



# Input to the Enhanced Nationally Determined Contribution of the Republic of Paraguay

## 1. Background

The Republic of Paraguay is seen as a vulnerable country to climate change impacts, ranked 95 out of 181 countries in the 2019 Notre Dame Global Adaptation Index (ND-GAIN)<sup>1</sup>. Due to a combination of political, geographic, and social factors, as well as economic reliance on agriculture, animal farming and hydroelectric energy production, Paraguay is particularly exposed to the effects of rising climate variability and climate change.

Paraguay's total GHG emissions (including land-use change and forestry - LUCF) stood at 95.29 MtCO<sub>2</sub>e in 2018, which are considered low, compared to 73.24 MtCO<sub>2</sub>e in 2000 and 75.16 MtCO<sub>2</sub>e in 1990 (WRI 2021). Emissions in Paraguay have been increasing gradually since 2000, mainly due to land-use change and agriculture. The country has a 0.02% share of global CO<sub>2</sub> emissions in 2017. Excluding the LUCF sector, which is by large the main source of GHG emissions (46.12 MtCO<sub>2</sub>e), Paraguay's GHG emissions are mainly from agriculture (30.03 MtCO<sub>2</sub>e), energy sector (9.46 MtCO<sub>2</sub>e), waste (7.72 MtCO<sub>2</sub>e) and industrial processes (1.96 MtCO<sub>2</sub>e).

Paraguay submitted its Nationally Determined Contributions to the UNFCCC in 2016 and its Third National Communication (NC3) in 2017, in support of the country's objectives to achieve its development goals and increase its resilience to climate change by enhancing mitigation and adaptation efforts. Climate adaptation is a priority in the National Development Plan (2014–2030) and in the subsequent Climate Change Policy, across the following sectors: water resources, forests, agriculture and livestock production, territorial planning, energy, infrastructure, health, disaster risk management and early warning systems. Paraguay signed and later ratified the Paris Agreement in 2016.

Paraguay's intended nationally determined contribution (NDC) outlines both adaptation and mitigation targets and actions. As per the mitigation targets, Paraguay intends to reduce GHG emissions by up to 10% by 2030 compared to the *Business as usual (BAU) scenario*. In case technical and financial international support is available, a more ambitious goal is set to reduce emissions by up to 20% till 2030 (Table 1). The estimates and the baseline setting for BAU are based on multiple scenarios developed. The Intended Nationally Determined Contribution (INDC) does not identify any priority areas for mitigation action, considering all IPCC relevant sectors, but the 3<sup>rd</sup> National Communication by Paraguay to UNFCCC indicates that alternative renewable energy, energy efficiency, biomass, biofuels and hydropower will contribute greatly to achieving the emission reduction target. Priority sectors in adaptation action include water resources, forests, agriculture, energy, infrastructure, as well as disaster risk management and healthcare.

The INDC assumes a process of regular updating of the national priorities and sectorial adaptation programs and action plans, which will be informed by assessments of outcomes from the earlier adaptation plans.

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<sup>1</sup> "Inicitive rooted in the power of data, grounded in science-based evidence and driven by a mission of Science Serving Society".



Table 1: Paraguay's emission reduction targets – INDC 2015

	<b>Unconditional</b>	<b>Conditional</b>
<b>2030</b>	<b>10%*</b> ↓ GHG emissions w.r.t BAU	<b>20%</b> ↓ GHG emissions w.r.t BAU
<b>2050</b>	<b>Carbon neutrality</b>	<b>Carbon neutrality</b>

In 2021, the Republic of Paraguay intends to submit an updated Nationally Determined Contribution (NDC) outlining plans to reduce greenhouse gas emissions across different economic sectors and to boost renewable energy. The following recommendations are aimed at strengthening Paraguay's enhanced NDC submission and are aligned with IRENA's ongoing *Renewable Readiness Assessment (RRA)* for the country.

## 2. Setting Clear and Ambitious Renewable Energy and Energy Efficiency Targets

### Background

Renewable energy targets have been a key driver to promote the expansion of renewable technologies in many countries. Targets have often been specifically focused on renewables, for example by requiring a certain share to be achieved or by setting specific technology deployment targets. These mechanisms can set countries on the path towards sustainable energy and help them diversify their energy landscape. Furthermore, targets for CO<sub>2</sub> reduction or fossil-fuel phase out can also drive renewables and all the innovation tied to it. As of the end of 2019, 166 countries had renewable targets in the energy sector, 49 in the heating and cooling sector and 46 in the transport sector (IRENA 2015; REN21 2020).

