

Greenhouse Gas Inventory - 2011

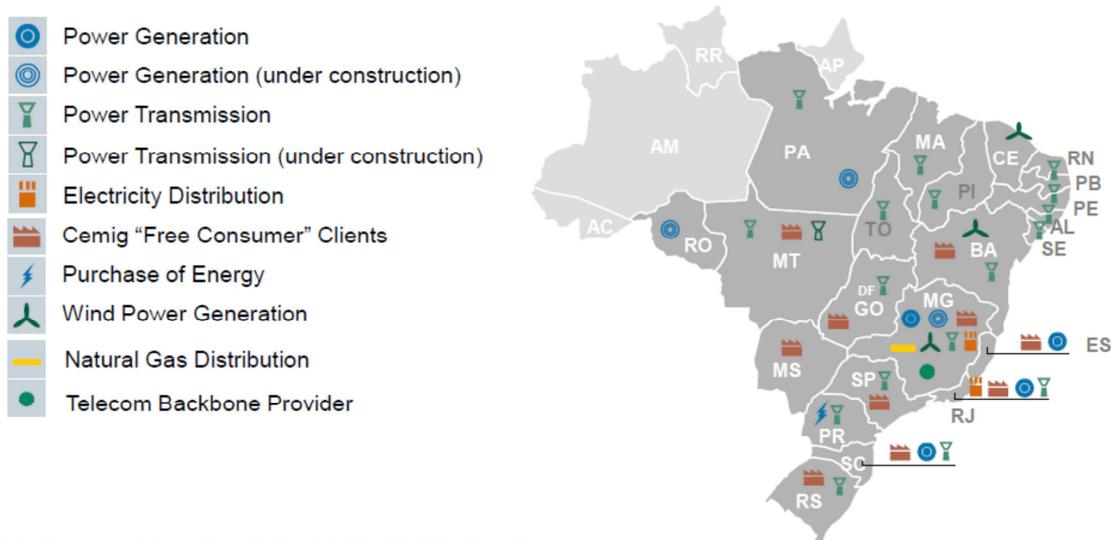
Cemig – Companhia Energética de Minas Gerais



1. Cemig

Cemig is one of the most solid groups in the electric energy sector in Brazil. Its operations are coordinated by a holding company (Companhia Energética de Minas Gerais – Cemig) and its two subsidiaries: Cemig Geração e Transmissão S.A. (Cemig GT) and Cemig Distribuição S.A. (Cemig D). It has stakes in 114 companies, 15 consortia and a holding fund with assets and businesses in 22 states in Brazil and the Federal District, in addition to Chile (Figure 1). It is active in the areas of electric energy generation, transmission and distribution and energy solutions and also has investments in natural gas distribution and data transmission.

Cemig: Present in 22 states, in the Federal District and in Chile



* in terms of length of electricity distribution lines

In 2011 the Company increased to 32.5% its stake in Light (26.06% held directly), which is an energy distributor that serves the capital of the state of Rio de Janeiro and other municipalities in that state. It also has stakes in the companies that comprise TBE - Transmissoras Brasileiras de Energy, which owns and operates transmission lines in the Northern and Southern regions of the Country and a 56.7% stake in Transmissora Aliança de Energia Elétrica S.A. (Taesa).

In the area of electric energy distribution, Cemig has a share of approximately 12% of the Brazilian market (free and captive markets).

Cemig is a joint-stock company controlled by the Government of the State of Minas Gerais and has 115,000 shareholders in 44 countries (data from January 2012). Its shares are traded on the São Paulo, New York and Madrid stock exchanges.

A benchmark in the global economy, Cemig is recognized for its sustainable performance. For 12 consecutive years, it has been part of the Dow Jones Sustainability Index and is the only company in the Latin American electric sector listed in the index. Cemig's market value reached R\$ 22.7 billion on December 30th, 2011.

The Conglomerate's consolidated net operational revenues amounted to R\$ 15.8 billion in 2011, based on an energy matrix whose main source is renewable. Cemig's generation system has an installed capacity of 6,964 MW, of which 96.6% is hydroelectric generation, 2.7% is thermal (1.9% waste gases from steel mills and 0.8% fuel oil) and 0.7% wind generation.

