



## **INTENDED NATIONALLY DETERMINED CONTRIBUTION FROM THE PLURINATIONAL STATE OF BOLIVIA**

In accordance with the relevant paragraphs of Decisions 1 / CP.19 and 1 / CP.20, Bolivia communicates its Intended Nationally Determined Contribution (INDC), conditional to the new climate agreement to be approved at the COP 21 effectively reflects article 4.7 of the United Nations Framework Convention on Climate Change (UNFCCC), which states: " ... the extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties."

Respecting and demanding compliance with the UNFCCC, the Plurinational State of Bolivia observed the intention of several Annex I countries to standardize the emission reduction responsibilities eliminating the principle of Common but Differentiated Responsibility, through the figure of a standard "contribution" for all countries, regardless of the historical responsibility, as well as limiting responsibility for the provision of means of implementation under article 4.7 of the UNFCCC aforementioned.

Therefore, in Warsaw COP19 the Plurinational State of Bolivia submitted a "LEGAL INTERPRETATION" in regards to the INDC, stating that to Bolivia, decision FCCC/ADP/ 2013/L.4/Add.1 should be applied in strict accordance to Article 4, in particular paragraph 7 of the Convention.

Consequently, the contribution made by Bolivia applies under strict compliance with Article 4.7 of the UNFCCC.

Bolivia's contribution bears into account that the new climate agreement must be developed over the basis of the vision of the peoples and social organizations, to be revealed in the conclusions of World People's Conference on Climate Change and the Defence of Life in October 2015, rejecting in turn the vision of empires and transnational corporations, paving the way for a solution to the climate crisis from another alternative to the current view.

The structural cause that has triggered the climate crisis is the failed capitalist system. The capitalist system promotes consumerism, warmongering and commercialism, causing the destruction of Mother Earth and humanity. The capitalist system is a system of death. Hence, capitalism is leading humanity towards a horizon of destruction that sentences

nature and life itself to death. In this regard, for a lasting solution to the climate crisis we must destroy capitalism.

The capitalist system seeks profit without limits, strengthens the divorce between human beings and nature; establishing a logic of domination of men against nature and among human beings, transforming water, earth, the environment, the human genome, ancestral cultures, biodiversity, justice and ethics into goods. In this regard, the economic system of capitalism privatizes the common good, commodifies life, exploits human beings, plunders natural resources and destroys the material and spiritual wealth of the people.

Thus, Bolivia presents its intended contribution consistent with its vision of holistic development, according to the provisions of the State Constitution, Law No. 071 of The Rights of Mother Earth and Law N° 300 of Mother Earth and Integral Development to Live Well, guided by the 2025 Patriotic Bicentennial Agenda and its 13 pillars, as well as national plans for medium and long-term.

Bolivia understands Living Well as the civilizational and cultural horizon alternative to capitalism, linked to a holistic and comprehensive vision that prioritizes the scope of holistic development in harmony with nature and as structural solution to the global climate crisis. Living Well is expressed in the complementarity of the rights of peoples to live free of poverty and the full realization of economic, social and cultural rights and the rights of Mother Earth, which integrates the indivisible community of all systems life and living, interrelated, interdependent and complementary beings who share a common destiny.

### **Distribution of global emissions budget**

Protecting the integrity of Mother Earth, and especially the rights to regeneration in the context of climate change can be achieved through the distribution of the budget surplus of carbon emissions and greenhouse gases among all countries of the world in the context of climate justice criteria.

The climate crisis which we live has been generated by the exploitation of atmospheric space by and in favor of developed countries, as expressed in the third paragraph of the UNFCCC, "*Noting* that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs."

The AR5 IPCC report states that a total of 2,000 GtCO<sup>2</sup> were emitted between 1750 and 2010, 1,160 correspond to the member countries of the Organization for Economic Cooperation and Development (OECD) till 1990 and the transition economies, in other words Annex I countries.

Much of the corresponding non- Annex I emissions during historical periods of colonialism and neo- colonialism favored the enrichment of the industrial and imperialist countries; configuring a climate colonialism expressed through the control of atmospheric space.

Country contributions should be consistent with the recognition of historical responsibility and as expressed in paragraph 2 of decision 1 / CP.18 " ... the efforts of the parties should be made on the basis of equity and common but differentiated responsibilities and respective capabilities ... and should take into account the imperatives of equitable access to sustainable development, the survival of countries and protecting the integrity of Mother Earth. "

Bolivia has proposed a fair and equitable sharing of atmospheric space, taking into account the capacity for regeneration and protection of the integrity of Mother Earth. To not exceed 1.5 degree temperature by 2050, the budget set by the Intergovernmental Panel on Climate Change (IPCC) is 650 GtCO<sup>2</sup>. In order to implement the distribution of remaining carbon budget that would ensure the stabilization of concentrations of greenhouse gases in the atmosphere, Bolivia has proposed a Climate Justice Index for the fair and equitable sharing of the global emissions budget; moreover this means of distribution would impart the carbon budget based on the following indicators:

- a) *Historical responsibility*. Includes responsibility for the cumulative emissions since the pre-industrial era (1750-2010).
- b) *Ecological Footprint*. A calculation based on the amount of land, water and forest people of the countries need to satisfy all the goods consumed and to assimilate the waste they generate.
- c) *Capacity development*. Represents the conditions of economic and social development of each country.
- d) *Technological capacity*. Measures the ability of countries considering their technological development based on expenditures on Research & Development and industrial performance of each of them, considering their capacity to produce and export goods with high technology.

