heavily in environmental education, with programs like Cine Ambiental, which promotes environmental awareness in schools and communities. In 2022, CEDAE consolidated strategic partnerships, collaborating with municipal environmental departments, environmental NGOs, and rural producers focused on protecting and recovering water sources.

CEDAE is also part of important groups and committees, such as the Paraíba do Sul Hydraulic System Operations Monitoring Group (GAOPS), the Permanent Monitoring Working Group for Hydraulic Operations in the Paraíba do Sul River Basin (GTAOH), and the Guandu River Basin Committee, reinforcing its commitment to the responsible and sustainable management of water resources. In addition, CEDAE is a **signatory to the UN Global Compact**, reaffirming its commitment to the Sustainable Development Goals (SDGs).

5.3.1. Replantando Vida Project

Replantando Vida is a socio-environmental initiative promoted by CEDAE aimed at the rehabilitation of inmates from the prison system of the State of Rio de Janeiro, offering professional training, income generation, and social inclusion, while also contributing to environmental protection. One of the program's central activities is seedling production and planting for forest restoration, focusing on the recovery and protection of springs and riparian forests, with **4.5 million seedlings already planted, restoring a total of 2,000 hectares of green areas.**

The project has received 26 national and international awards, establishing its credibility as one of Brazil's leading socio-environmental projects. Below are some of the results achieved:

- 600 inmates currently work in the program, and more than 6,000 people have participated in Replantando Vida;
- Production of seedlings from 254 native species of the Atlantic Forest, including 40 endangered species;

- Nurseries capable of producing nearly 2 million seedlings per year;
- 7 forest nurseries maintained in the Rio Metropolitan Region and 2 new nurseries under construction in the interior, benefiting the Paraíba do Sul River Basin;
- Continuous reforestation work on the banks of the Guandu River, which supplies more than 10 million people in the Rio Metropolitan Region, and on the Macacu River, which supplies more than 2 million through the Imunana-Laranjal System;
- The Tinguá-Bocaina Corridor Forest Restoration Program aims to restore more than 30,000 hectares of forest in an area that spans nine municipalities in Rio de Janeiro by 2050.

With these results, Replantando Vida has established itself as a prime example of the integration between environmental sustainability and social responsibility, aligning CEDAE's efforts with the Sustainable Development Goals (SDGs).



Image: Replantando Vida Project - Source: CADAE's Website.

6. Companhia Espírito-Santense de Saneamento (CESAN)

The Water Utility of the State of Espírito Santo (CESAN) is a public mixed-capital corporation, headquartered in Vitória, Espírito Santo. The Government of the State of Espírito Santo is the majority shareholder, holding 99.8% of the shares. CESAN operates in water catchment, treatment, and distribution, as well as in wastewater collection and treatment in 53 out of 78 municipalities in the state, covering 73% of the population of Espírito Santo.

The utility operates predominantly in regions of the Atlantic Forest, providing essential services for environmental preservation and public health. With a vision aimed at achieving universal water services by 2030, CESAN continuously conducts studies, projects, and expands its infrastructure, seeking to improve the quality of life for the population of Espírito Santo.



Image: The volume of wastewater treated by the Utility in the year exceeded 72 million cubic meters.

Source: 2022 Management Report, CESAN.

6.1. Adaptation Measures

6.1.1. Water Resource Management

CESAN actively participates in the strategic management of water resources in Espírito Santo, especially during extreme climate events, such as droughts and floods. The **Water Crisis Management Committee**, of which CESAN is a member, is activated whenever there is a risk of water scarcity or excess. The utility has also implemented projects to improve its ability to respond to these events, which include the relocation of water captures and the adaptation of technologies to deal with increased water turbidity, a common phenomenon during periods of intense rain.

The utility has faced challenges such as the suspension of water captures due to the reduction of water levels or salinity at certain times of the year. Additionally, during drought situations, CESAN also deals with water resource shortages, which directly impact its water supply and the operation of treatment plants.

6.1.2. Infrastructure Adaptation

CESAN had to adapt its infrastructure in response to changes in the quality of the captured water. The increased turbidity of water sources caused by climate events led to the need for adjustments in water treatment, with greater use of chemical products. Additionally, the utility reported that concentrated rains, such as those in 2024 in the southern part of the state, resulted in the flooding of a newly constructed wastewater treatment plant, causing financial and environmental impacts, as well as delays in the project's completion.

6.1.3. Degraded Area Recovery

CESAN undertakes actions to **recover degraded areas** to meet environmental requirements, with the aim of restoring Permanent Preservation Areas, contributing to water conservation, strengthening soil protection, and enhancing forest biodiversity. The areas managed until 2022 totaled **167,000 square meters**, spread across six municipalities (Montanha, Dores do Rio Preto, Conceição do Castelo, Santa Leopoldina, Domingos Martins, and Vila Velha), in addition to actions in the restinga area of the Paulo César Vinha State Park, as part of the Degraded Area Recovery Plans.

6.2. Climate Empowerment Actions

6.2.1. Environmental Education and Awareness

CESAN develops a continuous environmental education program, focused on raising public awareness about the sustainable use of water resources and the importance of environmental preservation. The utility organizes guided visits to water and wastewater treatment plants and conducts educational events in schools as part of campaigns related to World Water Day and World Environment Day. In 2022, these activities involved students from dozens of municipalities, aiming to educate children and young people about water conservation.

Additionally, CESAN also engages its employees and their families in environmental awareness activities, such as ecological walks and guided visits to treatment plants. This aims to transform them into multipliers of sustainability, promoting a culture of preservation both within and outside the workplace.

