Report on Climate-Related Financial Disclosure (TCFD)

2022

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1) Introduction

With the purpose of complying with the recommendations of **Climate-Related Financial Disclosures - TCFD**[1] the report was prepared based on the criteria of the TCFD - Task Force on Climate-related Financial Disclosures, which describes the structure of Governance, Strategy and Risk Management and Metrics/goals, as exemplified in Figure 1:

Figure 1: Tool TCFD

The TCFD, or Task-Force on Climate-Related Financial Disclosures, as the name implies, is a task force bringing together a number of organizations with the purpose of developing a common standard for companies to measure and disclose climate-related financial risks.

In this report, we seek to present the strategies, mitigation and adaptation actions to climate change implemented by Cemig. The challenges to reduce GHG emissions require technological changes in the medium term, as with regard to direct emissions, the company has already achieved a 74% reduction in the last 5 years, mainly due to the closing of the Thermal Power Plant of Igarapé in 2019, making it more challenging reduce current emissions. It will be necessary a significant effort to achieve net zero emissions by 2040, in this trajectory we seek to encourage innovation, process improvements and investments in new technologies.

2) Context

Companhia Energética de Minas Gerais (Cemig) operates in the areas of generation, transmission, trade and distribution of electric energy, energy solutions (Cemig SIM) and natural gas distribution (Gasmig). The group is organized by the holding Companhia Energética de Minas Gerais (Cemig), the wholly-owned subsidiaries Cemig Geração and Transmissão S.A. (Cemig GT)

[1]The TCFD is the task force created by the Financial Stability Board in December 2015 to develop voluntary guidelines and recommendations for companies to provide information to all stakeholders on the risks and opportunities associated with climate change.

and Cemig Distribuição S.A. (Cemig D), totaling 185 Companies, 14 Consortiums and two FIPs (Investment Funds in Participations), resulting in assets present in 25 Brazilian states and the Federal District.

Cemig is a publicly traded company, controlled by the Government of the State of Minas Gerais (51%), with its shares traded in São Paulo, on B3 S.A. (Brasil, Bolsa, Balcão), in New York, on the New York Stock Exchange (NYSE) and in Madrid, on the Mercado de Valores Latino-Americanos (Latibex). The consolidated net operating revenue of the Company reached BRL33,646 million in 2021, based on a matrix whose main energy source is renewable resources. The generating park of Cemig has an installed capacity of 5,755 MW, of which 97% refers to hydraulic generation; 2% to wind generation; and 1% to solar generation. Cemig also owns Cemig Sim, a company dedicated to distributed generation that currently has 18 plants and 63 MWp of installed capacity.

It is important to note that, at the end of 2019, TPP [Thermal Power Plant] lof Igarapé, the only thermoelectric power plant of the Company, was deactivated, making the energy generation complex of Cemig 100% renewable. The organization has 4,936.38 km of transmission lines. In the area of electricity distribution, it is responsible for managing the largest electricity distribution network in Latin America, with an extension of 564,434 thousand km. At the end of 2021, Cemig had 5,025 employees.

3) Governance and Strategy

The Management of Cemig comprises the Board of Directors and the Executive Board. The members of the Board of Directors, elected by the Shareholders' Meeting, elect their Chief-Executive Officer and appoint the Executive Board. Reporting directly to the Chief-Executive Officer is the Deputy Officer of Communication and Sustainability, responsible for the issue related to climate change.

Among his several attributions are, for example, the approval of technical standards and normative instructions necessary for the development of corporate sustainability, climate change and social responsibility, in line with strategic guidelines and sectoral regulation.

Also within the governance structure of the topic, there is the Corporate Sustainability Committee of Cemig, the main role of which is to propose policies, guidelines, actions, plans and projects, in addition to strategic initiatives, to promote the operation of Cemig in the social, environmental, economic and corporate governance areas. All topics discussed are considered by Top Management, including issues related to climate change. The Committee is composed of representatives and respective deputies from all the company's boards, which has to monitor and anticipate market trends and practices related to corporate sustainability, as well as issues associated with climate change, proposing actions and initiatives taking advantage of opportunities or reducing exposure risks and relevant impacts on the Company.

In 2021, the Company carried out a review of the new strategic planning, prioritizing the generation, transmission and distribution businesses, seeking leadership in customer satisfaction, safety and efficiency, which was approved by the Board of Directors.

When it comes to ESG agenda, the strategy of the Company aims to accelerate the transformation based on five main pillars:

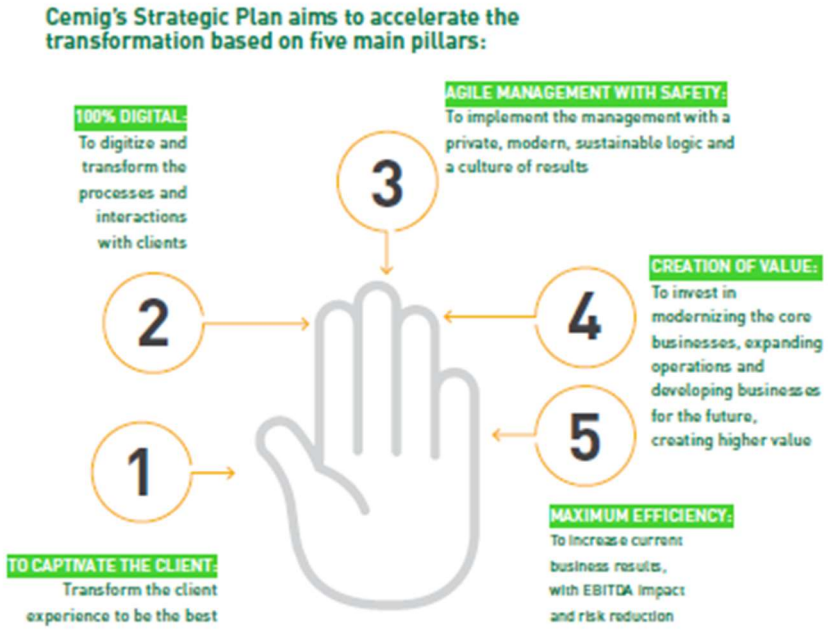


Figura 2: Cemig's Strategic Plan

This plan has as its nature to "FOCUS and WIN", having as ambition: "Focus on Cemig D and GT", leading in customer satisfaction, safety and achieving regulatory levels of efficiency, through management with a private, modern and sustainable logic, reaching Ebitda ~BRL7.7 Bi, TSR 20%, making investments of around BRL22.5 Bi (focusing on MG).

The plan brought the following ambitions for the year 2025:

Business Generation - Ambition: To add ~1 GW of installed capacity (~450 MWm) with an investment of BRL 4.5 Bi, focusing on renewable sources and increasing the efficiency of the portfolio.

Strategic Guidelines by business:

Transmission Business - Ambition: To focus on investments in Reinforcements and Improvements (~BRL1 Bi), on new projects (~BRL1 Bi) and on continuous efficiency improvement, enhancing transmission participation in MG.

Distribution Business - Ambition: To transform Cemig D into a reference in the distribution industry and promoter of development in the state of Minas Gerais: Leader in customer experience (TOP 3 NPS), security, efficiency (Increase Ebitda by BRL1 Bi, DEC 95% of the regulatory target and FEC 70% of the regulatory target) and prepared for the future, through investments in smart networks, digitalization and analytical capacity, with investments of BRL12.5 BI until 2025.

Distributed Generation Business: to achieve a relevant position in Distributed Generation, focused on the State of Minas Gerais. To invest BRL1 Bi by 2025 in projects to operate in DG [Distributed Generation] of vertical solar farms (equivalent to 275MWp) with an IRR equivalent to the market average, ensuring a relevant market share position (~30%) in solar farms in MG, with EBITDA annual amount of BRL170 Mi.

Gas Distribution Business - Ambition: To make solid the presence of Gasmig in Minas Gerais with investments of BRL1 Bi until 2025 with greater management and governance transparency, increasing commercial efficiency and expanding investments to expand the network and adding ~BRL318 Mi in EBITDA in 2025.

Based on the ambitions described above and approved by the Board of Directors, it can be seen that Cemig's actions are oriented towards managing risks and maximizing opportunities related to climate change.

As a result of this strategy, the actions that require approval or action by the Executive Board are discussed in meetings, against the background of the impacts resulting from climate change. Depending on the value of the project, approvals may occur within the scope of the executive board or the Board of Directors, to ensure the effective implementation of the strategy and promote its periodic monitoring.

The Company has indicators for monitoring and evaluating the business, including the DEC (Equivalent Duration of Interruption per Consumer Unit) and the FEC (Equivalent Frequency Interruption per Consumer Unit), which provide measurable data on interruptions in energy supply. These indicators are used by Cemig Distribuição to assess the quality of the service.

Furthermore, for the payment of the variable compensation of 100% of the Company's employees, there are 2 indicators totally linked to the climate change matter:

Total loss index, which represents 99% of the scope 2 of the Company emissions and "Approving an additional 300MW in energy generation projects".

In 2022, Cemig joined the Business Ambition Net Zero from UN, which brings together non-state actors (companies, cities, regions, financial, educational and health institutions) willing to take strict and immediate measures to halve global emissions by 2030 and zero net greenhouse gas

emissions by 2040. It is a natural move, given the company's history, which is in line with our growing investments in clean and renewable generation, especially after we deactivated the only thermoelectric plant that was operated by company in 2019. The commitment of Cemig has two central purposes: reducing the intensity of greenhouse gas emissions by 2030, in line with climate science, which indicates action as necessary to limit global warming to 1.5°C in relation to the levels pre-industrial industries and the ambition to reach zero net carbon emissions by 2040.

Cemig defined as a low carbon transition strategy, the identification of risks and opportunities related to climate change, the management of its greenhouse gas emissions, as well as the definition of targets to reduce these emissions. Figure 3 represents the pillars of action including the climate strategy.

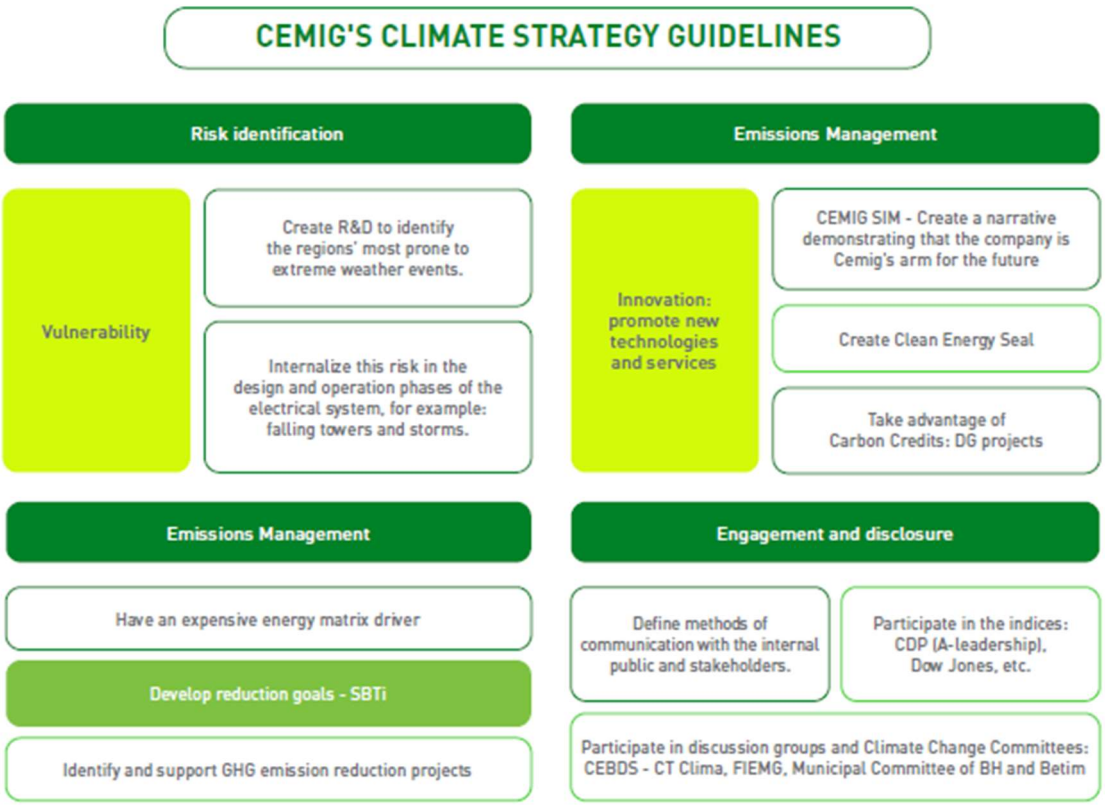


Figure 3: Summary of Climate Strategy of Cemig

The pillars of climate strategy of Cemig consist of identifying risks and opportunities and measuring financial impacts, image impacts, environmental impacts, compliance impacts and continuity impacts. The risks and opportunities are reviewed from time to time with the contribution of the areas that work in the management, mitigation of risks and in the prospection of opportunities.