This index fairly determines the effort required by each country to stay within the budget of remaining emissions that corresponds to them. This implies that countries with high historical responsibility, high ecological footprints, greater development and greater technological capabilities, have a smaller share of the budget.

As a result of implementing the Bolivian index proposal, non- Annex I countries would have a total of 89% of the budget and Annex I countries only 11%. Also, to perform monitoring and sanction non-compliance with international commitments involves establishing an *International Climate Justice Tribunal*.

### **National Circumstances**

Bolivia has all the climates of the intertropical zone, from tropical climate in the plains to polar climate— as it reaches the high mountains, thus the impacts of climate change are diverse. During the past 50 years, the country has lost about 50% of the glacier surface and higher temperatures and stronger precipitation events are expected during the rainy season, which will expose different regions of the country to prolonged dry periods and an increase in the frequency and magnitude of floods, flash floods, hailstorms, overflowing

ivers, landslides and frost. The effects are evident in the social sectors (health, education, housing), economic (agriculture and industry) and infrastructure and services, which affect the way of life and production of the most vulnerable populations.

From 1982 to 2014, more than 4 million people have been directly affected by these phenomena, reaching about 40% of the population with an economic impact between 1-2% of GDP, depending on the severity of the weather event. By 2030, 27% of the country could be affected by persistent drought and 24% with highly recurrent floods.

Extreme poverty in Bolivia reached 17.3% of the population in 2015, and this will be eradicated by 2025. However, this is not possible if there are no actions to fully develop the national economy and reduce the impacts of change climate. Thus, Bolivia has prioritized a linkage of mitigation and adaptation actions in complementarity with the holistic development in the areas of water, energy, forests and agriculture as part of its 2025 Patriotic Agenda, and national development plans.

Bolivia has launched programs "My Water" and "My Irrigation" that have led to increased drinking water coverage to 90% in urban areas and 61% in rural area by 2012, and in relation to irrigation, irrigation coverage has increased to 362,000 hectares by 2014, on the basis of comprehensive and community management of water resources. In the immediate future, Bolivia plans to implement multipurpose hydro projects to enable coverage of irrigation and water storage capacity in the country and thereby strengthening adaptation to climate change.

Bolivia has large forest areas, with 52.5 million hectares in 2015. In Bolivia, forests provide livelihoods for communities and small producers and their environmental functions promote and contribute to the *living well* of urban and rural populations. Protected areas in Bolivia cover 22.5% of the national territory, of which 17 million hectares are under national jurisdiction. Bolivia considers that forests facilitate the provision of environmental functions, strengthen food security and livelihoods of local and national population in a complementary manner and promote timber and non-timber forest production and agroforestry systems, consolidating their contribution to development of the country. Thus forests contribute jointly to mitigation and adaptation to climate change.

With regard to agricultural production, Bolivia faces the challenge of expanding the area of food production in areas with agricultural potential mindful of environmental functions and promoting community and small farmers production. To date, Bolivia has an area of 3.5 million hectares for agricultural production and 2.2 million hectares for livestock production, which represents 5% of the country. Small farms and communities comprise a total of 57% of the titled area, 33% owned by the State, including protected areas and public land, and 9% are medium and large properties. Thus, agricultural production with the participation of smallholders and communities has an important contribution to climate change adaptation.

With regard to energy, Bolivia has increased access to electricity to 82% of the population in national average, and plans to achieve universal electricity coverage by 2025. Energy development is a key factor in expanding economic diversification, producing renewable energy and improving energy efficiency. Electric power will become one of the generators

of wealth for Bolivians through investments in hydropower and alternative energy. This will also increase the export capacity of energy from renewable sources to neighbouring countries. Therefore, energy is an important part of efforts to mitigate climate change.

### **Bolivian Context for actions on mitigation and adaptation to climate change**

Living Well with the vision of holistic development in which the Intended Nationally Determined Contribution of Bolivia is based on, includes the construction of a holistic human being without material, social and spiritual poverty; universal access of the population to all basic services, in the context of the human right to water; a social and community production model that generates wealth and redistributes it to build a more equal society; productive growth based on diversification by strengthening the energy, agriculture and tourism, and boosting oil and mining sectors with industrialization; roadside, railway and river integration of the country, connecting populations and the flow of goods between the Atlantic Ocean and Pacific Ocean; and an environmental management model for living systems to eradicate poverty, fully develop the local and national economies in a complementary way with the conservation of environmental functions and the development of sustainable production systems.