Since the initial NDCs were developed, innovation has flourished and technology costs have fallen, alongside other developments that can enable countries to enhance their NDCs. The cost of renewable energy technologies – including battery storage and charging infrastructure – has declined dramatically, opening possibilities in the power and transportation sectors (IRENA 2018).

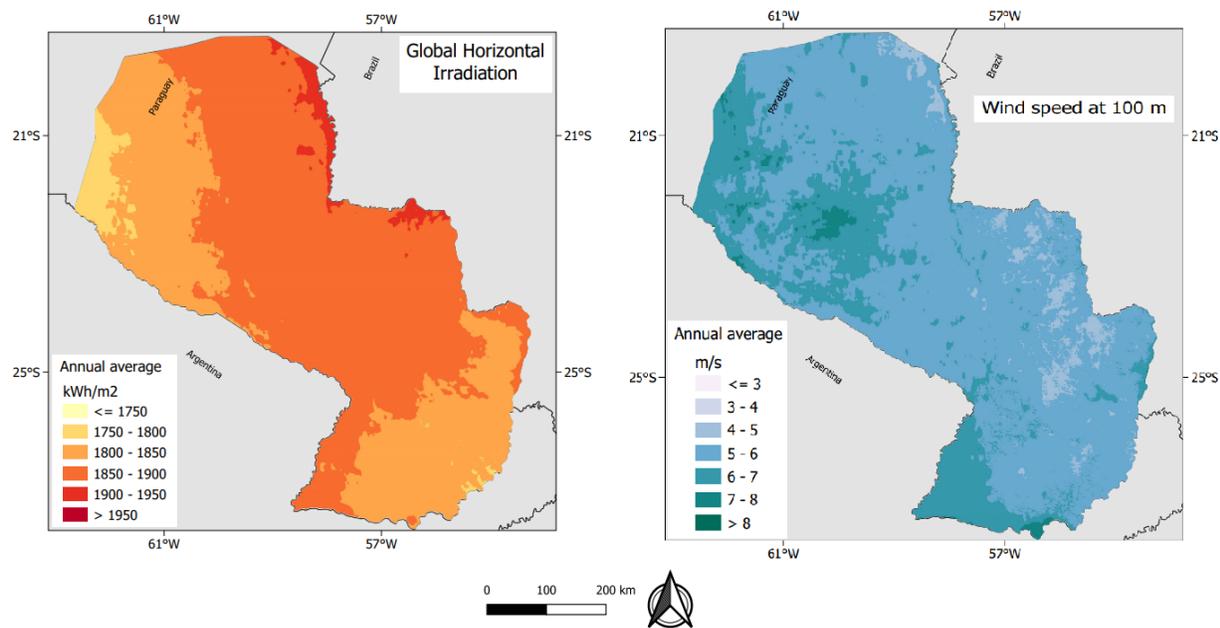
Several national strategies have identified goals for the promotion of renewables in Paraguay, such as the *Paraguay 2030 National Development Plan (2014-2013)* which sets out various objectives for instance, increasing the consumption of renewable energy by 60% and reducing the use of fossil fuels by 20%, as well as improving the physical energy infrastructure within its “Valorization of Environmental Capital” strategy. Earlier, the *Generation Master Plan (ANDE, 2015)* or the external report *Renewable energy situation in Paraguay (GIZ, 2011)* mentioned the country's potential to generate electricity from “new renewable energy sources”, such as biomass, biofuels, solar, wind and small-scale hydropower. Lastly, the *Energy and Human Development Report (UNDP, 2020)* studies the use of non-conventional renewable energy as well. Some of these targets and studies have been present in most energy planning stages, but they are not concrete nor time-bound.

According to the National Energy Balance (VMME, 2017), national energy supply is predominantly renewable, considering the weight of hydropower in the total (47% of its energy supply). In second place, there is biomass (33%), most of which is unsustainably exploited, and lastly, hydrocarbons (20%), which are all imported. From the perspective of national energy demand, the main energy source is biomass (44%), followed by hydrocarbons (40%) and, in a distant third place, electricity (16%). The main source of energy produced in Paraguay is thus the least used in the country.

Paraguay’s field of non-conventional renewable energy remains largely an opportunity to diversify energy production, strengthen the grid, foster innovation, and boost end use sectors’ adoption rate. Targets set for non-conventional renewable energy sources can provide a direction for the decarbonization of heating, transport as well as industry, especially when taking into account the rapid decline in renewable energy technology costs during the last decade.

Figure 1 presents an overview of the solar irradiation and annual average wind speed at 100m for Paraguay, according to the IRENA Global Atlas. Solar irradiation in the country shows values between 1,800 and 1,900 kWh/m<sup>2</sup> in the central territory, while reaching values above 1,900 kWh/m<sup>2</sup> in regions such as Alto Paraguay. The wind speed at 100m presents values between 5-6 m/s in most of the Paraguayan territory, with slightly higher values in regions such as Boqueron, Presidente Hayes and the South West area of the country.