Business opportunities are identified in a decentralized manner with support from the sustainability area. In the highlights is the sale of renewable energy certificates (I-REC) and Cemig-REC and the carrying out of studies to analyze the feasibility of marketing carbon credits.

Cemig owns the company Cemig Sim, which operates in the market for distributed generation, energy efficiency and energy solutions. In 2021, CEMIG SIM sold 4,452 MWh/month from 14 photovoltaic generation plants, with investments in innovation and efficiency, the company reached 4,735 residential and commercial customers in the last year.

Technological prospecting studies are coordinated by the "R&D" [Research and Development], Innovation and Transformation Management. There are two ongoing projects on energy storage and others still in the prospecting phase on green hydrogen and carbon capture. Emissions management is coordinated by the Sustainability Management, which is responsible for preparing the GHG Emissions Inventory. Based on the identification and quantification of emission sources, measures to reduce GHG emissions are analyzed to achieve the goal of reducing these emissions. The main measures are in line with the strategic planning of the Company, which aims to maintain investments in generation assets from renewable sources, encourage the use of ethanol to supply the fleet, improve the management of SF6 gas emissions, invest in measures to reduce losses in the electricity distribution system and increase the commercialization of certified renewable energy (I-REC and Cemig-REC). In 2022, it will be prepared the Low Carbon Transition Plan, which will contribute and will be based on the medium and long-term business strategy, with proposals for actions aimed at reducing GHG emissions to limit global warming to 1.5ºC and reach zero net of issuance in 2040.

The company participates in committees, working groups and initiatives contributing to the transition to a low carbon economy. Among the main initiatives, we highlight the participation in the Municipal Committee on Climate Change and Eco-efficiency of Belo Horizonte, in the Benchmark Club Program of CDP, in the Assessing Low Carbon transition (ACP[2])-DDP project, which aimed to evaluate the strategies for reducing emissions of companies with sectoral and national decarbonization trajectories, the Climate Action Platform of the Global Compact, and the Ambition for the Global Compact SDGs program.

a) Risks and opportunities related to climate change that the organization has identified in the short, medium and long-terms.

Based on the guidelines established in the Risk Management and Internal Controls Policy, Cemig has structured a risk management program, which allows the mapping and assessment of both strategic risks and those arising from operational processes. This program is coordinated by the Risk Management and Internal Controls Department, which provides technical support to the

[2] The ACT is the only methodological framework with sectoral methodologies assessing how the strategies and actions of the Company contribute to the purpose of Paris Agreement of reducing GHG emissions (below 2ºC); DDP - Deep Descarbonization Pathways:

different areas of the Company. The purpose is to provide information to Senior Management for decision-making regarding the most relevant risks and opportunities.
For this, Cemig has structured a risk management process aiming to plan, identify, analyze, treat and monitor the risks that have been mapped. At first, the Company classifies the risks identified as (i) process risks, which are related to operations, limited to the activities of each of the processes; (ii) risks of macroprocesses, whose impacts cover different processes and managements of the Company; and (iii) Top Risks, which are macro-process risks that can directly impact the Company's strategy.

The Top Risks, as well as the treatment recommendations made by the Corporate Risk Monitoring Committee - CRMC, are communicated to Senior Management.

When a Top Risk is mapped for the first time at Cemig, the following steps must be followed:
1) Planning - alignment between risk management and the strategic purposes of the Company;
2) Identification – understanding the scope, causes and impacts of the risk;
3) Analysis – estimation of the probability of occurrence of the risks, as well as the potential damage caused by the impacts identified in the previous step;
4) Treatment – survey of all actions and controls to mitigate the risk, as well as the mitigating effect of these actions on the mapped impacts;
5) Monitoring – following up on mitigating initiatives and validating the risk with the holder.

In the risk identification activity, the area responsible for centralized risk management and internal controls consults the managers of the areas correlated to the identified topics, including those areas that interact with external stakeholders, such as investor relations, strategic planning, sustainability and general secretary office. After the result of this consultation with the leaders, a risk matrix proposal is presented to the CRMC, which represents the Executive Board and provides considerations for improvements in the matrix.

Subsequently, the matrix is forwarded for deliberation by the Executive Board, which also improves the product, forwarding it to the Board of Directors. Additionally, the proposed matrix can be presented to the supporting bodies of the Board of Directors, such as the Audit Committee and the Fiscal Council.

As a result of this process, Cemig builds the Top Risks Matrix, encompassing the Generation, Transmission, Distribution, Commercialization, Distributed Generation, Holding businesses, as well as common business risks and/or eventual adjustments to adapt to the current Strategic Plan.

In 2020, the Top Risk was identified: Inefficiency in measures to minimize and adapt to the impacts of climate change at Cemig

i. Description: They refer to the inadequacy of measures to mitigate and adapt to climate change, resulting from the non-implementation or inefficiency of the measures necessary to minimize the impacts resulting from extreme climate events.
ii. Example of Potential Impact: “Damage to electricity generation, transmission and distribution infrastructure, which may cause interruption of these services” and “Loss of revenue and market, due to new low carbon solutions implemented by competitors”.

In the Identification phase, some of the causes identified were: complexity in predicting the frequency and severity of climate risks, low diversification in the electricity production matrix (with high dependence on water resources), regulatory changes, fragility of transmission lines and distribution. Some of the impacts identified were: loss of revenue and market, increase in energy prices, damage to infrastructure and failure to comply with regulatory risks. In the next phase, of Analysis, the risk was classified as Impact “4. High” (worst case scenario) considering the six impact ranges (From “1. Not applicable” to “6. Catastrophic”) of the Risk Matrix. In terms of probability of occurrence (which ranges from “1. Unlikely” to “6. Very likely”), the risk was rated as “4. Likely”. In the Treatment phase, some actions and controls were taken for mitigation, such as participation in associations that monitor regulatory changes, structuring and execution of the Distributor Development Plan (PDD), continuous monitoring of weather forecasts and fire alert, among others. Finally, in the Monitoring phase, the risk was validated with the responsible officer, and start and end dates and those responsible for each mitigating measure were stipulated.

The Sustainability Department carries out a survey and assessment of Cemig's risks and opportunities in the face of climate change, as well as their respective monitoring, always working together with the Corporate Wealth Management Department and other related areas (Energy Efficiency Management, and Control of Measurement and Commercial Losses in Distribution, Energy Planning and Water Resources Management) at all stages of the process, through the integrated approach guiding the risk management of Cemig.
Tables 1 and 2 present the opportunities and risks, and the time horizons that were defined according to the annual periodicity of reviewing the Long-Term Strategy, the Multi-annual Business Plan and the Company’s Annual Budget. As short-term considers (0-1 year) and medium-term (1-7 years) and long-term (until 2040).

Table 1: Identification of Opportunities

Description of opportunity	Main Financial Impact	Time Horizon
Selling CERs in a cap-and-trade system. The establishment of a cap-and-trade market for emission trading in Brazil or in the world, along the lines of the CDM, for example, could lead Cemig to position itself as an important supplier of emission reduction certificates. This opportunity could lead to an increase in revenue at Cemig. Cemig has sought to explore the carbon credits market. Currently, it has an energy purchase and sale agreement, which is holder of carbon credits and is in the monitoring phase. Cemig has the potential to generate credits under the CDM for the Guanhães Energia, SHPP Cachoeirão, TPP Santo Antônio and SHPP Paracambi plants. For all cases, however, Cemig does not have operational control and, therefore, credit management is not exclusive to the company, requiring alignment with the partners. At Guanhães Energia, the potential for generating credits is 44,488, 49% of which are from Cemig; at SHPP Cachoeirão, it totals 34,059 credits, 49% of which are from Cemig; at TPP Santo Antônio it totals 4,015,196, 15% of which belongs to Cemig; and at TPP Paracambi it totals 33,993 credits, 49% of which are from Cemig. In 2021, these projects were monitored, corresponding to 657,424 credits of Cemig. .196 credits x 15%) + (33,993 credits x 49%)] * USD0.80 / credit * BRL5.05 / USD. Additionally, it will seek to enable carbon credits from its renewable energy projects to be built.	Increase IN revenue through new solutions for adaptation needs.	medium-term
Energy efficiency projects In a scenario of greater corporate investments in energy efficiency aimed at reducing energy consumption and, consequently, GHG emissions, the Cemig SIM subsidiary shall likely have an increase in demand for its services, including the implementation of projects to use lighting with LED technology, cogeneration, distributed generation and other energy solution services.	Increase in revenue for the Company and postponement of investments in energy generation	Short-term
Sale of Renewable Energy Certificates - Cemig REC and I-REC With the growing engagement of companies with the ESG matter, the opportunity to commercialize renewable energy certificates grows. In 2021, it was traded by Cemig GT 3,101,129.36 I-RECs and Cemig-REC.	Increase in revenue from the sale of Cemig-REC	Short-term
Acquisition of projects and undertakings, associated with the purchase of incentivized electricity, aiming to enable the implementation and operation of wind and solar parks that are aligned with the Strategic Business Planning of Cemig.	Increase in revenues through customer service through an incentivized source	Medium-term

Table 2: Identification of Risks

Description of Risks	Main Financial Impact	Time Horizon
Risk 1: Physical-chronic: Changes in rainfall patterns and extreme variability in climate patterns	Decoupling of cash flow of Cemig D due to the increase in energy purchase prices. Cemig has a specific organizational structure, fully dedicated to managing the purchase and sale of energy. It provides of the Energy Risk Management Committee – CGRE, with the purpose of minimizing risks in energy purchase and sale contracts, in addition to mitigating the risk of short-term exposure, resulting from bad hydrological conditions. With this structure, the company has mitigated this risk in years with unfavorable hydrology.	Short-term
Risk 2: Acute physical - Increase in severity and frequency of extreme weather events, as cyclones and floods	The occurrence of intense rains in a short period of time, accompanied by windstorms and lightning, may cause physical damage to the facilities that transport and distribute energy, leading to its unavailability and to an increase in Cemig's costs, caused by the reimbursement to consumers due to the interruptions in energy supply (DEC and FEC indicators). These phenomena are increasingly associated with the effects of an unfavorable microclimate, typical of large urban centers. Management methods seek to reduce the magnitude of this risk through preventive adaptation measures in the medium term, such as the management of urban afforestation through pruning, operation of weather stations and weather radar - which predicts the occurrence and intensity of storms with greater precision - and an emergency plan with the allocation of maintenance teams for the rapid restoration of energy supply. Furthermore, Cemig maintains the Distribution Development Plan - PDD, which consists of carrying out projects linked to the electrical system and associated with the expansion, expansion, renovation and renovation of assets of Cemig D, such as substations and distribution lines.	Medium-term
Risk 3 – Transition: Emerging Regulation – Carbon Pricing Mechanisms	Increase in indirect (operating) costs. One of the main emerging regulations related to climate change in Brazil covers carbon pricing. Cemig actively participated in the Consultative Committee of the Brazil PMR Project, which ended in December 2020 and aimed to discuss the convenience and opportunity of including the pricing of GHG emissions in the package of instruments aimed at implementing the National Policy on Change in the Environment Climate (PNMC) in the post-2020 period. One of the industries that have been analyzed in this context is fuel. A carbon price applied in the fuel industry would imply an increase in fossil fuel prices.	Medium-term

b) ***Impacts of risks and opportunities related to climate change on the organization's business, strategy and financial planning.***

In the Strategic Planning approved in 2021, the following investment initiatives in expansion in energy generation with wind and solar sources, investments in distributed generation through the company Cemig SIM.