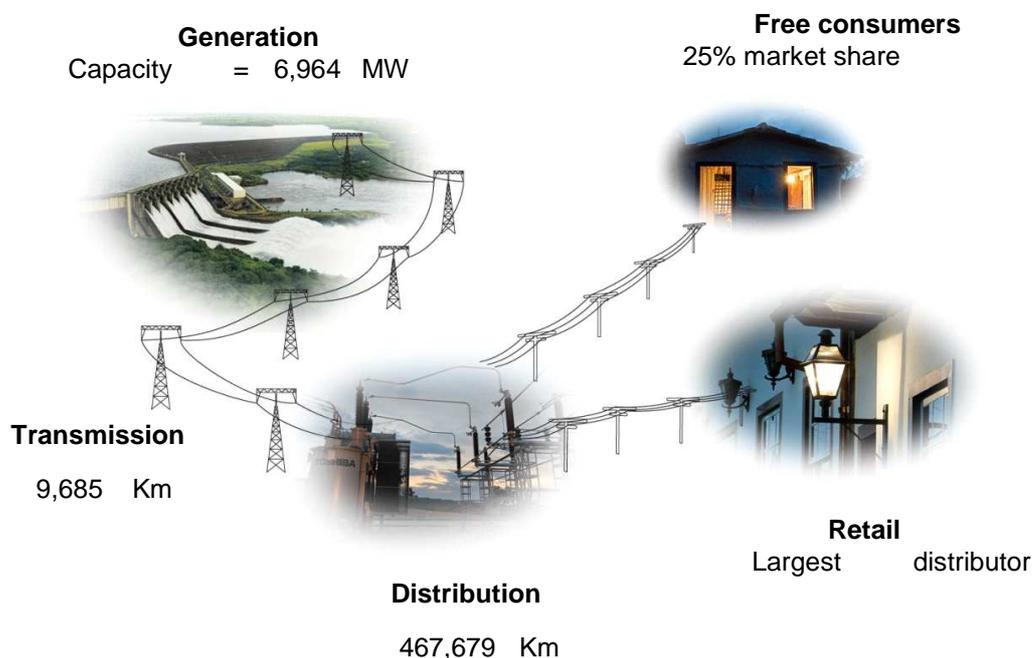


Figure 2 – Cemig's operational data

2. About the inventory

This report presents the results of Cemig's Greenhouse Gas (GHG) Emissions in 2011. The inventory was produced according to the directives established in the ISO Norm 14064-1 and the specifications of the Brazilian GHG Protocol Program, with 2008 being the historical base line year. The production of the GHG emissions inventory is an important step for Cemig because it determines the quantity and the origin (source) of emissions that may be reduced.

Though there is no legal obligation, Cemig, for the first time, has submitted its GHG inventory for independent verification, thus lending greater reliability to the document. This verification was performed by Bureau Veritas Certification.

The choice of the calculation methods resulted, mainly, from the availability of data and the specific emission factors. The data were assessed using existing logs in the company's ERP system, in corporate systems, invoices and log spreadsheets.

The inventory was produced based on the methodologies presented below:

- *ABNT NBR ISO 14064-Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*
- *“The Greenhouse Gas Protocol – a Corporate Accounting and Reporting Standard – Revised Edition. 2010*
- *Specifications from the Brazilian GHG Protocol Program: Corporate Accounting and Standards for the Development of the First Edition of the Report - 2010*
- *Intergovernmental Panel on Climate Change (IPCC) 2006, IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Program*

GHG emissions were calculated using the “Greenhouse gas emissions from cross-sector sources calculation tool” (GHG Protocol Tool) - Brazilian Version “Ferramenta v2011.2”.

To mobile source Cemig were used the emission factors of N₂O and CH₄ from the IPCC Guidelines for National GHG Inventories (2006), in order to provide comparability with emissions international.

In order to estimate the SF₆ loss percentage, a factor of 0.7¹% per year was used.