Bolivia considers that it must make fair and ambitious efforts to address the impacts of climate change, although it has not caused the phenomenon of global warming. Also, Bolivia defines its national contribution in the context of the 17 Sustainable Development Goals and its 169 goals, which are part of the new development agenda, from a holistic view of the commitments, to be implemented voluntarily by each State and framed by the Political Declaration of the General Assembly resolution document. The fight against climate change for sustainable and harmonious development with nature on the basis of management systems life is present in this vision.

This contribution responds to the application of a holistic approach to the construction of Living Well with joint impacts of mitigation and adaptation to climate change and takes place in a context of expanding the productive capacity of the country with diversification in the fields of agriculture and energy as sustainable sources of income for the country, strengthening the environmental functions, and the role of forests in the integral development, eradicating poverty as the basis of living well.

Bolivia will make an ambitious contribution in the context of national efforts; However, results and actions to mitigate and adapt can increase if it has the provision of means of implementation through mechanisms of international cooperation in the framework of the Convention, in accordance with the principles and provisions of the Convention, in particular Articles 4.4 and 4.7.

Bolivia considers that the joint approach between mitigation and adaptation in the context of overall development plans, is the only way to systematically address climate change, including the links between the different social, economic and environmental dimensions. Bolivia raises the need to establish a mechanism for international cooperation to support the integral development and climate resilience and the start of implementation of a Joint Mitigation and Adaptation Mechanism for Integral and Sustainable Management of Forests to strengthen synergies between mitigation and adaptation climate change in the field of

forests.

## **Comprehensive structural solutions and results and national action on climate change**

To contribute in solving the climate crisis based on the alternative vision of living well, helping to implement proposals that allow the world to advance structural solutions to the climate crisis, Bolivia presents the following contribution in two dimensions: one linked to the structural solutions, and other results and national actions within the framework of holistic development.

### **Structural solutions to the climate crisis**

1. Adoption of a new model of civilization in the world without consumerism, war-mongering, and mercantilism, a world without capitalism; build and consolidate a world order of Living Well that defends and promotes the integral rights of our peoples, undertaking the path of harmony with nature and respect for life.
2. Construction of a climate system based on responsibility to Mother Earth, the culture of life and the full realization of humanity in their holistic development, humanizing the economy, surpassing the simplistic approach to decarbonization of the economy.
3. Protection of the Rights of Mother Earth in an articulated and complementary manner to the rights of peoples to their development.
4. Defense of universal common goods such as the seas and oceans, water, atmospheric space, as well eliminate the technological monopoly, promoting people's access to the common heritage.
5. Elimination of patents on technologies and recognition of the human right to science and technology of life.
6. Effective implementation by governments of the human right to water.
7. Establishment of the International Court of Justice Climate and Mother Earth to enable countries to fulfill their international commitments to climate change in a context of respect for the rights of peoples and of Mother Earth.
8. Allocate the resources of the military machinery of the imperial powers and the war-mongers to finance the activities of the peoples against climate change.
9. Eradication of commodification of nature and carbon markets promoting business climate millionaires, which do not solve the problem of the climate crisis.
10. Decolonize natural resources environmental colonial biased views that see the peoples of the South as forest rangers of Northern countries and communities as enemies of nature.

### **Results and national actions in the context of holistic development**

Bolivia considers its nationally determined contributions as an ambitious and just effort, considering its national circumstances. Bolivia's contribution articulates in two periods in an integrated manner. The first is linked to the 2015-2020 period, in the understanding that all countries should undertake ambitious efforts now in order to achieve ambitious reduction in increase of global temperature. The second is related to the 2021-2030 scenario. Also, both periods consider the additional results that could be achieved with the support of international cooperation and the financial mechanism of the UNFCCC, understanding cooperation as grant-based finance and technology transfer.

The contribution seeks in a integrated and complementary manner different intended results linked to the achievement of living well in the context of climate change with regards to water, energy, forest and agriculture and livestock, in the following manner:

1. **2015-2030 Period with National Efforts.** The Plurinational State of Bolivia estimates reaching the following objectives and results in mitigation and adaptation in the framework on holistic development by 2030, with a 2010 reference year:

- Water. Increase in a holistic manner the adaptation capacity and systematically reduce the hydric vulnerability in the country.
  - Energy. Increase the electric generation capacity through renewable energies for local and regional development.
  - Forest and agriculture. Increase the capacity of joint adaptation and mitigation through the comprehensive and sustainable management of forests.
- i) **With regards to water**, actions will be promoted with a focus on adaptation to climate change and risk management, aiming for the following results:
- Triplicate (3.779 million m<sup>3</sup>) water storage capacity by 2030, in relation to 596 million m<sup>3</sup> in 2010.
  - Achieve 100% drinking water coverage by 2025, with resilient delivery services. 100% coverage of drinking water achieved by 2025, with resilient delivery systems and services.
  - Reduction of the water component of the Unsatisfied Basic Needs (NBI, for its name in Spanish) to 0.02% by 2030.
  - Triplicate irrigation surface to over 1 million hectares by 2030 with regards to 296.368 hectares in 2010, duplicate food production under irrigation by 2020 and triplicate by 2030, with regards to 1,69 million metric tonnes of 2010. In this manner, resilient agriculture and livestock systems will be achieved.
  - Significant improvement of social participation for local water management, increasing to 80% the number social organizations with resilient systems with respect to 35% of 2010.
  - Increase food production under irrigation, to more than 6 millions metric tonnes by 2020 with regards to 2010.
  - Increase the Gross Domestic Product (GDP) to 5,37% by 2030, with the contribution of resilient water and irrigation systems.
  - Reduction of water vulnerability from 0,51 to 0,30 units by 2030 with regards to 2010, which is measured with the *National Index of Hybrid Vulnerability* in the country, considering aspects related to exposures (treats), hydric sensitivity (hydric scarcity) and adaptation capacity.
  - Increase adaptation capacity from 0,23 units of 2010 to 0,69 units by 2030, which is measured through the *National Index of Adaptation Capacity of Water*