Table 3: Business plan Influenced by climate change

Initiative of Mitigation and Adaptation	Amounts to be invested in the next 5 years	Associated risk or opportunity; Mitigation
Adding ~1GW of capacity (~0.45GWm)1, investing ~BRL4.5 Bi, preferably Renewable	BRL 4.5 billion	Physical risk: changes in precipitation pattern Reduction of water dependence
Distributed generation: Development of projects for new solar farms via Cemig Sim	BRL 1.0 Billion	Physical risk: changes in precipitation pattern

Initiative of Mitigation and Adaptation	Amounts to be invested in the next 5 years	Associated risk or opportunity; Mitigation
		Mitigation Measure: Reduction of water dependence through investments in DG projects
Transmission: Reinforcements and improvements. Modernization of systems, via new technologies generating an increase in productivity and/or availability	BRL 1.1 Billion	Physical Risk: extreme climate events such as increased wind speed or increased frequency of fires caused by increased temperature and drought events can cause damage to the asset. Mitigation measure: system improvements reduce impacts on infrastructure through investments in maintenance and modernization of transmission lines
Distribution: Reduction of losses in energy distribution	BRL 280 million	Transition risk: regulatory changes penalizing activities that do not reduce their GHG emissions. Mitigation Measure: reduction of GHG emissions from the loss of electricity, through investments in shielded networks and modernization of existing lines and substations.
Distribution: expand, modernize and make the distribution network more robust, build + 150 New substations, + 20K km of networks and + 300K smart elements (switches, reclosers, sensors, smart meters, ...)	BRL 12.5 billion	Physical risk: extreme climate events (winds and storms) that can impact the infrastructure of electricity distribution services. Mitigation Measure: Increase in the resilience of the electricity distribution system, with a reduction in shutdowns caused by weather events.
Innovation: Storage (batteries, pumped storage, hydrogen...) Ancillary services Demand management Energy efficiency Electric mobility	Innovation: (BRL0.5 Billion)	Transition risk: technological and market change. Mitigation Measure: monitoring of new market trends with investments in new technologies.

The table below shows the most advanced projects in the maturation phase of generation expansion.

Table 4: Solar Generation Projects in Development

Description	Features
Solar: Boa Esperança	Capacity installed: 85 MW capex of approximately BRL320 millions

Description	Features
	Energization scheduled for April 2023.
Solar: Três Marias 1 (Floating)	Capacity installed: 60 MW and capex of approximately BRL270 millions Energization scheduled for April 2023.
Solar: Três Marias Downstream	Capacity installed: 70 MW estimated and capex approximately BRL250 million Energization Planned for the 1st semester of 2023
Wind Projects	Under analysis for the acquisition in 2022 of 5 projects with an installed capacity of 1,756 MW, estimated CAPEX of BRL 10,536 billion. Energization scheduled as of 2025.

4) Análise de Cenários

4.1) Assessment of Climate Risk

Cemig is a company in the energy industry and, in the Brazilian case, depends substantially on the generation of energy from renewable sources. These sources influence the company in all its main businesses, namely, generation, transmission, distribution and commercialization of energy. Like society as a whole, Cemig is sensitive to ongoing climate changes and is making efforts to increase the resilience of its businesses.

In a global effort to raise understanding of the issue, as well as its implications and risks, the United Nations created the Intergovernmental Panel on Climate Change. The IPCC, as it is known in English, periodically produces assessment reports to advise governments on the current state of the climate and changing trends, with the next expected to be released in 2022 (AR6). Among the tools used to prepare this report, climate models are the main source of information on climate change, representing the efforts of dozens of meteorological institutes and representing the state of the art in modeling biogeochemical processes.

4.2) Assessment of Physical Risk

With the purpose of estimating the impacts of climate change by 2050, an assessment of the physical risk of the climate was carried out using the analysis of scenarios available in the sixth phase of the Coupled Model Intercomparison Project (CMIP6).

The sixth report of the Intergovernmental Panel on Climate Change used, in addition to the well-known Representative Concentration Pathway (RCPs), the new Shared Socioeconomic Pathways (SSPs).

In the case of RCPs, the following were used for analysis by the technical staff of CEMIG:

1) RCP2.6 – It represents the scenarios in which the rise in the average global temperature would be below 2°C, being extremely strict with regard to greenhouse gas emissions. This scenario is unlikely in the short-term;
2) RCP3.4 – It represents an emissions scenario intermediate between 2.6 and 4.5, but still includes considerable removal of greenhouse gases from the atmosphere. This scenario is still unlikely, but less so than 2.6.
3) RCP4.5 – It represents an increase in concentrations, with an estimated peak around 2040 and then a decline until reaching a value of approximately half of that recorded around 2050, by 2100; Represents the most likely scenario among all CPRs.
4) RCP7.0 – It represents radioactive forcing stabilization scenarios at 6 W/m^2. It represents a less likely scenario than the previous one.
5) RCP8.5 – It represents scenarios with high greenhouse gas emissions, very useful for analysis up to mid-century, but highly unlikely beyond that.

RCP2.6 is the most optimistic scenario among the scenarios used in this report (there is still RCP1.9, but this is so unlikely that it is not used in the analysis), with radioactive forcing reaching a peak of 2.6 W.m^2. It provides a peak in CO2 concentration of approximately 490 ppm and a decline in this value by the end of the 21st century. In this context, the increase in terrestrial temperature would be between 0.3°C and 1.7°C from 2010 to 2100, and the rise in sea level would be between 26 and 55 cm. For this scenario to happen, however, there would need to be stabilization of GHG concentrations over the next 10 years and then their removal from the atmosphere (MMA, 2016). In turn, the RCP4.5 scenario has been one of the most used scenarios and it predicts an additional 4.5 Wm-2 of energy storage and stabilization of GHG emissions before 2100. In this case, the increase in land temperature would be between 1.1°C and 2.6°C and sea level between 32 and 63 cm (MMA, 2016).

Finally, RCP8.5 is a pessimistic scenario, and it is characterized by an accelerated pace of emissions, with no forecast of stabilization. This scenario foresees an additional energy storage of 8.5 Wm-2. Thus, the surface of the Earth could warm between 2.6°C and 4.8 °C over the course of the century, and the sea level could increase by 45 to 82 cm (MMA, 2016; SILVEIRA et al., 2016)

These scenarios were used until CMIP5, but in the new model version (CMIP6) they will be used together with the SSPs.

SSPs are the next generation of scenarios, succeeding the SRES published in 2000, and are intended to serve as baseline scenarios for various assessments in the area of climate change challenges as well as broader sustainability issues. SSPs complement Representative Concentration Pathways (RCPs) by adding the underlying socio-economic narratives and quantitative pathways consistent with mitigation and adaptation challenges. SSPs include five widely different global futures (SSP1-5) starting in the narrative for alternative development paths and vary depending on how energy challenges (i-iv) are handled.

Source: https://www.sciencedirect.com/science/article/pii/S0959378016301224#bib0155

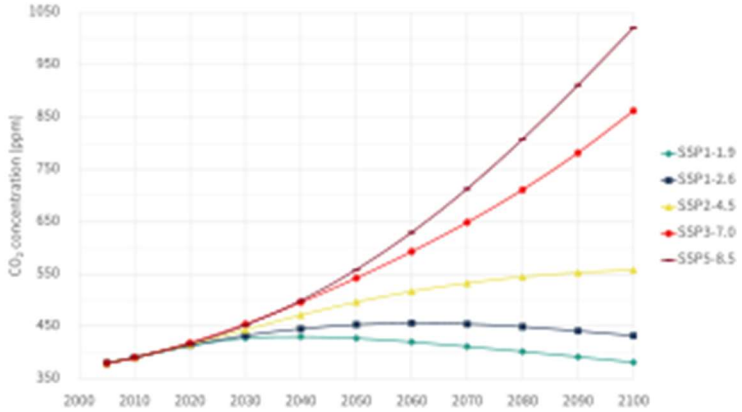


Figure 4: Atmospheric CO_2 concentrations by SSP throughout the 21st century (designed by MAGICC6, a simple-complexity climate model).

Figure 5: SSPs mapped to challenges for the mitigation/adaptation space

Scenarios were analyzed for the variables precipitation, temperature, humidity, wind speed and cloud cover for the following models:

Table 5 – Models used in studies of climate change scenarios.

Modelo	Responsável	País	Resolução de Lon e Lat	
AWI-CM-1-1-MR	Alfred Wegener Institute	Alemanha	0,94	0,9
CAMS-CSM1-0	Chinese Academy of Meteorological Sciences	China	1,13	1,1
CESM2	National Center for Atmospheric Research	EUA	1,25	0,9
CNRM-CM6-1-HR	Centre National de Recherches Meteorologiques	França	0,5	0,5
EC-Earth3	EC-Earth-Consortium	Europa	0,7	0,7
EC-Earth3-CC	EC-Earth-Consortium	Europa	0,7	0,7
HadGEM3-GC31-MM	Met Office Hadley Centre	Reino Unido	0,8	0,6

[Legend: **Model** | **Entity Responsible** | **Country** (German, Chine, USA, France, Europe, Europe, United Kingdom) | Resolution of Lon and Lat].

The analysis carried out by the team of Cemig makes it possible to identify the climate risk for each of the company's plants and for others in which Cemig is interested. Considering the analysis of the scenarios described above, with the identification of physical risks, a quantitative and qualitative analysis of their impacts on the company's operations was carried out, as well as their impact on the business. These models were applied to the SSP scenarios described and, over the next few years, the number of models used should be expanded, as well as the analyses. The data were used to carry out the studies and analyzes mentioned below, separated by business and areas of interest for Cemig:

1. Energy generation

Cemig has an energy generation portfolio totally based on renewable sources, with several hydroelectric, wind and photovoltaic plants, spread across different regions of the country (Figure 5.1). In the following items we will discuss some of the results found in the climate change scenarios for each of the energy generation sources.

Figure 5.1. Location of the power plants of group Cemig.

A. Hydraulic Source

Cemig has most of its hydroelectric power plants installed in the state of Minas Gerais, but there are also projects in the South and North of Brazil. In studies carried out by Cemig, it was analyzed 22 different precipitation scenario, comprising models, SSPs and periods described in table6.