CESAN also develops programs and projects to provide guidance on the use and conservation of water and wastewater systems, strengthen dialogue, and foster closer relationships with communities. This work encompasses social communication, community mobilization, and environmental education efforts.

In 2022, the utility held the Community Leadership Meeting, with the participation of over 200 leaders from Greater Vitória. During the event, utility projects and programs were discussed, as well as strategies to improve communication with the public about the importance of water services.

Finally, CESAN collaborates with various institutions, such as the Public Prosecutor's Office, and participates in water resource councils and committees. These partnerships help the utility maintain a high standard of environmental management and ensure that its operations align with sustainability goals.



Image: CESAN meets with community leaders to share its work and identify demands and needs.

Source: 2022 Management Report, CESAN.

6.2.2. Partnerships and Affiliations Related to Climate Change

CESAN is part of the Espírito Santo State **Water Crisis Management Committee**, which is activated in risk situations such as droughts and floods. Additionally, the utility has a technical cooperation agreement with other state agencies, such as the State Water Resources Agency, the Capixaba Institute for Research, and the Fire Department, to monitor water resources and provide data for strategic decisions. CESAN also participates in the hydrological monitoring of the Rio Bonito Small Hydroelectric Plant, ensuring water level control in reservoirs used for supply.

The utility is hiring a specialized consultancy to study climate change and identify risks and opportunities that may impact its operations. CESAN's participation in forums and councils related to water resource management demonstrates its commitment to adapting to and mitigating the effects of climate change.

The Southern Region of Brazil

7. Companhia Riograndense de Saneamento (CORSAN)

The Water Utility of the State of Rio Grande do Sul (CORSAN) is a mixed-capital corporation that serves approximately 6.5 million people in 317 municipalities in Rio Grande do Sul. The utility is committed to addressing environmental and climate challenges through various initiatives, which can be classified as mitigation actions, adaptation actions, and other climate empowerment actions.

7.1. Adaptation Measures

7.1.1. Addressing Floods

In 2024, the State of Rio Grande do Sul was severely affected by increased rainfall, which caused floods in 90% of the territory, resulting in the interruption of water supply in several regions. To mitigate these impacts, CORSAN adopted measures such as modifying water capture systems and replacing electric pumping panels, ensuring greater resilience in operations. In addition, the utility has an **Emergency and Contingency Plan** in each unit, allowing for faster and more efficient responses to critical situations.

7.1.2. Addressing Droughts

In 2021, as part of its actions to mitigate the impacts of water shortages due to climate change, CORSAN, with the support of International Finance Corporation (IFC) and World Bank, began developing the **Water Security Plan**. This plan aims to analyze the 25 river basins within CORSAN's area of operation to ensure water supply security in adequate quantity and quality, even in the face of extreme climate events.

Furthermore, CORSAN made significant improvements to its distribution infrastructure. It replaced 130.02 km of water distribution networks to modernize the system and reduce losses caused by leaks and pipeline wear, improving the efficiency of water resources. Additionally, the utility drilled 85 new wells and restored 80 existing wells to increase water capture and supply capacity. In many regions, the installation of supplementary pumps was necessary to enhance the raw water supply to the system, along with adaptations in the water treatment process. CORSAN has also been working to reduce water losses from 43% to 35% by 2024.

7.2. Mitigation Measures

7.2.1. GHG Emissions Inventory

CORSAN also adopts monitoring practices to ensure transparency and efficiency in managing its greenhouse gas emissions. The utility uses the GHG Protocol methodology to conduct its annual emissions inventory, which identifies and quantifies the GHGs generated by its operations.

7.2.2. Energy and Energy Efficiency

CORSAN has invested in renewable energy sources, such as hydroelectric, solar, and wind power, to improve the energy efficiency of its processes and reduce greenhouse gas (GHG) emissions associated with the high energy consumption in the water sector. In 2021, 93% of the energy contracted in the Free Energy Market came from renewable sources, generating savings of R\$ 51 million, while also significantly reducing GHG emissions. The utility is also developing projects for its own renewable energy generation, such as micro-hydroelectric plants and floating photovoltaic units, reinforcing its commitment to sustainability and mitigating environmental impacts.

7.2.3. Waste and Effluent Management

In 2021, CORSAN signed a contract with the National Service for Industrial Training (SENAI) to assist in defining the guidelines and strategies for managing solid waste generated in its units. SENAI contributed to the creation of standards covering everything from identification to the environmentally appropriate disposal of waste, in accordance with the National and State Solid Waste Policies.

Along the same lines, CORSAN is committed to reducing greenhouse gas (GHG) emissions, such as methane, from wastewater treatment, especially sludge, which is the primary waste generated by its operations. To address this, the utility created the **Sludge Working Group**, which establishes rules and prioritizes the development of new technologies for sludge drying. Additionally, CORSAN launched the **Strategic Sludge Management Project**, which seeks technological alternatives for dewatering and the appropriate disposal of this waste, avoiding landfilling and the consequent generation of methane. In partnership with the Brazilian Agricultural Research Corporation (EMBRAPA), CORSAN funds research dedicated to the use of sludge in agricultural soils, promoting sustainable disposal and contributing to the mitigation of GHG emissions.

7.3. Climate Empowerment Actions

In 2021, CORSAN intensified its environmental education efforts, promoting **740 activities that reached approximately 30,000 people**. One example of these actions is the H2OJE program, which was created to disseminate a culture of sustainability among children and adults, with games, educational materials, and animated series, as well as in-person and online activities.

Furthermore, **CORSAN actively participates in 25 River Basin Committees in Rio Grande do Sul**, with direct representation in decisions related to water planning and management. The utility has also formed strategic partnerships with the Public Prosecutor’s Office of Rio Grande do Sul for the conservation of springs and water sources.