The following measures and actions will be developed for the achievement of results linked with water:

- Development of resilient infrastructure for the production and service sector.
- Construction of coverage networks of drinking water and sewage.

- Reuse of water for productive purposes to increase food production.
- Restoration of vegetation cover (trees, grasslands, wetlands and others) to prevent erosion and reduce damage due to adverse climatic events.
- Increase in irrigated area through revitalized irrigation systems, irrigation technology, irrigation dams, water harvesting, and multipurpose water reuse projects.
- Construction of multipurpose hydropower to expand the water storage capacity.
- Treatment plants for domestic and industrial wastewater including from mining and other activities.
- Strengthening community management, union and local capacities for adaptation to climate change, including community irrigation management and collective management of water services.
- Implementation of ancestral practices and knowledge, in the context of integrated water management.
- Risk management actions to mitigate common threats of the risks of drought and flooding.
- Installation of hydrometeorological, geological and seismic stations articulated nationally.
- Management of water quality service and loss reduction, including promoting the use of artefacts in low water consumption, efficient health systems and alternative technologies.
- Rainwater harvest for various domestic uses, as well as the re-use of gray water from showers, sinks, laundries and downspouts, for various domestic purposes, except for human consumption.
- Broader use of water harvesting technologies, conservation of soil moisture and water more efficiently (irrigation and livestock) (such as when there are shortages and stock up as store when there are plenty).
- Implementation of treatment systems and water purification to improve water quality for human consumption.

ii) **With regard to energy**, actions are promoted with a focus on mitigation and adaptation to climate change and holistic development, achieving the following results:

- Increased participation of renewable energy to 79% by 2030 from 39% in 2010.
- Increased participation of alternative energy and other energy (steam combined cycle) from 2% in 2010 to 9% in 2030 in the total electrical system, which implies an increase of 1,228 MW by 2030, compared to 31 2010 MW.
- Increased power generation to 13,387 MW electricity sector by 2030, compared to 1,625 MW by 2010.
- Reduced the Unsatisfied Basic Needs (NBI) for electricity coverage from 14.6% in 2010 to 3% by 2025.
- Develop the export potential of electricity, generated mainly by renewable energies, reaching to export an estimated 8,930 MW by 2030, increasing energy state income.



- Reduce moderate poverty to 13.4% in 2030 and eradicated extreme poverty by 2025, according to impact, among others, of the generation and energy coverage, including growth, distribution and redistribution of energy income.
- Contribution to the growth of Gross Domestic Product (GDP) to 5.4% in 2030 due to the impact of the energy sector.

To achieve results related to energy the following measures and actions will be promoted:

- Change and diversification of the energy matrix with renewable energy growth through the construction of hydropower (small and medium hydropower plants, large hydro and multipurpose) and boost alternative energy (wind, biomass, geothermal and solar), and use other sources of energy (steam combined cycle).
- Universal energy that promotes universal access to clean energy with emphasis on the poorest population.
- Large networks of power lines for transmission and distribution services coverage.
- State participation in energy generation, creating income and implementing policies and redistribution of wealth.
- Promotion of energy surplus export from renewables sources, positioning Bolivia as a regional powerhouse with clean energy.

iii) **In relation to forests and agriculture**, actions will be promoted with a focus on joint mitigation and adaptation to climate change and holistic development, achieving the following results:

- Zero illegal deforestation by 2020
- Increased the surface of forested and reforested areas to 4.5 million hectares by 2030.
- Increased forest areas with integrated and sustainable community management approaches with 16.9 million hectares in 2030, in reference to 3.1 million hectares by 2010.
- Strengthened environmental functions (carbon capture and storage, organic matter and soil fertility, biodiversity conservation and water availability) in about 29 million hectares by 2030.
- Contribution to Gross Domestic Product (GDP) growth of 5.4% in 2030, boosted by agricultural and forestry production complementary to conservation.
- Reducing extreme poverty to zero in the population dependent on forests by 2030, based on approximately 350 thousand people by 2010.
- Increase net forest cover more than 54 million hectares by 2030, compared to the 52.5 million of 2010.
- Contributing to an increase in Gross Domestic Product (GDP) of 5.4 % in 2030, furthered by agricultural and forestry production, complementing conservation efforts.
- Extreme poverty has been reduced to zero within the population that depends on forests by 2030 from approximately 350 thousand people in 2010.
- Net forest coverage has increased in 2030 to more than 54 million hectares compared to the 52.5 million in 2010.
- Joint mitigation and adaptation capacity has increased in areas covered by forests, agricultural and forestry systems from 0.35 units in 2010 to 0.78 in 2030, as measured by the *Index of Sustainable Forest Life*, achieving productivity and

conservation systems that are both complementary and resilient.