Table 6 – Scenarios analyzed for the rainfall variable

Modelo	SSP	Experimento	Grade	Período
AWI-CM-1-1-MR	ssp126	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp245	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp370	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp585	r1i1p1f1	gn	20220116-21001216
CAMS-CSM1-0	ssp126	r1i1p1f1	gn	20150116-20991216
CAMS-CSM1-0	ssp126	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp245	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp370	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp585	r1i1p1f1	gn	20220116-20991216
CESM2	ssp126	r4i1p1f1	gn	20220115-21001215
CESM2	ssp245	r4i1p1f1	gn	20220115-21001215
CESM2	ssp370	r4i1p1f1	gn	20220115-21001215
CESM2	ssp585	r4i1p1f1	gn	20220115-21001215
CNRM-CM6-1-HR	ssp126	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp245	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp370	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp585	r1i1p1f2	gr	20220116-21001216
EC-Earth3-CC	ssp245	r1i1p1f1	gr	20220116-21001216
EC-Earth3-CC	ssp585	r1i1p1f1	gr	20220116-21001216
EC-Earth3	ssp434	r101i1p1f1	gr	20220116-21001216
HadGEM3-GC31-MM	ssp126	r1i1p1f3	gn	20220116-21001216
HadGEM3-GC31-MM	ssp585	r1i1p1f3	gn	20220116-21001216

[**Legend**: Model | SSP | Experiment | Grade | Period]

The analyzes were carried out for 77 hydroelectric plants, including Cemig plants and those of other companies, analyzing possible changes in the rainfall regime of these projects, identifying the physical risks, and performing a quantitative and qualitative analysis of their impacts on the company's operations, as well as its impact on business. Below are some examples of information collected for the power plant Três Marias.

Figure 5.2 shows a graph with data from the 30-year moving average of the history and the projections of six different models for Três Marias. It can be observed that both the history and the scenarios differ greatly from each other, and one of the first analyzes that were carried out was to identify which models had better adherence between their history and the data observed in the incremental basin. In the specific case of Três Marias, the models that had a history closer to the observed were the AW1-CM11-1-MR and the CESM2. This information is important to define which scenarios/models we will define as the most likely for a given region.

In figures 5.3 and 5.4 it is evident that for Três Marias the differences between the results of the two models are minimal, but for other regions this may not occur, for example, Maranhão and southern Brazil. Therefore, for each hydroelectric use, this similarity between the observational data and the history of each model was analyzed to define the relevance of the model in the region.

In the results for the power plant Três Marias, 80% of the scenarios point to a reduction in precipitation in the basin until, approximately, the year 2030. Only one of the models showed

an increase, HadGEM3, but it is also one of the ones with the greatest difference in history. With regard to the scenarios, even the most optimistic ones show a decline or stability in the next 10 years, but followed by recovery. In turn, with the most pessimistic ones (SSPs 3, 4 and 5) there are sharp drops and, in some cases, no recovery.

For the remaining power plants, the vast majority of those present in the Southeast and Center-West followed the pattern above, with some specific differences, which may indicate a risk of a sharp fall in precipitation for the coming years, with strong pressure on the operation of the Interconnected System. National. Based on this risk, Cemig has been improving and/or creating systems related to increased efficiency in the operation of its reservoirs and environmental alerts, as will be explained in the following sections.

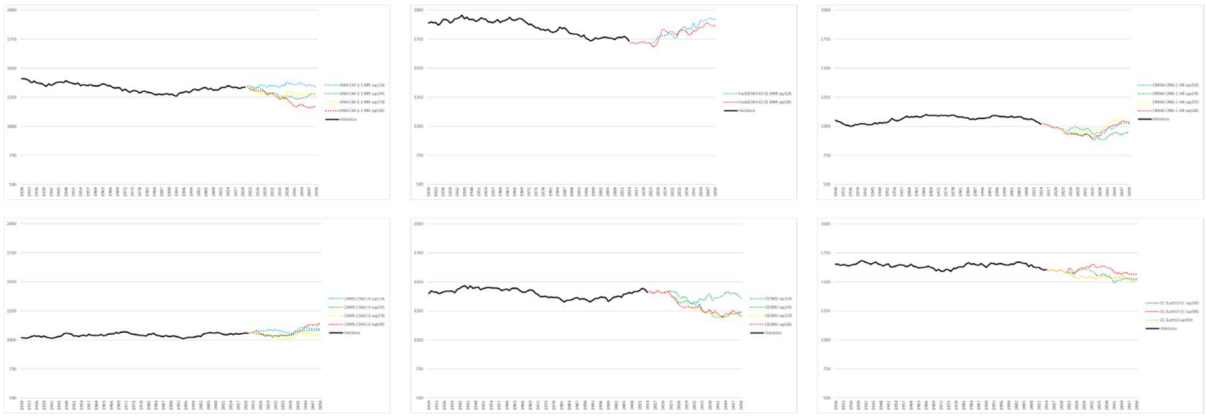


Figure 5.2 – 30-year moving average of precipitation in the incremental basin of Três Marias.

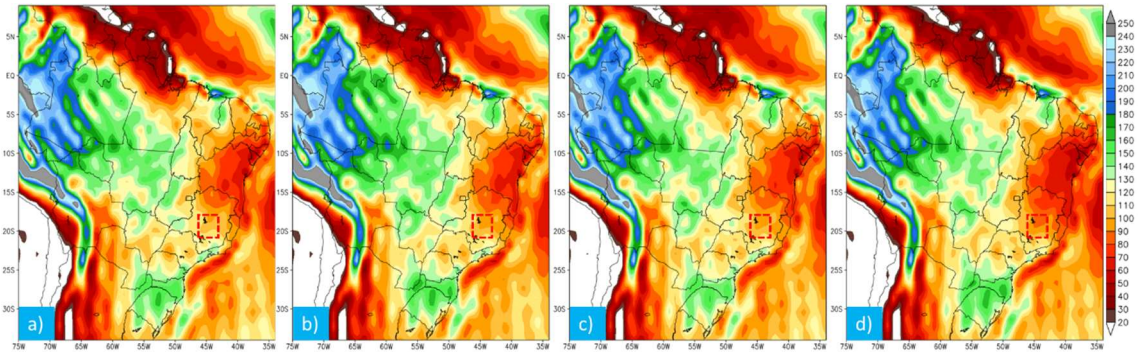


Figure 5.3 – Example of the monthly average rainfall (mm) from 2022 to 2051, for scenarios SSP126, SSP245, SSP370 and SSP585, of the AW1-CM11-1-MR model, with emphasis on the region of Três Marias.

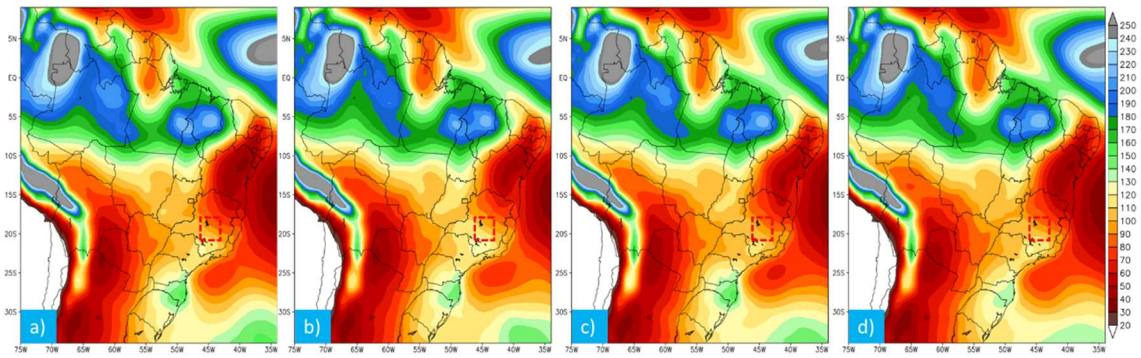


Figure 5.4 – Example of the monthly average rainfall (mm) from 2022 to 2051, for scenarios SSP126, SSP245, SSP370 and SSP585, of the CESM2 model, with emphasis on the region of Três Marias.

B. Solar Source

The solar farms currently owned by Cemig and that it intends to install have the state of Minas Gerais as their priority. Therefore, the solarimetric potential of the state and the possible changes in the variables that directly impact the generation by this source, such as cloudiness, temperature and air humidity, were evaluated in greater detail. **Out of these, cloud cover definitely has the greatest impact on production, as it directly affects the radiation incident on solar panels, while very high temperature and humidity levels negatively affect the efficiency of these panels**.

The state of Minas Gerais has a significant climatic heterogeneity in its territory, so it became necessary to divide the state into some macro-regions to assess the impact of climate change on the aforementioned atmospheric variables, creating the divisions shown in Figure 5.5, while the models used for cloud cover can be found in table 7.

In Figure 5.6, it can be seen that the vast majority of scenarios point to a reduction in cloudiness in the North region of Minas in the next 30 years, which positively contributes to an increase in energy production by solar source in the coming years, regardless of the SSP analyzed.

A similar analysis was carried out for the other regions, indicating a similar decrease in the Triângulo, Central and East, but showing stability in the South of Minas. The loss or gain in energy production by solar source, given the low magnitude of changes in cloudiness, however, must be accompanied by analyzes related to temperature and relative humidity, which will be explored over the next year.

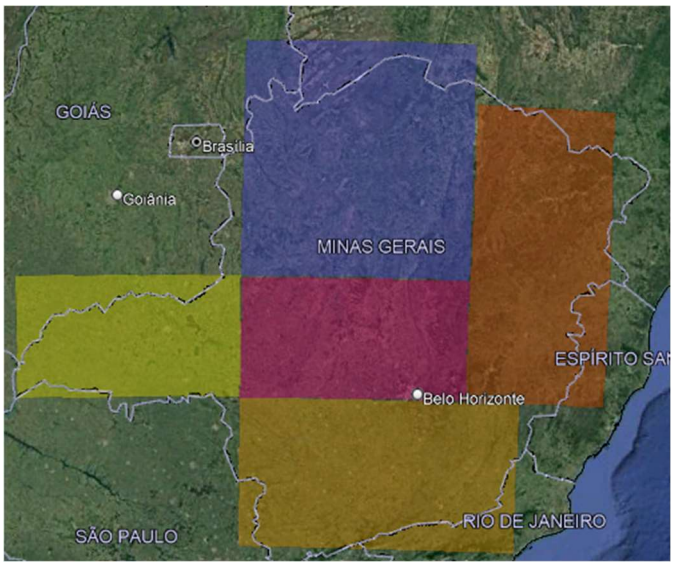


Figure 5.5 – Macro-regions of analysis.

Table 7 – Models used for analysis of Cloudiness.