When calculating the distance between airports in the item “business travel - Scope 3”, the following website was used: <http://www.gcmap.com>.

3. Organizational limits and emitting activities

Cemig has adopted the Operational Control approach, i.e., the companies which Cemig owns (100% control). Therefore, the following companies were included in the inventory:

- Cemig Geração e Transmissão S.A. (Cemig GT)
- Cemig Distribuição S.A. (Cemig D)

¹ E.Preisegger, R.Dürschner, W.Klotz, C.-A.König, H.Krähling, C.Neumann, B Zahn. Life Cycle Assessment Electricity Supply Using SF₆ Technology. Available at <http://www.denix.osd.mil/cmrmdupload/Life-Cycle-Assessment-SF6-Preisegger-at-al.pdf>

- Rosal Energia S.A.
- Sá Carvalho S.A.
- Efficientia S.A.
- Usina Térmica Ipatinga S.A.
- Cemig PCH S.A.²
- Horizontes Energia S.A.³
- Usina Térmica do Barreiro S.A.

The following emission sources were identified at these companies:

Scope	Comment	Emission sources
Scope 1: Direct emissions GHG	Emission sources that are owned by the company or controlled by it.	<ul style="list-style-type: none"> - Mobile Sources <ul style="list-style-type: none"> • Fuel consumption by the fleets of the following companies: Cemig GT, Cemig D, UHE Rosal, UHE Sá Carvalho, Cemig Telecom and Efficientia • Consumption of LPG, diesel and gasoline by stackers and cranes • Fuel consumption by aircrafts • Fuel consumption by small ships - Stationary Sources <ul style="list-style-type: none"> • Start-ups at thermal process gas plants - Barreiro Thermoelectric Plant (natural gas) and Ipatinga Thermoelectric Plant (fuel oil) • Igarapé Thermoelectric Plant

² Four Small Hydroelectric Plants operated by Cemig GT. The emissions are accounted for by Cemig GT.

³ Small Hydroelectric Plant operated by Cemig GT. The emissions are accounted for by Cemig GT.

		<ul style="list-style-type: none"> • Emergency generators • Air conditioning • Machinery that consumes Fossil fuels • Fugitive emissions of SF₆ • Fertilizers for the production of saplings and riparian forest replanting
Scope 2: Indirect emissions	Emissions generated through the consumption of electric energy by the company	<ul style="list-style-type: none"> - Electric energy consumption at administrative and operational units - Electric energy losses in transmission and distribution systems
Scope 3: Other indirect emissions	Emission sources that are not owned by the company nor controlled by it.	<ul style="list-style-type: none"> - Employee transportation - Electric energy consumption by final consumers - Materials and equipment transport - Business-related air travel

It should be noted that the contribution made by hydroelectric reservoirs to climate change was not evaluated quantitatively or qualitatively, due to the inexistence of a clear assessment of the role that it plays in relation to greenhouse gases. There are no still methodologies or conceptual models that are universally accepted for quantifying GHG emission from reservoirs. In 2011 Cemig began a research project in this area.

4. GHG Emissions

Scope 1 emissions in 2011 were 24,479 t CO₂e resulting from the fleet of vehicles and aircraft (14,894 t CO₂e), from leaks of SF₆ gas present in electrical equipment (3,452 t CO₂e), from emissions from thermal plants start-up (5,722 t CO₂e), from the use of emergency generators (156 t CO₂e), from the use of machinery and stackers (235 t CO₂e) and from the use of fertilizers (19 t CO₂e). Despite having been identified as a potential source of GHG emissions, there were no fugitive emissions of gases from air conditioning systems.

The Igarapé Thermoelectric Plant (131 MW) burns fossil fuels (fuel oil) when operating, but was not activated in 2011. Two thermoelectric plants, the Ipatinga

Thermoelectric Plant (40 MW) and the Barreiro Thermoelectric Plant (12.9 MW) burn blast furnace gases and other waste gases generated in the industrial steel processes as their main fuels. The consumption of fossil fuels (fuel oil and natural gas at the Ipatinga and Barreiro Thermoelectric Plants, respectively) only occurs during start-up .