In 2021, CORSAN became the first utility in Latin America to join the Utilities for Climate (U4C) program of the International Finance Corporation (IFC), reinforcing its commitment to sustainability through a loan totaling R\$ 300 million aimed at reducing water losses and improving energy efficiency. Additionally, CORSAN committed to the IFC to implement a rigorous Social and Environmental Action Plan, setting goals for adapting to best environmental, social, and corporate governance practices.

Finally, due to its strategic ESG agenda, CORSAN has excelled in green financial operations, with a positive impact on the availability and cost of capital. The utility is now part of the **Inter-American Development Bank’s (IDB) Sustainable Bonds Transparency Platform**, which gathers data on projects financed by “green bonds” and “sustainable bonds” in Latin America and the Caribbean.



Images: Environmental Education Actions - Source: 2021 Sustainability Report - CORSAN.



Image: H2OJE Project - Source: H2OJE's website.

8. Companhia Catarinense de Águas e Saneamento (CASAN)

The Water Utility of the State of Santa Catarina (CASAN) is a public company responsible for providing water supply and wastewater services in the State of Santa Catarina. The utility serves 194 municipalities, including one in the state of Paraná, and operates in various biomes, such as the Atlantic Forest, Pampa, and Araucaria forests. These geographical characteristics make CASAN play a crucial role in managing water resources and preserving the environment in these areas.

8.1. Adaptation Measures

8.1.1. Water Resource Management

CASAN participates in shared water resource management systems, in partnership with agencies such as the Civil Defense, which collects data on water sources and publishes hydrometeorological bulletins to help combat water scarcity. These partnerships are essential to ensure that the utility continuously monitors the water situation and prepares for extreme climate events, such as droughts that severely affected the state of Santa Catarina between 2019 and 2021.

Additionally, CASAN implements emergency protocols, such as identifying emergency water sources and using water trucks to ensure water supply during critical periods. The utility has also invested in water transposition and the leasing of ponds, as well as modernizing its catchment infrastructure to withstand greater climate variability.

8.1.2. Reducing Water Losses

CASAN has invested in controlling and reducing water losses in its distribution networks. One of the main measures adopted was the replacement of water meters and the fight against water connection fraud. Additionally, the utility installed macro meters to monitor the volumes of treated and raw water, implementing Measurement and Control Districts to sectorize areas and improve control.

Active leak detection, using geophones, and the preventive replacement of pipelines in key cities such as Florianópolis and Criciúma are also part of CASAN's plan to mitigate losses. These actions aim to increase the efficiency of water resource use and reduce waste, which is essential for the sustainability of operations.

8.1.3. Infrastructure Adaptation

To cope with the direct effects of climate change, CASAN has adjusted its infrastructure, particularly in terms of water treatment. With increased water turbidity, the utility has increased the use of chemical products to ensure water potability. The modernization of capture and treatment structures also included the use of more advanced technologies to withstand extreme climate events.

The utility is continuously reviewing its practices and infrastructure, hiring experts to assess medium- and long-term climate risks. These studies aim to ensure water security for the population served, through investments in more resilient technologies and infrastructures.

8.2. Mitigation Measures

8.2.1. Energy Efficiency and Renewable Sources

CASAN is in the process of transitioning to the Free Energy Market, focusing on renewable sources. Currently, 9% of the energy used by the utility already comes from sources such as solar and wind power, and its first photovoltaic plant is expected to begin operation in 2024. This plant is projected to supply 45% of the energy consumed by the Water Treatment Plant in Palhoça.

To reduce energy consumption in its operations, CASAN is also investing in the installation of pressure-reducing valves and pumping modulation systems. These measures help reduce greenhouse gas (GHG) emissions and increase energy efficiency, reducing the reliance on fossil fuel sources.

8.2.2. Greenhouse Gas Management

CASAN prepared its first Greenhouse Gas (GHG) emissions inventory based on the Brazilian GHG Protocol Program, using the average from 2021 to 2023 as the starting point for setting future targets. The utility's emissions are classified into three scopes: scope 1 (direct emissions, such as from wastewater treatment), scope 2 (indirect emissions from energy acquisition), and scope 3 (additional indirect emissions, such as waste transportation).

The greatest impact comes from wastewater treatment operations, which are responsible for 75% of CASAN's GHG emissions. To reduce this impact, the utility uses **automatic biogas burners**, which reduced approximately 6,912 tons of CO₂ equivalent in emissions. The acquisition of renewable electricity has also contrib-

uted to mitigating emissions associated with energy consumption, although the exact quantification of this reduction has not yet been included in the first inventory.

8.3. Climate Empowerment Actions

8.3.1. Environmental Education and Awareness

CASAN has a robust environmental education program that promotes actions aimed at raising public awareness about the importance of the conscious use of natural resources, especially water. In 2023, the program held **267 activities**, including visits to water and wastewater treatment plants, lectures, and educational workshops. **These actions reached over 10,000 people**, strengthening the utility’s commitment to education and environmental preservation.

In addition to activities aimed at the external public, CASAN trains its own employees to act as environmental multipliers, spreading knowledge about sustainable practices to the communities served. In 2023, the utility held the third Environmental Multipliers Meeting, involving around 50 employees.



Images: Environmental Multipliers in different actions. Source: 2023 Sustainability Report, CASAN.

8.3.2. Partnerships and Environmental Projects

CASAN participates in important projects for the recovery and preservation of water sources. One example is the “Riparian Forest Project,” which since 2006 has invested in the conservation of permanent preservation areas in public water supply sources, in partnership with the Iberê Consortium. In 2023, **the project recovered 6,852 hectares of spring and watercourse areas** in various municipalities in western Santa Catarina.