Modelo	SSP	Experimento	Grade	Período
AWI-CM-1-1-MR	ssp126	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp245	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp370	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp585	r1i1p1f1	gn	20220116-21001216
CAMS-CSM1-0	ssp126	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp245	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp370	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp585	r1i1p1f1	gn	20220116-20991216
CESM2	ssp126	r4i1p1f1	gn	20220115-21001215
CESM2	ssp245	r4i1p1f1	gn	20220115-21001215
CESM2	ssp370	r4i1p1f1	gn	20220115-21001215
CESM2	ssp585	r4i1p1f1	gn	20220115-21001215
CNRM-CM6-1-HR	ssp126	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp245	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp370	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp585	r1i1p1f2	gr	20220116-21001216
EC-Earth3-CC	ssp245	r1i1p1f1	gr	20220116-21001216
EC-Earth3-CC	ssp585	r1i1p1f1	gr	20220116-21001216
HadGEM3-GC31-MM	ssp126	r1i1p1f3	gn	20220116-21001216
HadGEM3-GC31-MM	ssp585	r1i1p1f3	gn	20220116-21001216

[**Legend**: Model | SSP | Experiment | Grade | Period]

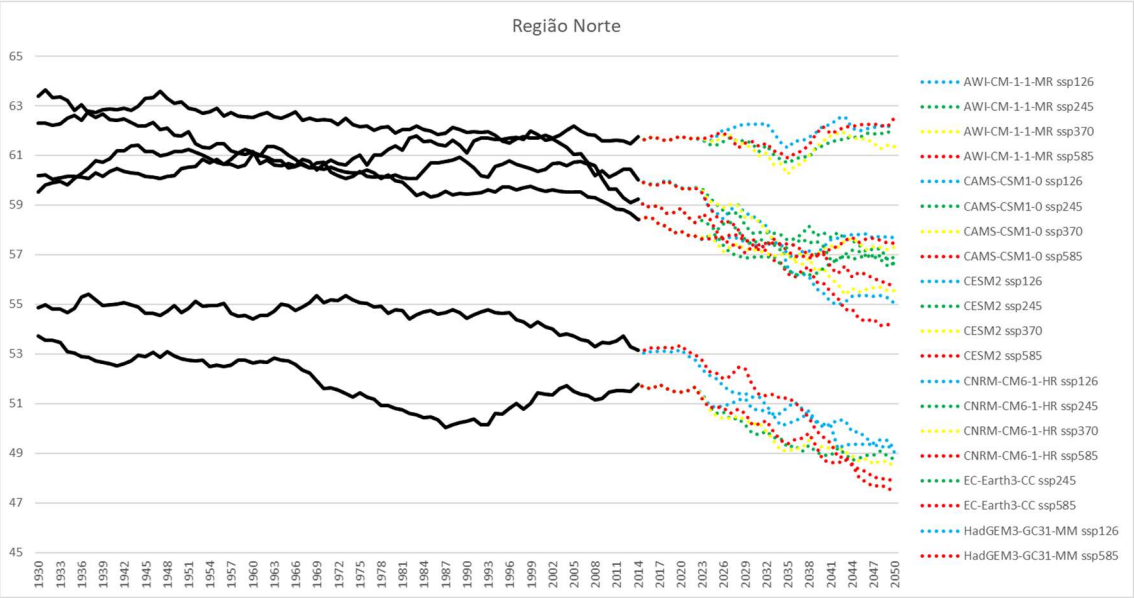


Figure 5.6 – History and forecast scenarios for cloudiness (%) until 2050 for the North region of Minas Gerais.

C. Wind Source

In the analysis of climate change in wind sources, it was analyzed the regions shown in figure 5.5 and the Volta do Rio and Parajurú wind farms, owned by Cemig (figure 5.7). For such, SSP models and scenarios described in the table below were used.

Table 8– Models used for wind magnitude analysis.

Modelo	SSP	Experimento	Grade	Período
AWI-CM-1-1-MR	ssp126	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp245	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp370	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp585	r1i1p1f1	gn	20220116-21001216
CAMS-CSM1-0	ssp126	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp245	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp370	r1i1p1f1	gn	20220116-20991216
CAMS-CSM1-0	ssp585	r1i1p1f1	gn	20220116-20991216
CNRM-CM6-1-HR	ssp126	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp245	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp370	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp585	r1i1p1f2	gr	20220116-21001216
EC-Earth3-CC	ssp245	r1i1p1f1	gr	20220116-21001216
EC-Earth3-CC	ssp585	r1i1p1f1	gr	20220116-21001216
HadGEM3-GC31-MM	ssp126	r1i1p1f3	gn	20220116-21001216
HadGEM3-GC31-MM	ssp585	r1i1p1f3	gn	20220116-21001216

[**Legend**: Model | SSP | Experiment | Grade | Period]

Figure 5.7 – Location of the Parajurú and Volta do Rio wind farms.

In the case of wind farms present in Ceará, the variation is almost imperceptible, but with a slight downward trend in the most pessimistic scenarios. As the wind regime in Ceará is dominated by the southeast trade winds, which arise due to the difference in equator-pole warming. Therefore, this warming difference shall continue to occur, regardless of climate change scenarios. As for the regions of Minas Gerais, there were significant differences between the North and East, which showed stability in all scenarios, while the South and Triangle showed increases in SSPs 245 and 370, while in the Central region there was a very high variability.

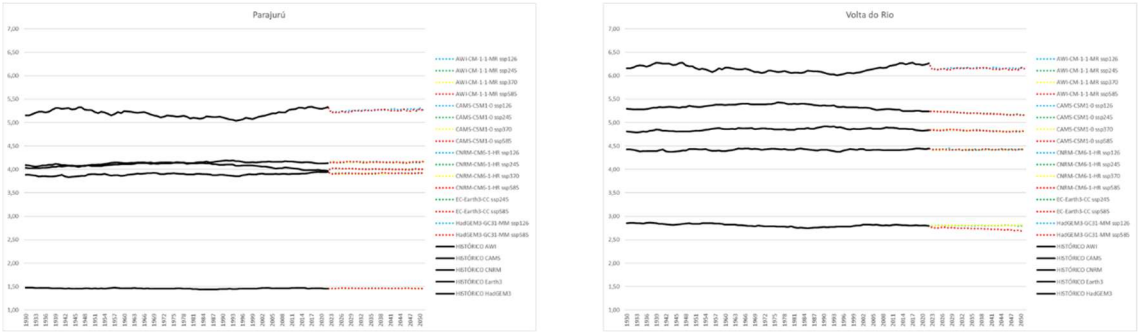


Figure 5.8 – History and predicted scenarios for surface wind speed (m/s) until 2050.

2. Energy Transmission and Distribution

Energy transmission and distribution represent two of the company's core businesses and are directly affected by prevailing weather conditions. During the rainy season, they are hit hard by storms, while in the dry season, fires punish the lines, leading to a high number of annual outages.

One of the ongoing studies evaluates the changes in the frequency of occurrence of fires near the transmission and distribution lines of energy. These fires affect both the duration and the frequency of unscheduled disconnections of consumers, two aspects that, in one, have a direct correlation with indicators related to the performance of the concession of these services.

In the above context, two variables that directly affect the occurrence of fires are air temperature and humidity, variables that were evaluated for the models and scenarios presented in tables 9 and 10.

Table 9 – Models used for the analysis of Relative Air Humidity.

Modelo	SSP	Experimento	Grade	Período
CNRM-CM6-1-HR	ssp126	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp245	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp370	r1i1p1f2	gr	20220116-21001216
EC-Earth3-CC	ssp245	r1i1p1f1	gr	20220116-21001216
EC-Earth3-CC	ssp585	r1i1p1f1	gr	20220116-21001216
EC-Earth3	ssp434	r101i1p1f1	gr	20220116-21001216

[**Legend**: Model | SSP | Experiment | Grade | Period]

Table 10 – Models used for temperature analysis.

Modelo	SSP	Experimento	Grade	Período
AWI-CM-1-1-MR	ssp126	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp245	r1i1p1f1	gn	20220116-21001216
AWI-CM-1-1-MR	ssp370	r1i1p1f1	gn	20220116-21001216
CESM2	ssp126	r4i1p1f1	gn	20220115-21001215
CESM2	ssp245	r4i1p1f1	gn	20220115-21001215
CESM2	ssp370	r4i1p1f1	gn	20220115-21001215
CESM2	ssp585	r4i1p1f1	gn	20220115-21001215
CNRM-CM6-1-HR	ssp126	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp245	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp370	r1i1p1f2	gr	20220116-21001216
CNRM-CM6-1-HR	ssp585	r1i1p1f2	gr	20220116-21001216
EC-Earth3-CC	ssp245	r1i1p1f1	gr	20220116-21001216
EC-Earth3-CC	ssp585	r1i1p1f1	gr	20220116-21001216
EC-Earth3	ssp434	r101i1p1f1	gr	20220116-21001216
HadGEM3-GC31-MM	ssp126	r1i1p1f3	gn	20220116-21001216
HadGEM3-GC31-MM	ssp585	r1i1p1f3	gn	20220116-21001216

[**Legend**: Model | SSP | Experiment | Grade | Period]

In all scenarios evaluated for air temperature, there is an increase in air temperature for all regions of Minas Gerais. In some scenarios, such as those represented for the North region (figure 5.9), SPS585, this increase could exceed 4°C over the next 30 years.

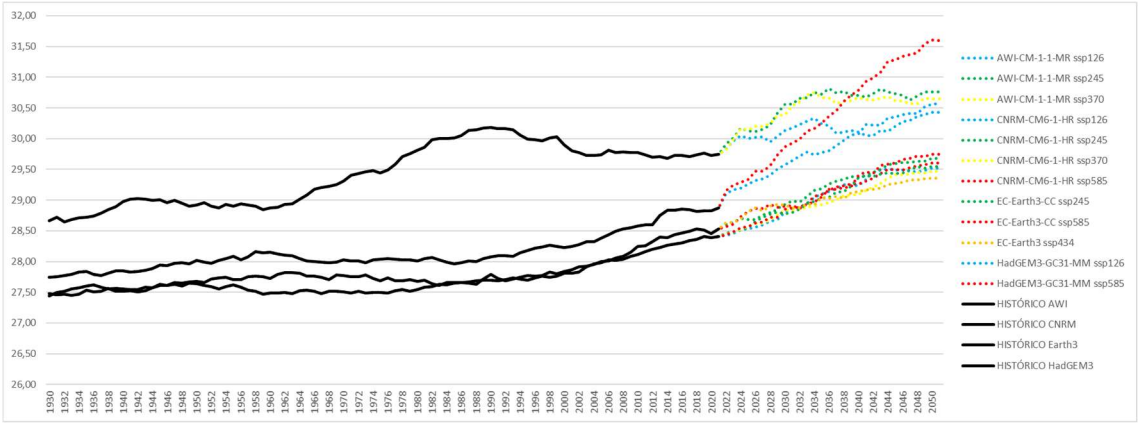
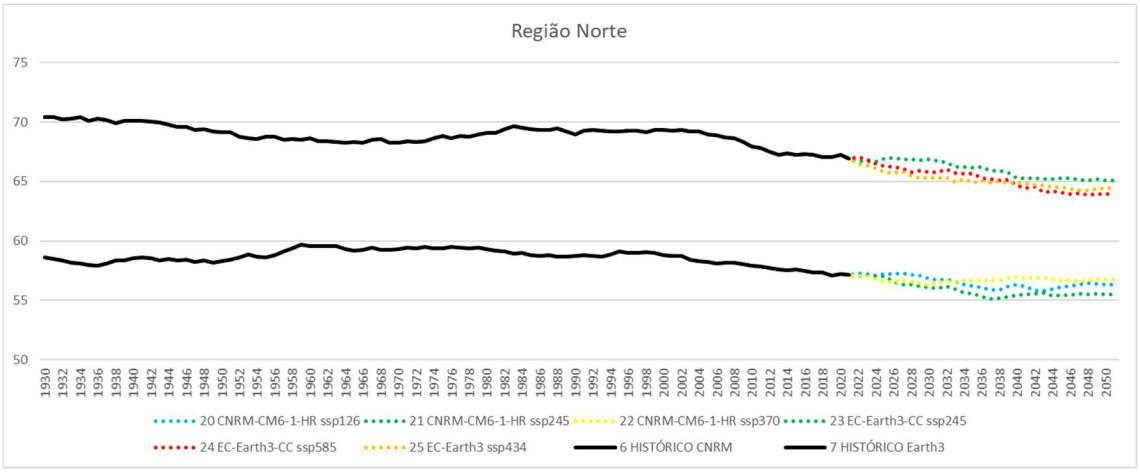


Figure 5.9 – History and predicted scenarios for the maximum surface temperature (°C) until 2050.