Figure 3 presents the sources of Scope 1 emissions per source. Note that the majority of Scope 1 emissions came from mobile sources (61%), due to the large number of vehicles in the company's fleet.

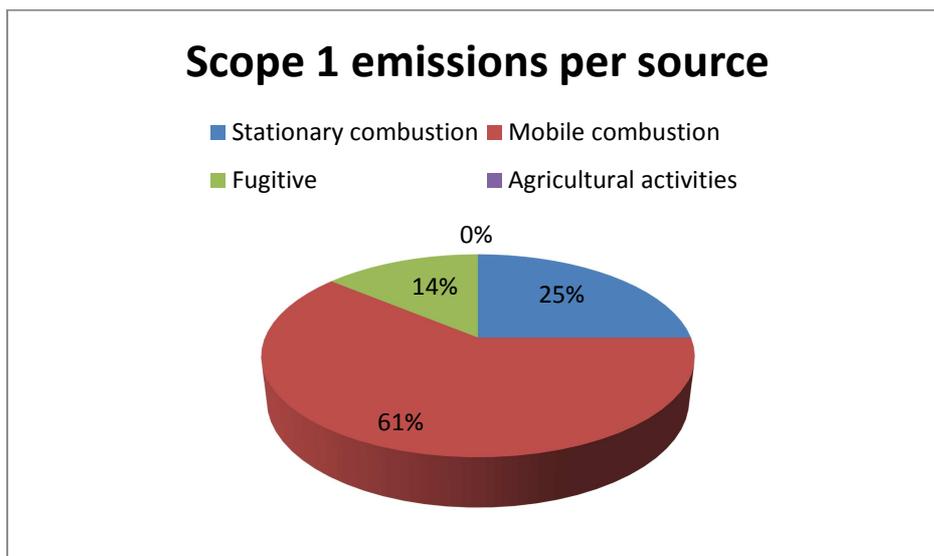


Figure 3: Scope 1 emissions per source

The table below presents the data on Scope 1, 2 and 3 emissions from 2008 to 2011.

Table 1: Scope 1, 2 and 3 GHG emissions Historical - 2008 to 2011

<i>Year</i>	Scope 1 (t CO₂e)	Scope 2 (t CO₂e)	Scope 3 (t CO₂e)
2008	260,641	282,439	-
2009	81,069	138,871	-
2010	41,904	295,477	3,692,314,055
2011	24,479	168,189	2,217,160,753

The decrease in scope 1 emissions, in 2008 in relation to subsequent years is due mainly to the non-operation of the Igarapé Thermoelectric Plant, which runs on fuel oil.

It should be noted that this plant enters into operation at the determination of the National System Operator - ONS, the federal body responsible for regulating energy generation in Brazil.

Thus, in 2009, 2010 and 2011, the main sources of GHG emissions were the Ipatinga Thermoelectric Plant (machinery start-up) and the company's vehicle fleet.

Beginning in 2011 the Ipatinga Thermoelectric Plant began to utilize coke gas for machinery start-up, resulting in a reduction in emissions from 18,930 t CO₂e in 2010 to 146 t CO₂e in 2011.

Also worth noting is the efficient management of fuel consumption by the vehicle fleet, which resulted in a reduction of 21.32% in emissions in the 2008-2011 period. This reduction was achieved with the implementation of measures such as improvements to the Fleet Control system, the implementation of Fueling Cards, the replacement in 2011 of 2,047 vehicles in the fleet (854 passenger vehicles, 869 light trucks and 324 trucks) along with the acquisition of six TetraFuel (4 different types of fuel) vehicles.

Therefore, Cemig's Scope 1 emissions intensity in 2011 was 0.72 kg CO₂/MWh. When comparing this figure with that of the National Interconnected System (29.2 kg CO₂/MWh) and the global and European averages (603⁴ kg CO₂/MWh and 412⁵ kg CO₂/MWh, respectively), one can see that Cemig's GHG emissions intensity is lower. This is because in 2011, continuing the trend of the past two years, 100% of the energy generated by Cemig was from renewable sources.