8.3.3. Water Producer Project of the Rio Cubatão

Since 2022, CASAN, in cooperation with the State of Santa Catarina, has been implementing the Water Producer Project in the Rio Cubatão watershed. The project aims to conserve water sources and maintain ecosystem services, especially ensuring water quality and supply. In 2023, efforts focused on developing instruments and methodologies for project implementation, including strategic planning with watershed diagnostics and the identification of priority areas for intervention.

In addition, the Cubatão Payment for Environmental Services program was officially launched, with the support of various institutions, including the Watershed Committee. The project provides for the creation of a tariff component to fund investments necessary for the recovery and maintenance of ecosystem services. This funding will be directed to environmental preservation actions, with the goal of ensuring the sustainability of the region's water supply.



Image: Infrastructure for expanding water collection in the Cubatão River. Source: CASAN website.

8.3.4. Other Environmental Actions

In addition to the aforementioned projects, CASAN collaborates in various environmental preservation initia-



tives, such as the “Riparian Forest Project,” which aims to isolate and recover permanent preservation areas in water sources, in partnership with the Iberê Consortium. Finally, the utility is also developing the “Cultivating Water Project” focused on conserving the Piçarras River Watershed.

9. Companhia de Saneamento do Paraná (SANEPAR)

The Water Utility of the State of Paraná (SANEPAR) was established in 1963 with the mission of providing high-quality basic water services to the population of the State of Paraná. The utility is a mixed-capital corporation controlled by the State of Paraná and serves 344 municipalities in Paraná and one in the state of Santa Catarina (Porto União). SANEPAR stands out as one of the leading utilities in the sector in Brazil, with operations covering water catchment, treatment, and distribution, in addition to wastewater collection and treatment, and solid urban waste management in seven municipalities.

The utility's goal is to provide basic water services, including executing projects and works to expand its service networks. As a **signatory to the Global Compact**, which outlines the 17 Sustainable Development Goals (SDGs), SANEPAR focuses on maintaining innovation and sustainability as pillars of its corporate strategy, using cutting-edge technologies to ensure operational efficiency and environmental preservation.



Image: Solar Energy Panels at Passaúna Catchment – Photographer Luis Henrique Novak. Source: 2021 Sustainability Report, SANEPAR.

9.1. Adaptation Measures

9.1.1. Water Resource Management and Addressing Scarcity

SANEPAR actively participates in shared water resource management, promoting water conservation actions in watersheds and water sources used for public supply. This involvement is critical to addressing water scarcity, which has become more frequent and severe due to climate change. The utility experienced direct impacts during the 2020-2021 water crisis, especially in the Curitiba Metropolitan Region (RMC), and implemented a series of adaptation measures to ensure water security and supply continuity.

Among the adaptation actions, SANEPAR contracted an environmental and hydrometeorological monitoring service in partnership with the Environmental Monitoring and Technology System of Paraná. This contract provides for **real-time monitoring of the water sources** used by SANEPAR, allowing for the prediction of droughts and floods and the **adoption of preventive measures**. This system was integrated into Infohidro, a strategic planning platform that offers precipitation and water flow forecasts for up to seven months.

9.1.2. Infrastructure Adaptation

The utility has also made **adaptations to its infrastructure to cope with extreme weather events, such as floods and droughts**. An example is the city of Maringá, which suffered from a severe flood in 2016, forcing SANEPAR to modify the local water treatment plant, raising control panels, and installing submersible pumps. This type of adaptation makes the facilities more resilient to the impacts of climate change.

In addition, **SANEPAR is developing new projects that already consider the impacts of climate change**, such as rising temperatures and extreme variations in rainfall patterns. These new projects include public water sources that meet water security and resilience criteria, ensuring a greater capacity to cope with the consequences of climate change.

9.2. Mitigation Measures

9.2.1. Greenhouse Gas Emissions Inventory

Since 2010, SANEPAR has prepared its Greenhouse Gas (GHG) Emissions Inventory using the methodology of the Brazilian GHG Protocol Program. This inventory includes the quantification and qualification of the utility's emissions and is a crucial tool for monitoring and reducing SANEPAR's climate impacts. In addition to the corporate inventory, SANEPAR also prepares the Regional Greenhouse Gas Mapping (MARGEE),

which identifies the main sources of emissions in its regional units and develops specific action plans for mitigation.

9.2.2. Renewable Energy and Biogas Use

SANEPAR has invested heavily in renewable energy, particularly in **generating energy from biogas produced in its wastewater treatment systems**. The utility uses high-efficiency burners and flare systems to burn the generated biogas, minimizing methane emissions, a potent greenhouse gas. Additionally, SANEPAR is conducting research to quantify and improve the energy use of biogas, including **studies on its potential for renewable hydrogen production**.

Another innovative project is the **floating solar power plant** installed in the Passaúna reservoir, which uses solar energy to power the local wastewater system. These projects reinforce SANEPAR's commitment to decarbonization and the transition to a low-carbon economy.



Image: ETE Ouro Verde Photovoltaic Panel - Photographer: Alexandre Moreno Lisboa. Source: 2021 Sustainability Report, SANEPAR.

9.2.3. Waste Management and Circular Economy

In the field of waste management, SANEPAR has stood out for its innovative **use of wastewater sludge in**

agriculture. Over the past three years, **more than 60,000 tons of sanitized sludge have been used to fertilize agricultural crops.** This practice promotes a circular economy and reduces the need to send waste to landfills, thereby lowering GHG emissions. Additionally, SANEPAR is investing in thermal sludge drying technologies, a sustainable process that uses biogas generated in treatment plants.