In the case of relative air humidity, the scenario is the opposite, with a drop in humidity in all regions of the state, such as, for example, in the northern region (figure 5.10). The combination

of rising temperatures, falling humidity and precipitation can lead to a future with an extreme increase in the frequency and extent of fires in the state of Minas Gerais, which is why Cemig created its own system for monitoring, analyzing and alerting fires, which shall be described below.



[Legend: North Region | History]

Figure 5.10 – History and predicted scenarios for surface relative humidity (°C) until 2050.

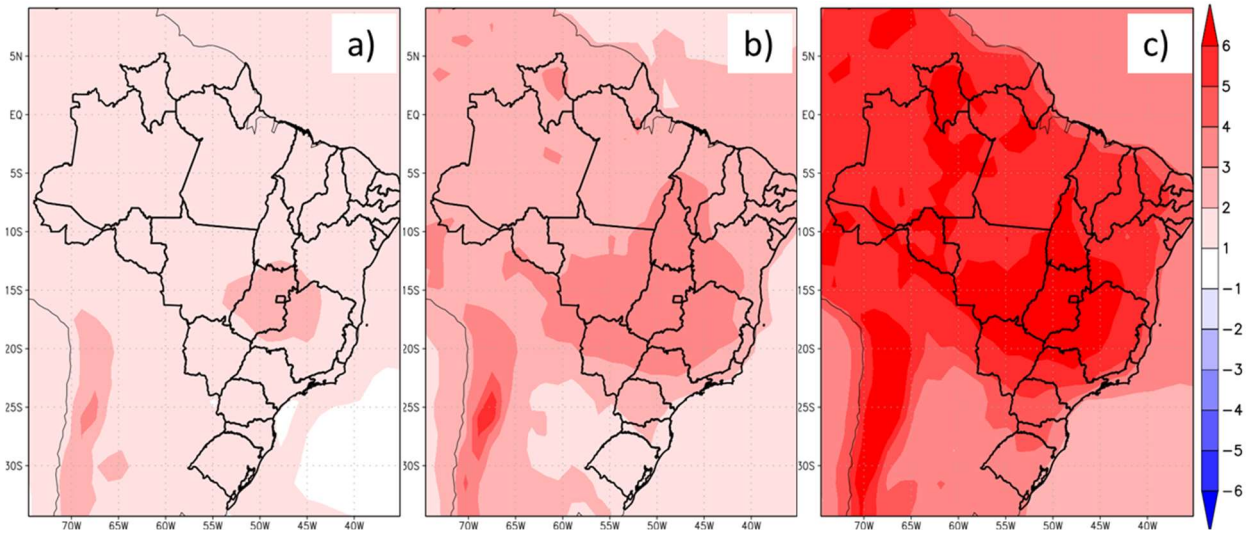


Figure 5.11 - Anomalies (°C) for SSP1 (b), SSP2 (c) and SSP5 (d) scenarios. Source: CNRM/FR.

3. Adaptability measures

Over several years, Cemig has been implementing a robust infrastructure made up of equipment, systems and professionals with the aim of allowing a greater capacity for adaptation of the company's various businesses to climate change.

Cemig has a meteorological monitoring system made up of dozens of automatic data collection stations, its own network for detecting atmospheric electrical discharges, a satellite image reception station and a C-band meteorological radar, strategically installed in the center of the state, being the only company in the electricity sector to have such equipment.

Based on the information provided by this system in real time, the team of professionals of Cemig issue possible weather alerts to the company's distribution and transmission operation centers. From then on, the teams from these centers and those in the field work together to anticipate possible damage to the assets of Cemig, caused by storms, for example, allowing for a quick re-establishment of power outages or issuing alerts to the communities surrounding the plants about possible floods.

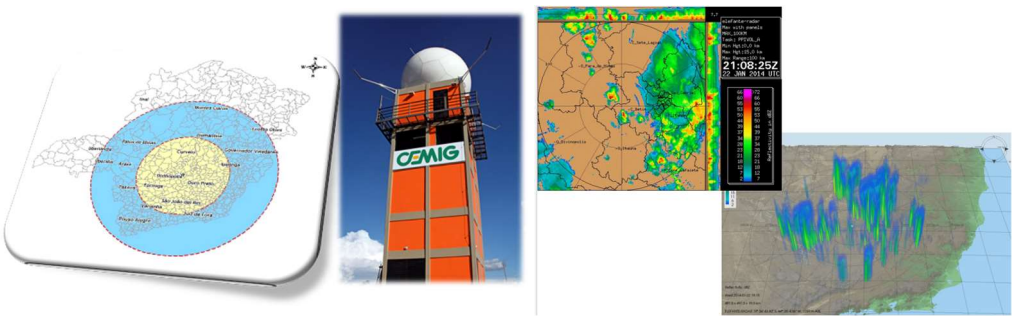
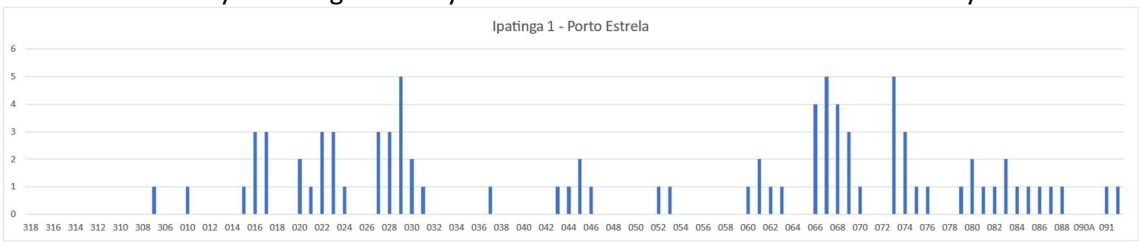


Figure 5.12 – Cemig Meteorological Radar and example of its data.

With the systematic increase in the occurrence of fires in recent years, as well as the forecast of an increase in the coming decades, Cemig does not measure efforts to increase its resilience to this phenomenon.

Then, it was developed the Cemig Fire Monitoring, Analysis and Alert System (SMAQ-Cemig), consisting of tools and techniques allow the company to:

1) Identify the regions affected by fires along their transmission and distribution lines. This allows a more efficient analysis of disconnections, optimization of the cleaning activity of the right-of-way and environmental education of the nearby communities



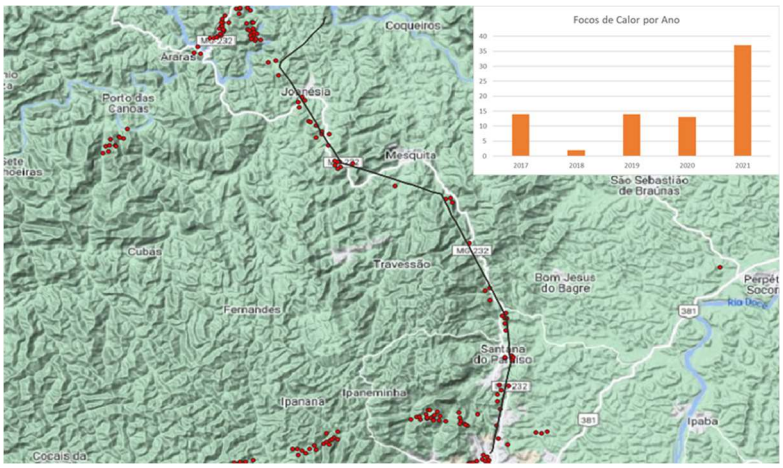


Figure 5.13 – Analysis of fires along the line Ipatinga 1 – Porto Estrela.
[Legend: Heat Spots per Year]

2) Monitoring and issuing alerts in real time, allowing field teams to be dispatched to assess the situation before reaching the lines.

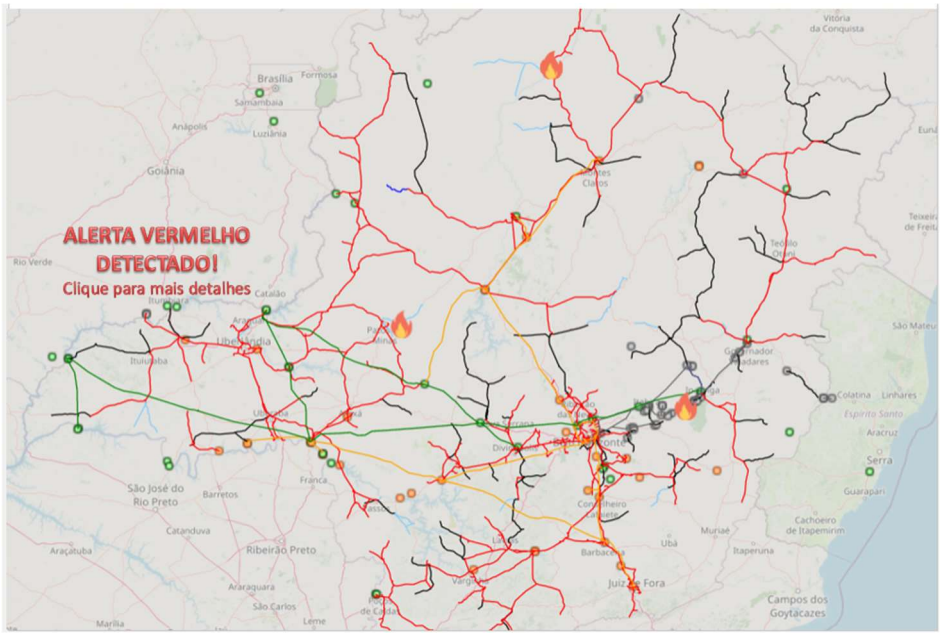
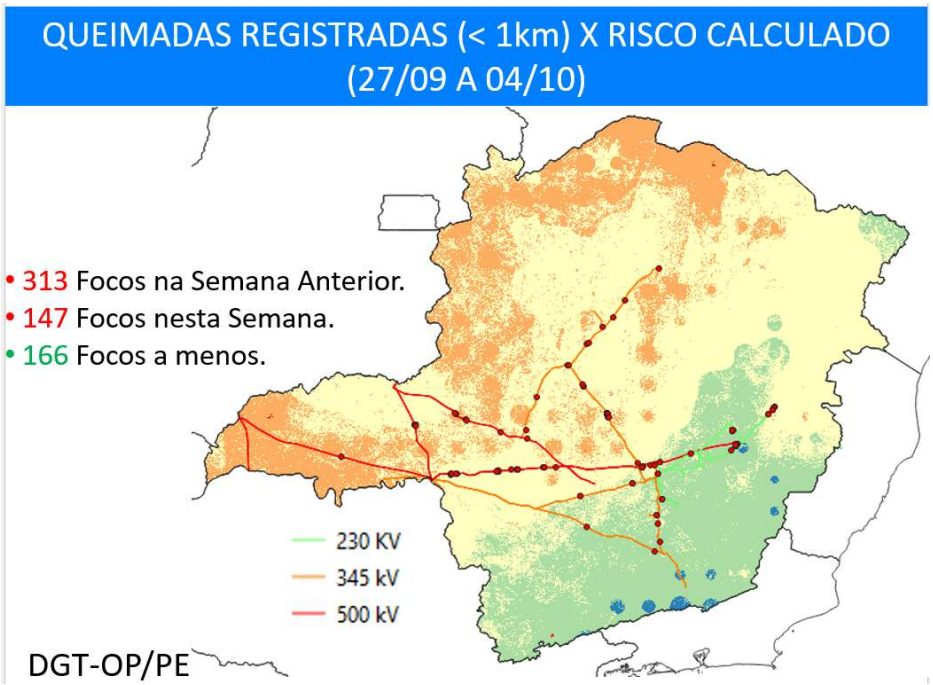


Figure 5.14 – Fire monitoring and alerts portal of Cemig.
[Legend: Red alert detected! Click for more details].