Scope 2 emissions refer to the consumption of electric energy at industrial and office facilities, which comes from the National Interconnected System (SIN), as well as energy losses in the electric system, with this being the main source of the Company's emissions. It should be noted that Scope 2 emissions are strongly influenced by the Brazilian emissions factor. In 2010 this factor was 0.0513 t CO₂/MWh and in 2011 this factor fell to 0.0292 t CO₂/MWh. Of the total scope 2 emissions in 2011, 0.8% (1,369 t CO₂) resulted from energy consumption and 99.2% (166,820 t CO₂) was the result of losses.

The main source of Scope 3 emissions is the consumption of electric energy by final consumers, be they industrial, commercial or residential. As the energy commercialized by Cemig is integrated into the National Interconnected System, the emissions factor for the grid is used to calculate these emissions. In 2011 this source was responsible for 2,213,681.200 t CO₂e. In comparison, between 2010 and 2011, the energy commercialized by Cemig rose from 71,944 GWh to 75,811 GWh. However, the emissions factor fell from 0.0513 t CO₂/MWh in 2010 to 0.292 t CO₂/MWh in 2011, which led to the fall in emissions.

In addition, 1,889 t CO₂e were emitted through business travel, 1,042 t CO₂e from employee transport and 549 t CO₂e from cargo transport.

⁴ Source: How the energy sector can deliver on a climate agreement on Copenhagen International Energy Agency 2009 p. 31. http://www.worldenergyoutlook.org/docs/weo2009/climate_change_excerpt.pdf

⁵ Source: WEO 2010 International Energy Agency (p. 640): 412 kg/MWh

The actions taken to minimize these emissions are described in item 11.

The table below presents the emissions breakdown per company (t CO₂e). It can be seen that Cemig GT and Cemig D represent 76% of the total Scope 1 emissions, caused mainly by the consumption of fossil fuels by the company's fleet. With regard to Scope 2 emissions, Cemig D is responsible for 92% of total emissions, originating from losses in the distribution system.

Table 2: Emissions breakdown per company (t CO₂e)

<i>Operation Unit</i>	<i>Scope 1 Emissions (t CO₂e)</i>	<i>Scope 2 Emissions (t CO₂e)</i>
Cemig Geração e Transmissão S.A.	3,126	13,314
Cemig Distribuição S.A.	15,572	154,875
Rosal Energia S.A.	1.8	0
Sá Carvalho S.A.	31	0
Efficientia S.A.	4	0.2
Usina Térmica Ipatinga S.A.	146	0
Usina Térmica do Barreiro S.A.	5,577	0
Cemig Telecomunicações S.A.	22	0.2
Total	24,479	168,189

5. Direct GHG emissions, quantified separately for each GHG, in tonnes of CO₂e

The table below presents the Scope 1 GHG emissions per greenhouse gas (t) and in metric tonnes of CO₂ equivalent (t CO₂e). It can be seen that CO₂ is the gas that is emitted in the greatest quantity, due mainly to the consumption of fossil fuels by vehicles.

Table 3: GHG emissions in tonnes of GHG gas and in metric tonnes of CO₂ equivalent (t CO₂e)

GHG	<i>in metric tonnes of each gas type</i>	<i>Global warming potential of each gas⁶</i>	<i>In metric tonnes of CO₂ equivalent (t CO₂e)</i>
CO₂	18,668	1	18,668
CH₄	18	21	377
N₂O	6	310	1,982
HFCs	0	140 – 11,700	0
PFCs	0	6,500 – 9,200	0
SF₆	0.1	23,900	3,452
Total	-	-	24,479

6. GHG emissions from biomass

The GHG Protocol and the IPCC (2006) recommend that emissions from the burning of biomass be reported and such emissions be considered neutral. For fossil fuels with the addition of biofuels, the values indicated by the National Petroleum Agency (ANP) were adopted and they were compiled using the Brazilian GHG Protocol Program Tool. In 2011, the average addition of ethanol to gasoline sold in Brazil was 23.75% and 5% for biodiesel added to diesel. In 2011, Scope 1 and Scope 3 emissions from biomass were, respectively, 1,103 t CO₂ and 78 t CO₂.