9.3. Climate Empowerment Actions

9.3.1. Environmental Education

SANEPAR develops a series of environmental education programs aimed at raising public awareness about the importance of preserving water resources and sustainability. The “Sustainability: From School to the River” project, for example, promotes continuous activities in schools, encouraging awareness about responsible water use and environmental preservation.

Another significant program is “Se Ligue na Rede” (“Get Connected to the Network”), which operates in watersheds where SANEPAR runs wastewater systems. This program integrates social, environmental, and financial aspects to ensure proper property connections to the sewer system, preventing river pollution and promoting public health. The program’s actions also include training local plumbers, creating opportunities for income generation and environmental awareness in the communities served.

9.3.2. Partnerships Focused on Climate Change

SANEPAR is strongly integrated into networks and forums focused on sustainability and water resource management. The utility is a member of several entities, including the National Water Resources Council, the State Water Resources Council, and various Federal and State Watershed Committees. These memberships reinforce SANEPAR’s commitment to the shared and strategic management of water sources, ensuring that its resources are used sustainably for both current and future generations.

SANEPAR is also involved in several Technical Chambers that address the protection of environmental areas and water sources, such as the Technical Chamber for the Passaúna and Iraí Environmental Protection Areas (APA). Additionally, **SANEPAR is part of the Paraná Climate Change Forum**, a strategic platform for discussing greenhouse gas emissions and preparing for future legal requirements. Internally, the utility has the Blue Fund, a financing program for environmental projects aimed at the conservation and recovery of watersheds. Finally, the utility is a **signatory to the Global Compact**, which outlines the 17 Sustainable Development Goals (SDGs) proposed by the United Nations.

The Midwestern Region of Brazil

10. Saneamento de Goiás S.A. (SANEAGO)

The Water Utility of the State of Goiás (SANEAGO) is a mixed-capital corporation present in 223 of the 246 municipalities in Goiás, including the state capital, Goiânia. Responsible for water supply and wastewater services, the utility has a strong commitment to sustainability and addressing climate change, which we will classify into mitigation actions, adaptation actions, and other climate empowerment actions.

10.1. Adaptation Measures

The climate crisis has brought increasingly intense challenges to the Goiás region, such as prolonged droughts, heat waves, intense rainfall, changes in the quality of raw water captured from water sources, and the risk of uncontrolled introduction of exotic plants and invasive species during dry months. In response, SANEAGO has implemented various actions to adapt to these impacts.

10.1.1. Water Security

Water security is one of the key pillars of SANEAGO's Sustainability Policy, focusing on ensuring adequate water supply in quantity and quality, especially in regions experiencing water stress. The utility develops initiatives to mitigate the impacts of climate change, such as implementing water allocation agreements and modernizing water capture and distribution infrastructures.

In this regard, in 2023, SANEAGO continued the execution of three contracts for well drilling, initiated in 2022, which include the drilling of 390 wells in three different lots.

10.1.2. Spring and Water Source Protection

SANEAGO develops **projects for spring recovery and water source protection**, supported by the CAIXA Socio-Environmental Fund. In 2023, **1,738,966 m² of areas were restored** in municipalities across Goiás. These projects involve the participation of the Utility for Technical Assistance and Rural Extension, the Public Prosecutor's Office, city halls, and rural producers, ensuring the sustainability of water resources through reforestation with native species and other conservation efforts.



Images: Spring Protection Actions - Source: SANEAGO Website

10.1.3. Reducing Water Losses

SANEAGO has a robust program to combat water losses in its distribution system. Among various actions is the development and use of the “Nighttime Minimum” tool, a water loss reduction technology that detects leaks in districts and enables repairs before customers file a complaint.

Additionally, the utility monitors the Management of the Technical Water Network Registry, which allows hydraulic simulations and proposes solutions such as modulation and the installation of pressure-reducing valves (PRVs), reducing network stress and extending its service life.

Thanks to these initiatives, SANEAGO is now one of the state-owned utilities with the lowest water wastage rate in the country. According to the 2022 report from the National Water and Wastewater Information System (SNIS), the utility is one of the few to maintain a **water loss rate below 30%, having achieved 25% in 2023**. The utility has also set a target to reduce the loss rate to 23% by 2028. Notably, Goiânia, the state capital, recorded a loss rate of only 12.77%, making it the best-performing capital in Brazil in this regard.

10.2. Mitigation Measures

In addition to adapting to climate impacts, SANEAGO has also been committed to mitigating greenhouse gas (GHG) emissions.

10.2.1. GHG Emissions Inventory

SANEAGO annually conducts its Greenhouse Gas (GHG) Emissions Inventory, an essential tool for monitoring and managing carbon emissions, allowing the utility to implement corrective and compensatory actions.

10.2.2. Energy and Energy Efficiency

SANEAGO has migrated to the Free Energy Market and expanded the use of renewable energy sources such as solar, wind, biomass, and Small Hydroelectric Plants (SHPs). In 2023, the utility acquired 101,330,487.27 kWh of clean energy, avoiding the emission of 15,199.5 tons of CO₂ and saving R\$ 18.8 million. The goal is to operate with 70 Consumer Units in the Free Contracting Environment, covering 53% of total energy consumption and reducing costs by 20% to 25% in the coming years, reinforcing the commitment to ESG practices.

10.2.3. Waste Management

SANEAGO has developed the Institutional Solid Waste Policy, which establishes guidelines for the proper management of solid waste generated in its operations. Implementation will begin in 2024, with a timeline aimed at covering all units in Goiânia and the Metropolitan Region by 2025. The expansion to the interior of the state will be gradual, with the goal of achieving full functionality in all utility units by 2033.