3) Calculation of the physical risk of ignition of fires, enabling the proper sizing of field teams.



[Legend: Fire registered (<1km) x Calculated Risk (09/27 to 10/04)
- 313 Focus in the Previous Week.
- 147 Focus this Week.
- 166 Less focus.]

Figure 5.15 – Physical risk of fires at Cemig.

Over the next few years, Cemig shall implement new initiatives with the objective of improving its operational efficiency and resilience to climate change, including, but not limited to, a complete analysis of all climate models available in CMIP6, an increase in the number of meteorological stations, expansion of the lightning detection sensor network, analysis of the risk of sea level rise on the northeast coast of Brazil and studies on the increase in the frequency of severe events in the areas of interest to Cemig.

Table 11: Summary of Main Adaptation and Mitigation Measures - Physical Risk

Description of Risk	Adaptation or Mitigation Measures
Physical Risk: Change in precipitation pattern	Diversification of the energy matrix, with investments in solar and wind energy. Cemig established in its strategic planning the goal of adding ~1GW of installed capacity (~450 MW) by 2025, investing BRL$4.5 billion in renewable sources and increasing the efficiency of the portfolio, in addition to investing BRL1 billion by 2025 in projects to Distributed Generation operation in vertical solar parks (equivalent to 275MWp);. Another action is the efficient management of the reservoir by increasing the assertiveness of the numerical weather and climate forecast. In this regard, hydrological models are used to support short-term decisions, as well as medium-term analyses.

Description of Risk	Adaptation or Mitigation Measures
Physical Risk: Intensification of extreme events	Management methods seek to reduce, in the medium-term, the magnitude of this risk through preventive adaptation measures, such as the management of urban afforestation, operation of climatological stations and meteorological radar, which more accurately predicts the occurrence and intensity of storms, and the emergency plan with the allocation of maintenance teams for the rapid restoration of energy supply. Cemig also carries out the Distribution Development Plan - PDD Cemig D, covering investments in the maintenance and modernization of the electricity distribution network. The company aims to be a leader in customer experience (TOP 3 in NPS), and security - with performance at least at regulatory levels (increase in Ebitda by BRL 1 billion, DEC at 95% of the regulatory limit, FEC at 70 % of regulatory cap) – preparing for the future through investments in smart grids, digitalization and analytics. Capex BRL12.5 bn (2021-2025). Fire: Measures to mitigate this impact are awareness campaigns, a fire warning system and fire prevention manuals. The adoption of hydrological models of rainfall x flow transformation allow the prediction of future flow scenarios. In this regard, in order to assess the risk associated with extreme events, analyzes are carried out by ensemble of forecasts, in order to obtain a cloud of probabilities and define the risk strategy for each situation. As a risk management tool, the *Proximidade* [Proximity] application establishes the company's relationship with the community for flood warning and a control instrument for civil defenses.

4.3) Assessment of Transition Risk

Implementation Scenario of NDC Brazilian

One of the main emerging regulations related to climate change in Brazil covers carbon pricing. Cemig actively participated in the Consultative Committee of the Brazil PMR Project, which ended in December 2020 and aimed to discuss the convenience and opportunity of including the pricing of GHG emissions in the package of instruments aimed at implementing the National Policy on Change in the Environment. Climate (PNMC) in the post-2020 period. It is expected that in the medium-term a regulated emissions trading system shall be implemented, encouraging companies to reduce their emissions. In 2022, the federal government published Decree No. 11075/22, which provides the procedures for the preparation of Sectoral Climate Change Mitigation Plans and institutes the National System for the Reduction of Greenhouse Gas Emissions. The decree provides for the preparation of sectoral plans to mitigate climate change, in which, we consider that the electricity industry shall be included, however, it does not establish deadlines and rules for the implementation of these sectoral plans, but the goals to be established shall be in line with the commitments assumed by the country the United Nations Framework Convention on Climate Change through the **NDC.**

Scenarios IEA SDS and NZE

The study considered was of World Energy Outlook (WEO), which uses energy projections from the International Energy Agency (IEA), which examines medium and long-term trends using world energy models (WEM).

Our analysis was based on the two-scenario model of WEO-2021: Scenario of Zero Net Emissions by 2050 (NZE) and the Sustainable Development Scenario (SDS). The NZE scenario, projected actions needed to achieve specific results for an emissions trajectory consistent with limiting global temperature rise to 1.5°C without a temperature excess (with a 50% probability). The IEA SDS scenario is integrated with the sustainable development goals, UN 2030 agenda, in which mitigation trajectories are traced to achieve a "well below 2°C" target of the Paris Agreement (SDG13), as well as ensuring universal access to energy services by 2030 (SDG7) and improves air quality (SDG 3.9)

Scenario: Zero Net Emissions by 2050 – NZE and Deep Decarbonization Scenario (DDS)

In Scenario NZE (Net Zero Emissions by 2050 Scenario), it is estimated that policies shall be implemented to comply with the Brazilian NDC, total decarbonization by 2050.

Considering the Deep Decarbonization Scenario (DDS), made available by the independent Policy Research Institute and a multi-stakeholder dialogue platform (IDDR[3]I), the analysis of decarbonization scenarios was developed through the ACP-[4]DDP project, in which Cemig, participated as a company in the electricity industry. In the study prepared by COPPE (Instituto Alberto Luiz Coimbra for Graduate Studies and Research in Engineering, from Universidade Federal do Rio de Janeiro [Federal University of Rio de Janeiro]), it projects a reduction of 88% in the emission intensity of the factor of the national interconnected system, 0.1264 tonCO2/ MWh in 2021 to 0.0014 tonCO2/MWh in 2040. In this scenario of deep decarbonization, it considers the implementation of a regulated carbon market in Brazil, with prices at 50 USD/tCO2 in 2040[5].

In the simulation presented in the table below, we consider the predicted emissions to meet the science-based reduction target to limit global warming to 1.5C by 2030 and achieve net zero emissions by 2040. It is estimated an increase in costs with the offset of 10% of residual emissions. The simulation results are shown in the table below.

Assumptions	2040
Emissions expected of Cemig (tCO2)	728,177.57

[3] https://ddpinitiative.org/

[4] ACP- Assessing low-Carbon Transition Initiative and DDP – Deep Decarbonization Pathways Initiative. ACT is the only methodological framework with sectoral methodologies assessing how the strategies and actions of the Company contribute to the purpose of Paris Agreement of reducing GHG emissions (below 2ºC). The initiative is part of the Global Climate Action Agenda of UNFCCC and has been supported by the French government since 2015.

[5] http://www.centroclima.coppe.ufrj.br/index.php/en/producao-academica-3/2015/158-deep-decarbonization-pathways-project/file

Assumptions	2040
Offset of 10% of emissions (tCO2)	72,817.76
Price per metric ton of carbon (USD/tCO2)	50
Offset cost USD	USD3,640,887.85
Offset cost BRL	**BRL 18,204,439.25**

Sustainable Development Scenario (SDS)

We consider the IEA Sustainable Development Scenario, and the implementation of public policies to achieve the goals of the sustainable development goals, guaranteeing access to energy (SDG 7) and combating climate change (SDG 13), in order to comply with the Paris Agreement.

In this scenario, we estimate that there shall be a demand for new products and services necessary for companies to reach their GHG emission reduction targets, in addition to investments in new technologies to reduce dependence on fossil fuels. The main negative impact for the company would be the loss of revenue due to new demand for services or loss of market with new players in the industry more adapted to market demand.

With regard to technological advances, we identified that the implementation of smart grids, distributed generation, energy storage, new energy sources, electrification of the fleet are the ones that most impacted the company's activities. An increase in electricity demand is projected to meet electromobility, the need for investments in infrastructure, and the expansion of renewable sources (solar and wind) and natural gas thermal plants to ensure energy security.

Table 12: Summary of Opportunities

Risk	Opportunities
Risk of Transition: Regulatory Change	Compliance with regulatory requirements and the emergence of new international agreements can create opportunities for Cemig, since the Company, as it has a predominantly renewable energy matrix (installed capacity 2020: 98.1% hydraulic and 1.9% between wind and solar) and with low carbon emissions, it is better prepared than its competitors to adapt to this scenario. The establishment of a cap-and-trade market for emission trading in Brazil or in the world, along the lines of the CDM, for example, could lead Cemig to position itself as an important supplier of emission reduction certificates. This opportunity could lead to an increase in revenue at Cemig.

Risk	Opportunities
Risk of Transition: market	Sale of energy efficiency projects: In a scenario of greater corporate investments in energy efficiency aimed at reducing energy consumption and, consequently, GHG emissions, the Cemig SIM subsidiary shall likely have an increase in demand for its services, including the implementation of projects to use lighting with LED technology, cogeneration, distributed generation and other energy solution services. It should be noted that these projects are carried out through performance agreements where Cemig SIM contributes the necessary resources and recovers its investment through the savings of these projects. In this context, Cemig SIM may also experience an increase in demand for consulting services for the implementation of an Energy Management System based on ISO 50001. Cemig SIM was created in October 2019, resulting from the merger of the operations of the companies Efficientia and Cemig GD, to operate in the market for distributed generation, energy efficiency and energy solutions. In addition to the branding and marketing strategy focused on retail and the digital transformation of the electricity industry, the organizational culture of SIM, with a strong innovative and technological character, is being built so that customers are always at the center of decisions.

5) Innovation

The electric energy sector is undergoing a set of transformative changes, driven by the intersection of several factors such as: i) increasing decentralization of energy generation systems; ii) advancement of energy storage technologies; iii) proliferation of digital technologies, which allow energy to be produced, transmitted and consumed in a more intelligent and efficient way; iv) growth of variable renewable energy sources, such as wind and solar; v) trend towards decarbonization of the energy system, as part of global efforts to mitigate climate change.

With a view to this set of changes, Cemig has implemented, since 2018, the Strategic Plan for Digital Technology, which includes training, diagnosis, prospecting and technological roadmaps, in order to:

• training for the new business modalities emerging in the country and in the world;

• creating request for proposals of R&D proposals in the area of digital technologies with a view to putting the company in line with technological evolution and major digital transformations;

• preparing projects able to drive new businesses creating economic and social benefits for the Company.

Constant innovation is one of main pillars of Cemig, and part of this is discovering new ideas for the industry. Therefore, in August 2021, the Cemig Innovation Challenge 2021 was launched, which will be valid for 18 months.

The challenge was open to the general public, who shall be invited to submit proposals for the formatting of new Research & Development projects, according to rules of Aneel. The projects shall be analyzed under the Innovation guidelines approved in the 2021-2025 strategic planning

and, if approved, shall be formalized with the new contractual drafts for the development of the approved ideas.

The Challenge Cemig [*Desafio Cemig*] awaits proposals from individuals and companies based in Brazil on the following matters:

• Smart products and services;

• Electric systems of the future;

• Electrification and electromobility;

• Alternatives in sustainable generation.