7. GHG Removal

Cemig undertakes a series of actions aimed at contributing to the removal of GHG, though it has opted not to quantify them.

The Company maintains environmental stations that cover a total of 5,742 hectares (57.42 km²). In addition, it produces and processes seeds, produces saplings and plants Riparian Forests. Cemig runs two forest nurseries at the Itutinga and Volta Grande environmental stations, along with a seed laboratory.

The Forest Seed Laboratory, located in Belo Horizonte, has collected 3,804 kg of fruit in 2011. Following administrative procedures and processing, they resulted in 622.7 kg of seeds of roughly 110 species, which were distributed to the Volta Grande and Itutinga nurseries and also sent to nurseries run by the State Forest Institute (IEF).

The Volta Grande and Itutinga nurseries have produced a total of 430,000 saplings of native species for use in the Company's riparian reforestation procedures, and 15,800 saplings for urban tree management initiatives. Of

⁶ Source: IPCC Second AR (1995)

these saplings, 40,000 were sent to the nursery at the Três Marias HPP, which is responsible distribution to rural landowners in the Northern region of the State who are interested in undertaking riparian recovery projects. The others were distributed among the Company's regional centers.

Regarding reforestation actions, 89 hectares of riparian forests have been planted at 7 of the Company's hydroelectric plant reservoirs: Camargos HPP – 14ha, Cajuru SHP – 4ha, Jaguará HPP – 3ha, Nova Ponte HPP – 08 ha, Rosal HPP - 10ha, São Simão HPP – 20 ha and Volta Grande HPP – 30ha.

8. Exclusions from the inventory

The inventory sought to account for all Cemig's main emission sources, except those resulting from the generation of effluents and solid waste (organic material).

9. Recalculation of the inventory

The inventories in 2008, 2009 and 2010 were recalculated since there has been an alteration in the methodology of the Brazilian GHG Protocol Program Tool - "Ferramenta v2011.2".

10. Inventory uncertainties

Cemig utilized the calculation methodologies and emission factors from the most recent and reliable sources (for example: The Greenhouse Gas Protocol Specifications for the Brazilian GHG Protocol Program and the IPCC Guidelines for GHG Inventories), which guarantee comparability with other Brazilian and international companies.

The data used to produce the inventory were gathered, for the most part, from existing logs in the ERP system and were verified by a third party, which has made the inventory more reliable.

Cemig has management systems based on the ISO 9001, 14001 and OHSAS 18001 norms. The standards for guaranteeing the realization of critical analyses, the handling and management of information and the normative requirements followed to ensure greater reliability of the results are described in the Management Systems Manual and in the General Procedures produced and approved at the corporate level. The areas that have been identified as emitters or managers of information related to Greenhouse Gases are certified in at least one ISO Norm and, therefore, are audited periodically both by internal and external, third party auditors.

In addition, some of the information utilized to produce the emissions report is verified annually within the scope of the Annual and Sustainability Report audit.

In order to measure the uncertainty of the GHG inventory, Cemig utilized the “*GHG Protocol Short Guidance for Calculating Measurement and Estimation Uncertainty for GHG Emissions*” with an uncertainty level of +/- 5.1% considered “Good” for the tool.

11. GHG reduction/management programs or strategies

Cemig considers the issues related to climate change to be important. Through the “10 Climate Initiatives”, it demonstrates its strategy for mitigation, adaptation and raising awareness among society. <http://www.cemig.com.br/sites/en/Sustainability/ClimateChanges/Documents/DezIniciativasClimaING.pdf>

The Company’s preparedness for and commitment to a low carbon economy are aimed at aligning its businesses based on an assessment of the climate-related risks and opportunities, informing society and investors of the strategies adopted by the Company.