To achieve the results mentioned beforehand in forests and in agricultural, forestry and agro-forestry production systems, the following measures and actions will be implemented:

- Resilience has been achieved through the strengthening of environmental functions and the productive capacities of agricultural and agroforestry systems.
- Integrated and sustainable management of forests has strengthened through the management of timber and non-timber products in an integrated and sustainable manner.
- Conservation of areas with high environmental functions.
- Restoration and recovery of degraded soils and forests.
- Consolidation and strengthening of regenerative capacities of forests and forest systems.
- Implementation of control, monitoring, and tracking systems for the appropriate use of areas of forest life.
- Actions related to supervision and control for the proper management of forests has been achieved.
- Actions pertaining to the proper management of protected areas and forest areas with conservation priority have been achieved.
- Consolidation of agroforestry systems.
- Transition to semi - intensive systems of livestock management and integrated management of agroforestry and silviculture techniques.
- Transition to agricultural systems with sustainable management practices.
- Reduction of vulnerabilities in agricultural, fisheries, and agro-forestry systems of production.
- Sustainable use of biodiversity resources, wildlife and aquatic life for food security and sustainable industrialization.
- Control of illegal deforestation and establishment of systems of control and monitoring of deforestation, fires and forest fires.
- Training in technologies adapted to climate change (local knowledge and modern technologies).
- Actions to reduce the vulnerability of production systems in a climate change scenario.
- Usage of better local adapted varieties of species suited for the climate, and resistant to pests and diseases.
- Measures of agricultural and livestock production insurance to include additional conservation actions, making resilient agricultural and forestry production systems.
- Development of research and information on alternatives for climate change and adaptation technologies.
- Strengthening of local capacities for adaptation to climate change.
- Strengthening community based stewardship in forest management and farming systems.
- Forestation and reforestation, forest plantations, parks and urban forests.

2. **Period 2015-2030 with International Cooperation.** In the framework of international cooperation and with the support of the financial mechanism of the United Nations Framework Convention on Climate Change estimates that Bolivia could increase their results as detailed below:

i) In regards to water, the following results is estimated:

- Water storage capacity has quadrupled in 2030 (3.779 million m<sup>3</sup>) compared to 2010 (596 million m<sup>3</sup>).
  - Agricultural irrigation has increased to 1.5 million hectares by 2030, compared to 2010 with 296,000 hectares.
  - Agricultural production under irrigation has quadrupled by 2030 (9.49 million tons) compared to 2010 (1.69 million MT) .
  - Local water management by social organizations has increased to 90 % by 2030.
- ii) In regards to energy, the following results is estimated:
- Increased participation of renewable energy to 81% by 2030, compared to 39 % in 2010 .
  - We have consolidated the participation of alternative energy and other energy (steam combined cycle) to 9 % of the total electrical system with an installed capacity of 1,378 MW by 2030.
  - Bolivia's energy export potential has increased, generated mainly from renewable energy to power 10,489 MW by 2030.
- iii) In regards to forests and agriculture, the following results is estimated:
- Community forest management has increased sevenfold in the area of forest management in 2030.
  - Timber and non-timber production has increased by 40%, doubling food production from the integrated management of forest and agricultural systems in 2030.
  - Increased reforestation by 6 million hectares by 2030.

## ANNEX

### **Additional information Intended Nationally Determined Contribution by**

## the Plurinational State of Bolivia

This annex contains the methodologies used to calculate the results of the Intended Nationally Determined Contribution by the Plurinational State of Bolivia.

### *Global emissions budget*

Bolivia has developed the *Climate Justice Index* to calculate the participation of countries in the distribution of CO2 budget fairly and with a climate justice criterion. For this purpose data of the ecological footprint, historical responsibility, development capacity, technological capacity, and the population of the countries were used.

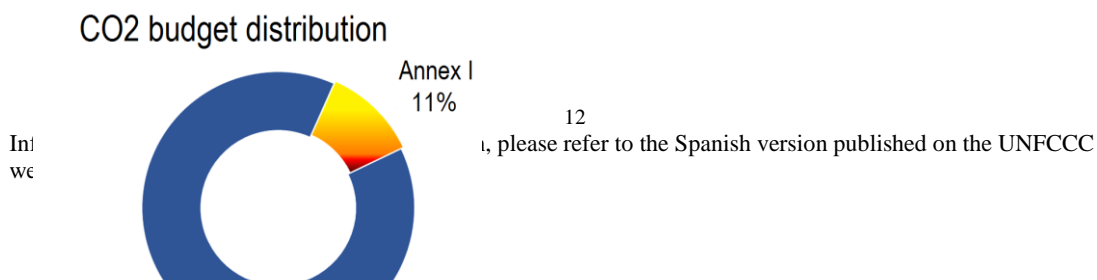
The following calculation for the these variables and data sources are used: i) for the calculation of the ecological footprint, the Ecological Footprint Global Index used by the UN Programme (UNEP) and the Convention on Biological Diversity (CBD), corresponding to *Footprint Network*; ii) The historical responsibility is calculated based on CO2 emissions since 1750, distributed according to IPCC data for 2010; iii) For the calculation of development capacity, the following was used: i) Gross Domestic Product (GDP) with World Bank data, ii) Poverty as a percentage of the population living on less than \$ us1,25 with data from the Statistical Division of the United Nations, and iii) the Human Development Index (HDI) developed by UNDP; and iv) The technological capability used the Performance Index of Industrial Competition by UNIDO and R&D expenditure as a percentage of GDP based information from the World Bank.