Additionally, it is important to note that in 2023, **approximately 95% of the sludge produced** (the main by-product of the industry) **was properly treated and donated to rural properties, totaling 49,186.94 tons used for soil enrichment**, benefiting eight farms over a combined area of approximately 925 hectares. This is excellent for reducing the emission of greenhouse gases, such as methane, produced during sludge decomposition.

10.3. Climate Empowerment Actions

10.3.1. Environmental Education

SANEAGO conducts a series of environmental education actions aimed at raising awareness in communities about the importance of preserving water resources and the impacts of climate change. A highlight is the “Banja and Sato” initiative, SANEAGO mascots that are part of an environmental awareness campaign designed to teach children the importance of saving water and protecting the environment.



Images: Environmental Education Actions - Source: SANEAGO Website

10.3.2. Engagement with Organizations and Initiatives

SANEAGO aligns itself with the United Nations Sustainable Development Goals (SDGs) and **participates in the Global Compact**. Additionally, the utility is part of the +Água Movement, which aims to ensure water security in Brazil. Moreover, SANEAGO has signed two negotiated water allocation agreements to mitigate the impacts of water scarcity in regions under water stress. These agreements were negotiated with two watershed committees and validated by the Goiás State Water Resources Council.

11. Companhia Ambiental de Saneamento do Distrito Federal (CAESB)

The Utility of Environmental and Water Services of Federal District (CAESB) is a public corporation responsible for providing basic water services in the National Capital District. Its mission is to ensure water supply and wastewater collection and treatment in a sustainable manner, preserving the environment and promoting public health. CAESB also aims to universalize its services, with ambitious goals to expand access to water services to the entire population of the Federal District and surrounding regions.

Additionally, CAESB maintains a vision focused on innovation and sustainability. The utility adopts modern environmental management practices, investing in technologies that optimize the use of water and energy resources. With a long-term focus, the utility is committed to aligning its operations with the United Nations Sustainable Development Goals (SDGs), particularly concerning wastewater and environmental preservation.

11.1. Adaptation Measures

11.1.1. Monitoring and Management of Water Resources Quality

CAESB has implemented a robust hydrological monitoring system with real-time data transmission to efficiently manage the watersheds under its responsibility, such as Pipiripau and Barroão. This system allows the utility to assess water availability and quality, supporting decision-making during water scarcity, especially in drought periods. In addition, CAESB conducts piezometric monitoring to assess the pressure and behavior of groundwater, complementing water resource management efforts.

A concrete example of CAESB's adaptation actions was the project to reverse water quality in Lake Paranoá. The utility used advanced monitoring technologies to ensure the quality and preservation of this essential resource for water supply and environmental balance in the region.



Image: Laboratory analysis. Source: CAESB Annual Management Report 2023.

11.1.2. Water Loss Control and Reduction

Another important adaptation effort by CAESB involves controlling and reducing water losses in its distribution system. The utility adopts technologies and strategies to reduce both real losses, such as leaks, and apparent losses, related to fraud and measurement errors.

In Sobradinho I, a pilot project focused on loss control resulted in significant water savings, demonstrating the feasibility and effectiveness of the utility's actions in this area.

CAESB also conducts strict inspection campaigns to identify and correct irregularities, such as meter fraud and illegal connections. The replacement of meters in critical areas is another action aimed at improving measurement accuracy and reducing water waste. These initiatives, in addition to reducing the environmental impact of operations, contribute to the utility's financial sustainability by optimizing the use of water and energy resources.

11.2. Mitigation Measures

11.2.1. Energy Efficiency

CAESB has invested in energy efficiency, one of the utility's main focuses to mitigate the impacts of climate change. The utility participates in Neoenergia's Energy Efficiency Program (PEE) to optimize electricity use in its facilities and contribute to environmental sustainability.

Additionally, technical visits were conducted focusing on national priorities such as biogas, decentralized systems, Nereda, and desalination. The goal is to invest in self-generation of photovoltaic and biogas energy and replace high-energy-consuming equipment in operational units with more modern alternatives.

These systems are implemented in Water Treatment Plants (WTP) and Wastewater Treatment Plants (WWTP) to reduce dependency on non-renewable energy sources and increase the utility's energy self-sufficiency.

Moreover, CAESB invests in modernizing its equipment, replacing high-energy-consuming machinery with more efficient alternatives. The migration of several operational units to the Free Energy Market is also underway, which will allow the utility to reduce energy costs and further decrease its greenhouse gas emissions. These measures reflect the utility's commitment to energy sustainability and reducing the impacts of climate change.

11.2.2. Waste Management

Waste management is another area where CAESB has adopted measures to mitigate climate change. The utility operates an efficient waste management system for the waste generated in its Water and Wastewater Treatment Plants, as well as in its laboratories.

Of particular note is the continuous review of the Waste Management Plan; improvements in the utility's recycling collection (which increased from eight units in 2022 to twenty-three in 2023), including training for cleaning service providers; and overseeing and executing contracts for the transportation and environmentally appropriate disposal of waste. In addition, approximately 30 tons of special waste generated in laboratories and water and wastewater treatment plants were disposed of over the course of the year.

11.3. Climate Empowerment Actions

11.3.1. Environmental Education

CAESB invests in environmental education as part of its climate empowerment strategies. Through educational campaigns, the utility seeks to raise public awareness about the importance of rational water use and the preservation of natural resources.

Additionally, the utility actively participates in public events and forums, where it shares its sustainable management practices and encourages discussions about solutions to environmental problems. The goal is to empower citizens and communities to adopt more sustainable practices in their daily lives, minimizing environmental impact and promoting a more sustainable future.

11.3.2. International Partnerships and Innovation

CAESB maintains international partnerships that strengthen its ability to address the challenges of climate change. An example is the international mission conducted in the Netherlands, organized by the Dutch Consulate in Brazil and the Brazilian Association of Regional Water Utilities (AESBE).