The main actions aimed at reducing GHG emissions at Cemig are:

Scope 1

- Repowering of the Igarapé Thermoelectric Plant with an expected resulting increase in average efficiency of 1.407%, compared with the average from 2007-2008;
- Adoption of new fuel consumption management systems featuring the possible use of ethanol;
- Fleet renewal policy the results in improved efficiency;
- Keep the committed to prioritize the identification of new business opportunities in power generation toward renewables
- Investments in training and equipment, changes in methodology and processes, all focused on mitigating SF₆ losses, whether by eliminating leaks or by eliminating losses in the maintenance processes.

Scope 2

- Establishment of goals for the consumption of electric energy for Cemig Geração e Transmissão;
- Investments on the order of R\$ 300 million to reduce technical and non-technical losses.

For more details on Cemig's actions, please consult the Annual and Sustainability Report, Loss Management item.

Scope 3

- Realization of energy efficiency projects, with the priority publics being low income communities, hospitals, public institutions and non-profit educational and assistance institutions. In 2011, R\$ 53.8 million were invested, producing a reduction in energy consumption of 44,178 MWh/year and a reduction in peak demand of 16,235 kW in the residential and commercial sectors served by the program. This is equivalent to avoided emissions of 1,290 t CO₂eq. For further details please see the Energy Efficiency and Conservation chapter in the Environmental Dimension and the Intelligent Energy Program chapter in the Social Dimension of the Annual and Sustainability Report.
- In order to serve the non-residential public, Cemig has the whole subsidiary Efficientia, which is an Energy Conservation Services Company (ESCO) that is involved in the development and implementation of technological solutions that result in the efficient use of energy and the consequent reduction in greenhouse gas emissions at the facilities of medium and large size clients in the commercial, industrial and service sectors. At the end of 2011 the accumulated energy saved as a result of the implementation of projects managed by Efficientia and that are still fully operational reached a total of 110,037 MWh/year, representing an annual reduction of 3,213 t CO₂eq.

In addition, it is worth mentioning that Cemig assesses the risk of an increase in carbon emissions in its energy matrix, by conducting environmental due diligence with regard to acquisitions and mergers, or by including this risk in the calculation of the technical-economic feasibility of new projects through sensibility analyses. This initiative has assisted the Company in the decision making process by including climate strategy in the expansion of its business.

Cemig identifies the main risks and opportunities resulting from climate alterations for its businesses and undertakes monitoring and control measures. For further details, we recommend reading Cemig's response to the Carbon Disclosure Project – CDP.

12. Prepared by

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VERIFICATION STATEMENT

Bureau Veritas Certification, based on the processes and procedures described in its Verification Report, adopting a reasonable level of assurance, states that the *Greenhouse Gases Inventory – 2011 – Version 02*, from CEMIG - Companhia Energética de Minas Gerais:

- is accurate, reliable and free from material discrepancy, error or misrepresentation and is a fair representation of GHG data and information on the reference period (base-year);
- was prepared in accordance with *ISO 14064:2007 Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals* and also the specifications of the *Brazilian GHG Protocol – Accounting, Quantification and Publication of Corporate GHG Inventories – 2nd Edition*;
- presents information in a clear, understandable and accessible way, which allows the reader to form a balanced opinion on the performance and status for CEMIG considered base-year, for the defined scope.

CEMIG, considering the scope defined in its *Greenhouse Gases Inventory – 2011*, has established appropriate systems to implement the principles of ISO 14064:2007 Part 1, as follows:

- *Relevance: Select the GHG sources, GHG sinks, GHG reservoirs, data and methodologies appropriate to the needs of the intended user;*
- *Completeness: Include all relevant GHG emissions and removals;*
- *Consistency: Enable meaningful comparisons in GHG-related information;*
- *Accuracy: Reduce bias and uncertainty as far as practical;*
- *Transparency: Disclose sufficient and appropriate GHG-related information to allow intended users to make decisions with reasonable confidence.*

This VERIFICATION STATEMENT, issued by Bureau Veritas Certification, on the quality and accuracy of the *Greenhouse Gases Inventory – 2011* information, in the systems, processes and their controls is based on information that has been made available to us, and conditioned to what is defined and presented in the Verification Report.

April 19th, 2012

Marco Francisco Prauchner
GHG Lead Verifier