The equation developed by Bolivia in calculating the *Climate Justice Index* comprises the ecological footprint (hj), historical responsibility (rj), development capacity (dj), technological capacity (tj) and population (pj) as detailed below:

$$ij = \exp(-\theta_1 h_j - \theta_2 r_j - \theta_3 d_j - \theta_4 t_j + \theta_5 p_j) \ell^1$$

The indicator of percentage distribution of the carbon budget (ij) is obtained by multiplying each variable normalized by a weight  $\theta \in R_{0,1}$  and adding the result to the equation, where the signs of the parameters  $\theta \in R_{0,1}$  reflect the direction the relationship between the variable and the percentage of budget.

**Graph 1. Distribution of the CO2 budget**



This graph shows the percentage distribution of the countries grouped in Annex I and non-Annex I, defined in the context of the UNFCCC, resulting from the application of this methodology. The indicator percentage distribution of carbon budget is obtained by multiplying each variable standardized by a specific weight with a vision of climate justice that gives greater relevance to the historical responsibility, population and development capacity when calculating the percentage distribution of CO2 budget equivalent. The calculations reflect the direction of the relationship between the variables and the percentage of budget (low budget to greater ecological footprint, greater historical responsibility, greater development capacity and / or technology, and higher budget compared to a larger population).

## Water

Bolivia has developed the *Hydric Vulnerability Index* based on the conceptual framework on vulnerability of the Fourth Report of the Intergovernmental Panel on Climate Change (IPCC) in 2007. It establishes that vulnerability depends on the sensitivity and adaptation capacity of the system. Base on this:

$$\text{Hydric Vulnerability} = \text{Hazard} + \text{Sensitivity of Water System} - \text{Water Adaptability}.$$

This index is based on an analysis of the comprehensive effect (external and internal), taking into account: i) intensity, persistence and recurrence of the threats of climate change, ii) sensitivity of living systems and communities that coexist in such systems and iii) ability to adapt to climate change, which in turn includes: catchment, reservoir, storage and provision of water for human consumption and irrigation, increased social community water management, improving agricultural production with more efficient irrigation systems, wastewater reuse in big cities, and the universal expansion of national coverage of drinking water.

Bolivia has also developed the Index of Adaptation Capacity in Water, which was calculated using data from community management ( $gj$ ), productivity ( $yj$ ) water storage ( $cj$ ), access to water ( $aj$ ) and poverty ( $pj$ ) between 2015 and 2030, through the following equation:

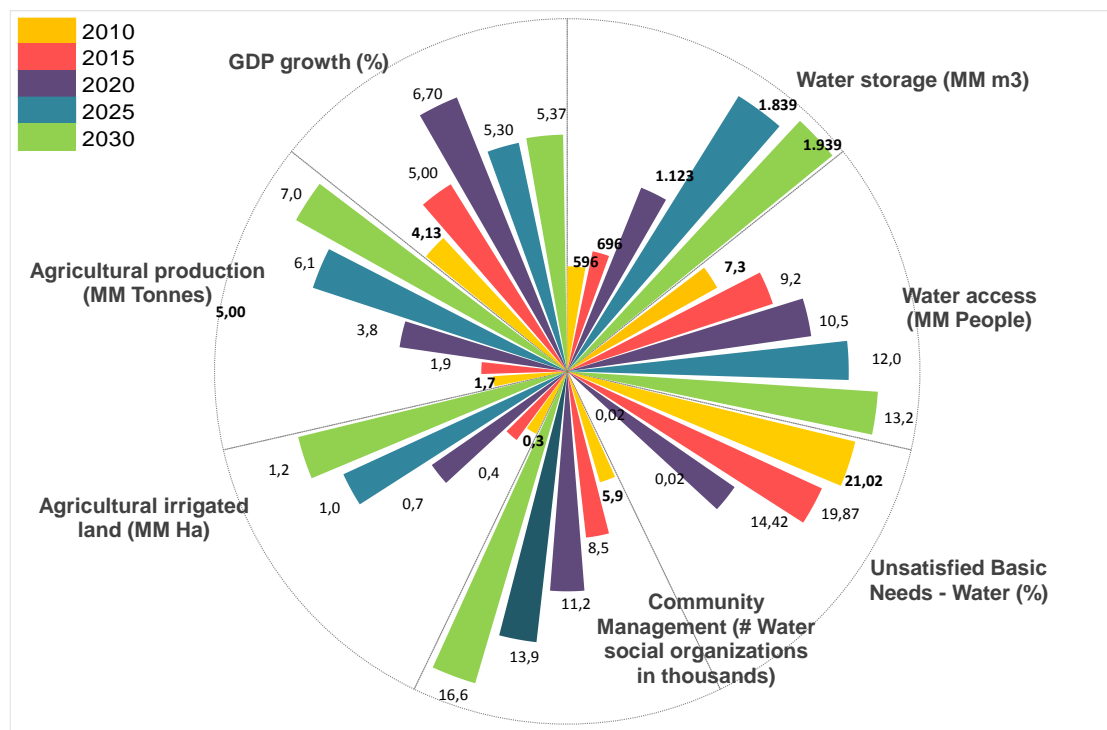
$$i_j = \theta_1 gj + \theta_2 yj + \theta_3 cj + \theta_4 aj - \theta_5 pj$$