The primary objective of this mission was to establish direct contact between Brazilian utilities and Dutch experts, researchers, entrepreneurs, and authorities, promoting the latest innovations in wastewater. The mission also aimed to present innovative and sustainable solutions in the water sector, explore business opportunities, and establish partnerships for Research, Development, and Innovation (RDI) programs between interested utilities and NHL Stenden University of Applied Sciences.

11.3.3. Climate Change Networks and Partnerships

CAESB actively participates in various initiatives and partnerships related to climate change. The utility is a member of the Paranaíba River Watershed Committee, where it holds the vice-presidency, and also participates in the General Secretariat of the Paranaíba River Tributaries Committee in the Federal District. Both committees play a crucial role in the sustainable management of the region's water resources, particularly in the context of climate change, where it is essential to ensure the preservation and proper use of these resources.

Additionally, the utility is part of the Managing Unit of the Descoberto Water Producer Program, dedicated to conserving watersheds critical to water supply. CAESB also participates in the **Federal District Envi-**



ronmental Council (CONAM/DF), collaborating in discussions on environmental policies and stormwater management. These associations reflect the utility's commitment to sustainable practices and mitigating the environmental impacts of its operations.

The Northern Region of Brazil

12. BRK Ambiental

BRK Ambiental is one of the largest private wastewater utilities in Brazil, operating in more than 100 municipalities and serving over 16 million people. This report presents the utility's key actions related to environmental sustainability and climate change adaptation, classified into mitigation actions, adaptation actions, and other climate empowerment actions.

12.1. Adaptation Measures

12.1.1. Water and Effluent Management

One of BRK Ambiental's primary operational areas is in the state of Tocantins, which has been severely impacted by the climate crisis, particularly due to water scarcity.

In this context, BRK has promoted adaptation actions, such as **reducing water losses**. In 2023, the utility invested R\$ 114 million to combat losses, replacing more than 300,000 meters and monitoring 11,000 km of the network to detect leaks. The goal is to reduce water distribution losses to a maximum of 25% by 2030.

Additionally, some water reuse initiatives also contribute to reducing losses. Ten Water Safety Plans (WSPs) were implemented, prioritizing areas of higher water risk to ensure more effective investments. BRK also continuously monitors the quality of water sources, captured water, discharged effluents, and receiving bodies, aiming to mitigate watershed degradation, water scarcity, and soil contamination.

12.2. Mitigation Measures

12.2.1. Greenhouse Gas Emission Management

The utility is committed to achieving net-zero greenhouse gas (GHG) emissions by 2040, with intermediate reduction targets of 10% by 2025 and 30% by 2030. To achieve this, a portfolio of mitigation projects has been established, divided into four main groups: efficient wastewater treatment plants with a potential to reduce emissions by 90%; solar sludge dryers; biogas burners; and self-generation of electricity from renewable sources.

12.2.2. Renewable Energy Sources

Currently, **63.2% of the energy consumed by BRK comes from renewable sources**, such as Small Hydroelectric Plants (SHPs) and solar plants, with the goal of reaching 70% by 2030. In 2023, BRK saved R\$ 106 million by migrating to the Free Energy Market, reinforcing its commitment to energy efficiency.

12.2.3. Emissions Inventory and GHG Protocol

BRK conducts an annual Greenhouse Gas (GHG) Emissions Inventory, following the GHG Protocol methodology. This transparent process aims to provide visibility into the utility's emissions and support strategic decision-making to reduce environmental impacts. The utility has achieved Gold Certification in the Brazilian GHG Protocol Program and is committed to reaching carbon neutrality by 2040. Emissions are monitored across scopes 1, 2, and 3, covering the main sources of CO₂, CH₄, and other gases.

12.2.4. Waste Management

BRK Ambiental strictly follows the National Solid Waste Policy (PNRS), implementing innovative technologies for sludge drying and reuse, which directly contributes to reducing the emission of polluting gases, especially methane, generated by the decomposition of organic matter—one of the main sources of emissions in the wastewater sector.

In 2023, sludge composting increased by 74% compared to the previous year, reflecting the utility's commitment to minimizing environmental impact. Additionally, BRK continuously monitors the generation and disposal of waste, ensuring compliance with current legislation and seeking solutions that reduce emissions and promote sustainability.

12.2.5. Nereda® System

As part of its waste management strategy, BRK is a pioneer in Brazil in using Nereda® technology, an advanced biological wastewater treatment process. This system not only eliminates the need for chemical products but also significantly reduces methane emissions, one of the most harmful greenhouse gases associated with the anaerobic decomposition of organic matter. The Nereda® technology has already been implemented in several stations, including the largest in the country, located in Rio de Janeiro, allowing for more efficient wastewater treatment.

12.3. Climate Empowerment Actions

BRK Ambiental is actively involved in various initiatives and governance bodies. The utility participates in Watershed Committees, State Water and Environmental Resources Councils, and aligns its business strategy with the United Nations Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Wastewater) and SDG 13 (Climate Action).

The utility also adheres to the standards of the National Environmental Council (CONAMA) and adopts sustainable practices across all its operations. Moreover, BRK collaborates with startups and partners to develop innovative solutions, such as online monitoring technologies for water quality and operational efficiency.

Finally, BRK invests in environmental education and awareness initiatives. In 2023, **more than 5,000 hours of environmental training were conducted**, ranging from lectures and tree planting activities to Environment Week. The utility also participates in environmental committees and forums, strengthening its dialogue with society and stakeholders.

Through these actions, BRK Ambiental demonstrates a strong commitment to preserving natural resources, mitigating the impacts of climate change, and promoting sustainable management, significantly contributing to the well-being of the communities it serves.