6) Investment made

In 2021, Cemig invested BRL 145.9MM in Expansion of the Transmission System, with emphasis on the Energization of 212MVA linked to the transformers of SE Neves 1 (Metropolitan region) and SE Várzea da Palma 1 (North of Minas region).

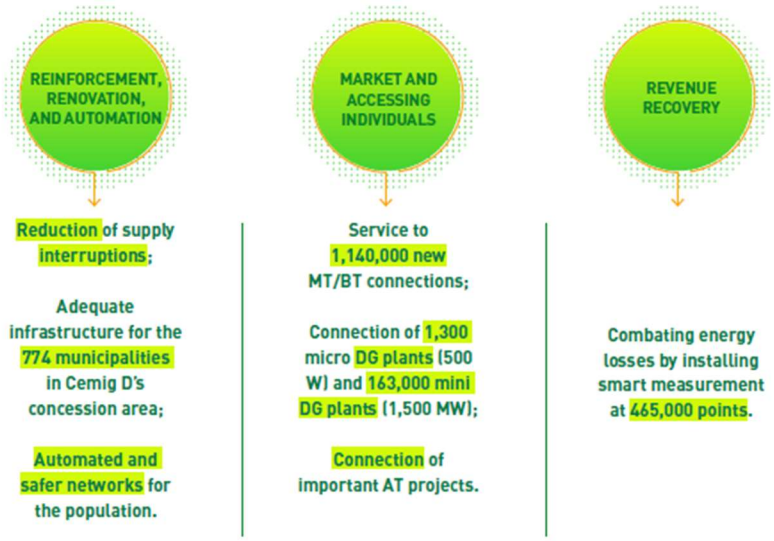


Figure 5.15: presents the main investments in electricity distribution infrastructure in 2021.

It also invested BRL 69.9MM in the modernization of transmission facilities, including replacement of equipment at the end of its useful life, automation and system adaptations, as well as the replacement of equipment from the emergency technical reserve. A spare 25MVA transformer was acquired to meet contingencies, strategically located in SE Neves 1 and a 300 MVA transformer for replacement in SE Ouro Preto 2.

Cemig invested BRL 80.1MM in improvements and expansion of its generation park, with emphasis on the inauguration of the Photovoltaic Power Plant Três Marias GD with a power of

2.5 MW and in the expansion of the SHPP Poço Fundo, with an increase from 9.16 MW to 30 MW installed power (expected completion in the 1st half of 2022)

At that moment, natural gas is configured as a transition fuel from a more intensive to a less carbon intensive economy. Companhia de Gás de Minas Gerais – Gasmig is the exclusive distributor of piped natural gas in Minas Gerais, by granting a concession, serving the industrial, residential, commercial and thermoelectric segments, supplying compressed natural gas (CNG), liquefied natural gas (LNG) and automotive (NGV). Cemig holds 99.57% of the capital of Gasmig. In 2021, Gasmig invested amounts of around BRL54.2 million (BRL50.2 million in 2020), mainly in the expansion of its Natural Gas Distribution Networks (RDGNs) in the State of Minas Gerais, and its customer base increased by 15.99%, from 61,414 in 2020 to 71,236 consumer units in 2021.

7) Metrics and Goals

Scope 1 emissions in 2021 were: 8,956.83tCO2e resulting from the fleet of vehicles, boats and aircraft; 3668.06 tCO2e of fugitive emissions of SF6 gas present in electrical equipment and fugitive emissions from natural gas distribution; 114.27tCO2e from stationary combustion (natural gas from stationary sources); 46.98 tCO2e, from agricultural emissions and land use change, totaling 12,847.64 tCO2e.

Emissions of Scope 2 of Cemig in 2020 totaled 861,233.04 tCO2e. Out of the total emissions of Scope 2 in 2021, 4,707.95 tCO2e resulted from energy consumption and 861,525.09 tCO2e (99.5%) resulted from electrical losses in the Transmission and Distribution systems. In addition, in 2021, the total loss indicator (IPTD) was 11.27% in relation to the total energy injected into the distribution system, a value adopted by Cemig this year. The IPTD results from the difference between the total energy injected into the distribution system, calculated by the Electric Energy Commercialization Chamber (CCEE), and the total energy consumed by the market. The IPTD is internally segmented into Technical Losses, which are inherent to the transport of energy, and Non-Technical Losses, which occur in the electrical system due to both measurement errors and energy theft.

Combining the emissions of Scope 1 and 2, the year 2021 presented a total of 874,080.68 tCO2e emissions, representing 8.61% of total emissions, and scope 3 with 9,280,380.25 representing 91.39% of the total of emissions.

Table 13 GHG Emissions debts by Scope and Category (tCO2e)

Scope	Category	Emissions (tCO_2e)	Representativeness (%)
Scope 1	Stationary combustion	114.27	0.89%
	Mobile combustion	8,956.83	69.72%
	Fugitive	3,688.06	28.71%

Scope	Category	Emissions (tCO_2e)	Representativeness (%)
	Agricultural activities	46.98	0.37%
	Change of soil use	41.50	0.32%
	Total Scope 1	**12,847.64**	0.13%
Scope 2	Electricity Consumption	4,707.95	0.55%
	T&D losses	856,525.09	99.45%
	Total Scope 2	**861,525.04**	8.48%
Scope 3	Purchased Goods and Services	244.06	0.00%
	Employee displacement (home-work)	553.58	0.01%
	Waste generated in operations	558.17	0.01%
	Transport and distribution (upstream)	2,726.37	0.03%
	Use of goods and services sold	9,276,221.56	99.96%
	Business trips	96.52	0.00%
	Total Scope 3	**9,280,380.25**	91.39%

The increase in Scope 2 and 3 emissions in 2021 is related to the increase in the grid emission factor, which went from 0.0617 tCO2e/MWh in 2020 to 0.1264 tCO2e/MWh in 2021, representing an increase of 48.81%. The variation of the grid emission factor is a consequence of the rainfall regime between the years, implying in the balance of energy demand through hydroelectric and thermoelectric plants.

The main source of emission in scope 2 are losses in energy transmission and distribution, while in scope 3 the main emission is associated with the commercialization of electricity, these two emission sources are directly affected by the increase in the grid emission factor. As a measure to offset emissions from energy sales to customers, they were used in 2021 (3,101,129.36 RECs or MWh), making it possible to offset 392,034.44 tCO2e.

Renewable Energy Certificates (RECs) aim to prove the renewable origin of the energy sold (Hydroelectric, wind, photovoltaic, biomass), allowing to trace and prove the origin of energy. In 2021, two types of RECS were issued: I-REC, which follows the methodology of the I-REC Standard, being produced by the TPP of Emborcações, and the CEMIG-REC, which follows CEMIG's internal methodologies, attributed to the HPPs Nova Ponte, Irapé and Três Marias.

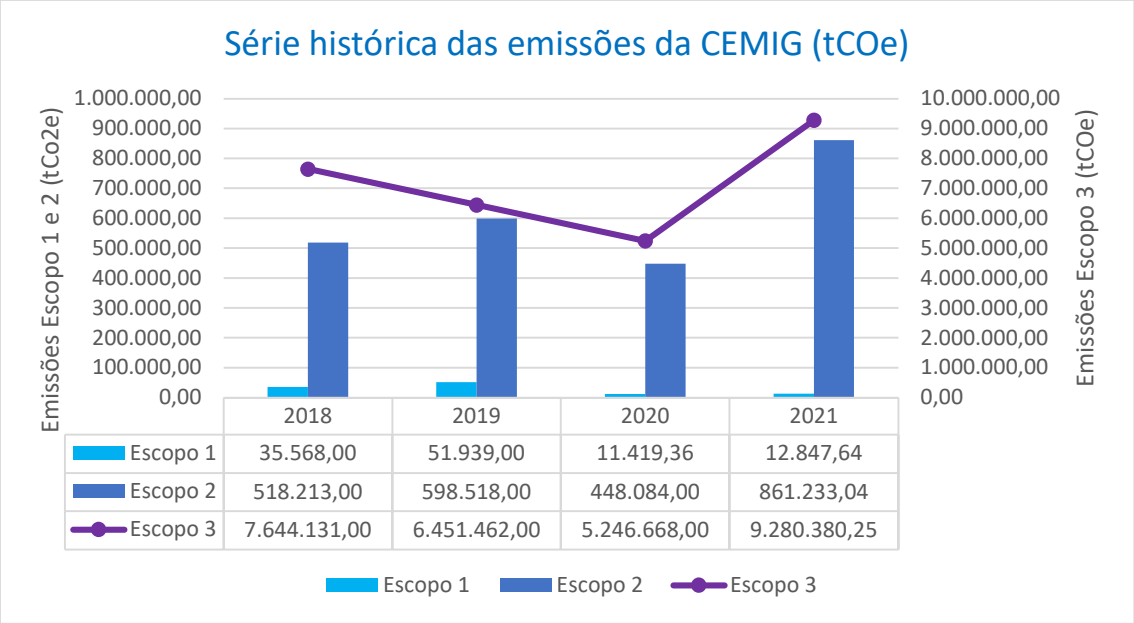


Figure 5.16 Historical Series of Emissions of CEMIG (tCOe).

[Legend: Emissions Scope 1 and 2 (tCo2e) | Historical Series of Emissions of CEMIG (tCOe). Emissions Scope 3 (tCOe) | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3]

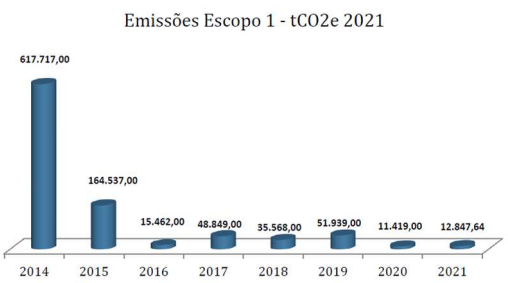


Figure 5.17: Emissions Scope 1 tCO2e 2021

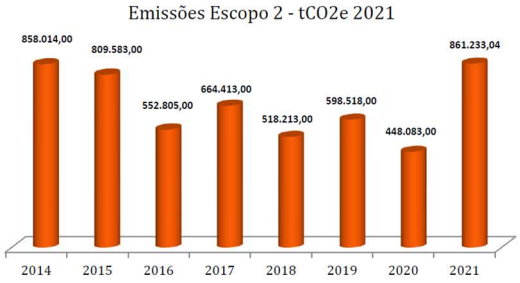


Figure 5.18: | Emissions Scope 2 tCO2e 2021

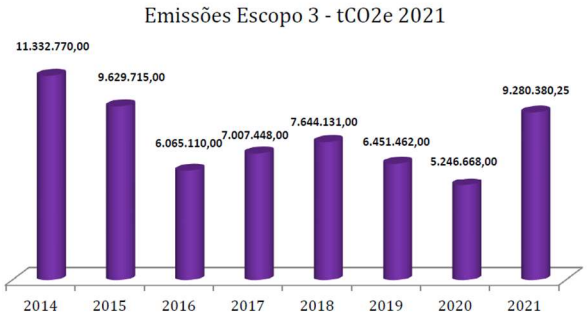


Figure 5.19: Emissions Scope 3 - tCO2e 2021

As described above, in 2022, the company committed to developing a science-based target for reducing GHG emissions, as recommended by the Science Based Targets (SBTi) initiative, which

establishes guidelines and methodologies for developing emission reduction targets based on scientific effort to limit global warming to 1.5 ^{o}C .

The SBT goals has a target year 2030 and is in the process of being validated by the expert team of the initiative SBT. The target was submitted in June 2022 and is still under review.