This index ( $i_j$ ) was obtained by multiplying each variable normalized weight  $\theta \in \mathbb{R} \wedge 0.1$  and adding the result to the equation, so that an increase in community management, productivity, storage and access to water will increase the value of the indicator, reflecting

greater resilience, while an increase in poverty will reduce the value of the indicator representing less adaptability.

The main variables analyzed are impacts and outcomes with respect to water, and articulated in an integrated and complementary way, the same as shown in the graph below.

**Figure 2. Reducing water vulnerability and increasing adaptive capacity in water**



The above graph displays, in an integrated manner, the articulation of different variables associated with the storage of water and its impact on increasing access to water and increased agricultural production, while promoting the growth of agricultural GDP and reducing poverty by unsatisfied basic needs, and including community management of social organizations as a fundamental tool for achieving resilience related to water.

### Energy

For the modelling of the scenarios in the electricity sector, as well as the calculation of carbon equivalent emissions (CO<sub>2</sub>e) and the optimization for each stage of electricity generation, the OSeMOSYS program (Open-Source Energy Modelling System), developed by the Royal Institute of Technology in Sweden (KTH)<sup>1</sup>. This program is an open source software that allows modelling and optimization the planning of medium and long-term energy systems.

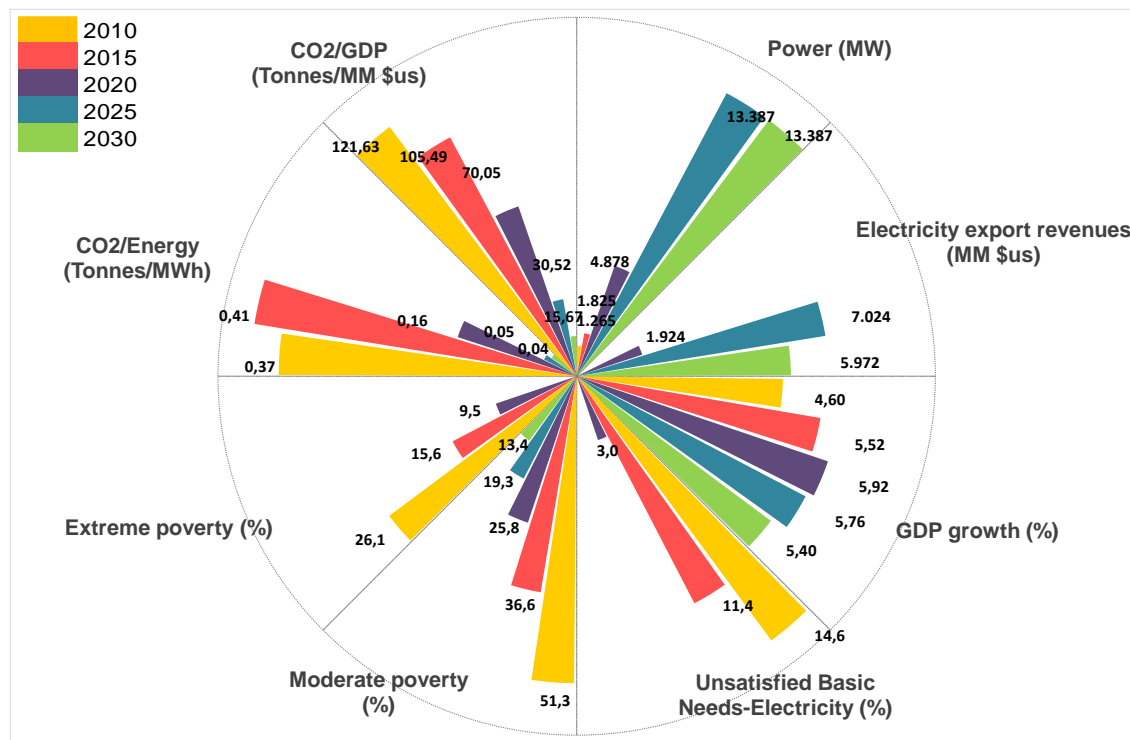
CO<sub>2</sub>e emissions are estimated with the OSeMOSYS model using the emission factor of

<sup>1</sup> For further reference, visit: [www.osemosys.org](http://www.osemosys.org)

each project and plant (the ability to generate CO2 per MWh). Therefore, we observe a trend in in emissions growth and avoidance of greenhouse gases for scenarios with national effort and international cooperation.