Images: Environmental Education Actions - Source: BKR Ambiental Website

13. Companhia de Águas e Esgotos de Roraima (CAER)

The Water Utility of the State of Roraima (CAER) is responsible for the water supply in Boa Vista and 50 other localities, including 14 district headquarters and 36 villages, benefiting approximately 630,000 residents. With committed management, CAER continuously seeks to invest in wastewater and universal access to water, ensuring a better quality of life for the people of Roraima.

13.1. Adaptation Measures

In 2024, aiming to adapt to the region's water crisis, CAER invested R\$ 800,000 in the acquisition of a new pump to ensure the efficiency of the water catchment system in the capital, Boa Vista. Currently, the capture center now has two pumps in operation and an additional surface water capture system, which assists during periods of low river levels, providing greater water supply security.

Additionally, CAER implemented a Loss Reduction Program to minimize real and apparent losses in the supply system. To reduce real losses, the utility focuses on pressure management, leak detection, and improving the speed and quality of repairs. For apparent losses, actions include the management of macro and micro metering, improving data registration and verification, and combating fraud, ensuring a more efficient and sustainable system.

13.2. Mitigation Measures

CAER implemented its Solid Waste Management Plan, which includes environmental education actions and internal guidelines on the proper storage, weighing, collection, and transportation of generated waste. In 2023, over 2 tons of waste were collected, reinforcing the utility's commitment to sustainability.

13.3. Climate Empowerment Actions

Through the CAER Socio Environmental Program, the utility develops a series of socio-environmental initiatives aimed at raising public awareness and education on the sustainable use of water resources, as well as organizing waste collection actions and campaigns on the proper use of the wastewater system.

In 2023, the utility developed initiatives to engage children and adolescents in environmental education through games and playful activities, such as the Water Path, in partnership with UNICEF and Cáritas/Orinoco. Additionally, specific projects are carried out, such as the Ecological Walk and "Caer nos Rio" (Caer in the Rivers),

which aim at conserving water sources. These actions reinforce CAER's commitment to sustainability and socio-environmental responsibility, contributing to public awareness and the preservation of natural resources.



Image: Environmental Education Talk - Source: CAER Website

14. Companhia de Saneamento do Pará (COSANPA)

The Water Utility of the State of Pará (COSANPA) is responsible for water supply and wastewater services in the state of Pará. Since its foundation, COSANPA has played a crucial role in managing water resources, providing drinking water and wastewater treatment to millions of inhabitants. Currently, the utility serves 52 municipalities in the state, with a clear commitment to quality, public health, and socio-environmental responsibility.



Image: “We have started testing the water quality of the new Alter do Chão water supply system”. Source: COSANPA official Facebook page.

14.1 Adaptation Measures

14.1.1. Monitoring and Water Security

COSANPA adopts essential measures to adapt to climate change, focusing on efficient water resource management. The utility continuously monitors surface water sources to ensure water security. Through contracts with specialized service providers, COSANPA conducts ongoing actions to control and correct leaks in its distribution networks. Between 2019 and 2022, a large-scale project was carried out to replace old pipelines in the most densely populated areas of Belém, aiming to reduce losses and improve water distribution efficiency.

14.2. Mitigation Measures

14.2.1. Reducing Greenhouse Gas Emissions

Although COSANPA has not yet systematically implemented emission reduction measures, the utility uses gas burners in some of its wastewater treatment plants, which helps mitigate the impact of methane emissions.

14.2.2. Digitalization and Waste Reduction

A significant mitigation measure was the digitalization of the utility's administrative processes through the PAE 4.0 system (State Administrative Process). Eliminating paper processes saved more than 4 million sheets of paper in just one year.

14.2.3. Energy Efficiency

Although COSANPA is still in the study phase for installing solar panels at its facilities, the utility is already linked to the Free Energy Market and uses renewable and incentivized energy in 80 consumer units. This transition to renewable energy is a direct response to the challenges posed by climate change, reducing reliance on unsustainable energy sources.

14.3. Climate Empowerment Actions

14.3.1. Environmental Education

COSANPA has a strong focus on environmental education, promoting activities that range from lectures and ecological contests to discussion groups and recycling workshops. The utility reaches thousands of people,

especially in Belém, with its educational activities. By October 2024, more than three thousand people had participated in awareness-raising actions on responsible water use, including guided tours of Water and Wastewater Treatment Plants. COSANPA conducts educational initiatives throughout the state, promoting seminars and workshops in schools and communities, and forming environmental school committees. These actions contribute to empowering local communities, fostering a culture of sustainability and awareness of the impacts of climate change.



Images: Workshop on poufs made with plastic bottles and School Committee activity planting seedlings in the school area. Source: provided by email by COSANPA.

14.3.2. *Cosanpa Sustentável* Project

COSANPA also promotes internal environmental awareness with the “Cosanpa Sustentável” project, which aims to reduce paper use and promote recycling among employees. The project is an important sustainability initiative, ensuring that the utility operates more efficiently while also serving as a model for other organizations regarding waste management and conscious consumption.

14.3.3. Partnerships and Affiliations Related to Climate Change

In terms of involvement with environmental networks and committees related to climate change, COSANPA is actively engaged in the Marapanim River Watershed Committee, representing the water user sector. Additionally, it participates in the State Water Resources Council (CERH) and its various technical chambers, including the Technical Chamber for Capacity Building in Environmental Education on Water Resources and the Technical Chamber for the State Water Resources Plan. The utility is also part of the Management Council of the Utinga State Park and the Interinstitutional Commission for Environmental Education (CIEA), reflecting its commitment to environmental preservation and education.

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