The main variables analyzed are impacts and outcomes with respect to energy articulated to integrated and complementary means, as explained in the graph below.

**Figure 3. Development of the electricity sector with a focus on climate change**



The graph above displays, in an integrated manner, the articulation of the most important different variables related to the electricity sector. The increase in electricity power influences the increase in export earnings, which in turn promotes the growth of GDP and this in the impact of reducing electricity NBI through electric coverage and reducing moderate and extreme poverty. Also, this displays the CO2 / energy and CO2 / GDP ratio, with a significant decrease in the proportion of CO2 influence in the economy and in power generation. Overall, this process contributes in reducing emissions from the electricity sector.

### Forestry and agriculture and livestock

Bolivia has developed the Sustainable Life of Forest Index to measure the combined capacity to mitigate and adapt to the comprehensive and sustainable management of forests, agricultural and agroforestry production systems.

The index articulates environmental functions ( $f_j$ ), poverty ( $p_j$ ), community management ( $g_j$ ), production ( $y_j$ ), and forest cover ( $c_j$ ), between 2015 and 2030. As environmental functions are provided for the following: i) carbon capture and storage; ii) the presence of organic matter in the soil; iii) availability of water; and iv) the presence of biodiversity in areas with high conservation value.

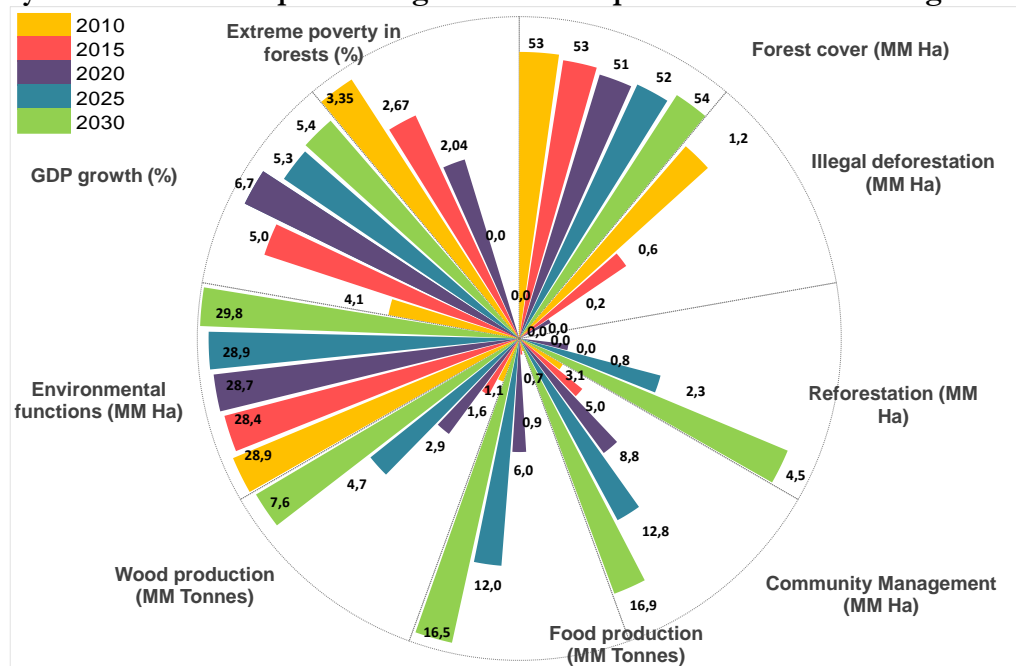
The equation designed by the Plurinational State of Bolivia to calculate the index *Sustainable Live of Forest Index* is:

$$i_j = \theta_1 \tilde{f}_j - \theta_2 \tilde{p}_j + \theta_3 \tilde{g}_j + \theta_4 \tilde{y}_j + \theta_5 \tilde{c}_j$$

The Index ( $i_j$ ) is obtained by multiplying each variable standardized by a weight  $\theta \in \mathbb{R}^{0,1}$  and adding the result in that equation, so an increase in environmental functions, community management, production and higher net forest cover, will increase the value of the index of aggregate capacity to mitigate and adapt, while a rise in poverty will reduce the value of the index.

The main variables analysed are results and impacts in relation to forests and agriculture and livestock articulate in an integrated and complementary way, as presented in the chart below.

**Figure 4. Integrated and sustainable management of forests and agricultural systems life with impacts mitigation and adaptation to climate change**



In the graph above the relationship between variables related to the integrated and sustainable management of forests and agricultural systems of life are displayed, highlighting the importance of community management of forests, with impacts on the growth of food production and timber forest products. The importance of reforestation,



reduction of illegal deforestation and increased forest cover in a scenario maintaining environmental functions is also displayed. As a result the increase of agricultural and forestry GDP impacts the reduction of national extreme poverty.