Figure 1: Zoning assessment for solar PV<sup>2</sup> (left) and onshore wind<sup>3</sup> (right) in Paraguay



Source: (IRENA 2021)

Boundaries and names shown on this map do not imply any endorsement or acceptance by IRENA

For comparison purposes, Paraguay has an estimated usable hydropower potential of 872.7 MW, distributed as follows: 325.24 MW in the basins of eastern Paraguay (which drain into the Paraná), 378.76 MW of interconnections with Itaipú, and 168 MW in the Paraguay River. According to national energy projections, by 2030, hydropower will not be sufficient to satisfy demand anymore unless it reduces energy exports.

Declining renewable energy technology costs further strengthen the case for more clear and ambitious targets. Falling prices are especially evident for solar PV and wind. Global weighted-average levelized costs

<sup>2</sup> IRENA: Global Atlas, Map data: World Bank, ESMAP, 2021, 2021 OpenStreetMap contributors, 2021 United Nation administrative boundaries.

<sup>3</sup> IRENA: Global Atlas, Map data: Technical University of Denmark (DTU), 2021, 2021 OpenStreetMap contributors, 2021 United Nation administrative boundaries.



of utility-scale solar PV fell by 82% between 2010 and 2019 to reach USD 0.066/kWh. Meanwhile, weighted-average levelized costs for wind energy have declined by around 39% over the same period to reach USD 0.053/kWh (IRENA 2019). By 2030, solar PV and onshore wind costs are expected to further decrease by 55% and 45% respectively (Taylor, 2020). Declining renewable energy costs are benefiting from a conducive financing environment and innovative financing schemes.

At the same time, the electricity consumption in Paraguay has increased a 77.46%, from 7.32 TWh in 2010 to 12.99 TWh in 2018, and a grand total of 509.86% since 1990. In 2018, hydropower supplied 5,091 ktoe of the Total Energy Supply (TES), while biofuels and waste supplied 3,084 ktoe, oil 2,707 ktoe and coal a negligible 4 ktoe.

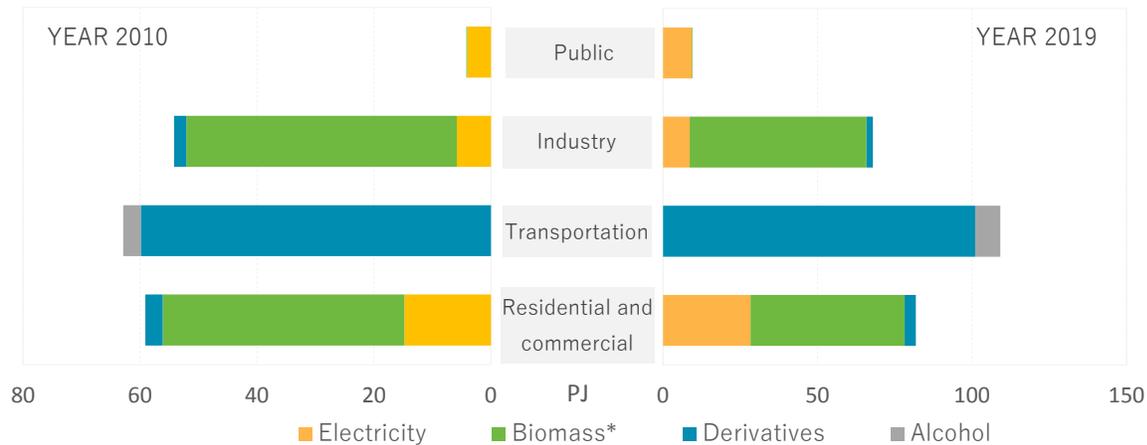
Paraguay's energy sector is therefore almost exclusively water-powered, which could exacerbate the vulnerability of the country to reduced flows. The large Itaipú dam, which Paraguay shares with Brazil, accounts for over 90% of the country's electrical supply. Surplus electricity is sold to Brazil and Argentina and contribute significantly (~7%) to Paraguayan GDP. According to the Latin American Energy Organization (OLADE) Paraguay is the only country in Latin America whose electricity consumption is entirely based on renewable energy. Paraguay is a net exporter of hydropower and a net importer of hydrocarbons for transport and industry. National demand is met through three hydroelectric plants: Central Acaray (property of Paraguay), Yacyretá (shared with Argentina) and, mainly, Itaipú (shared with Brazil). Energy transmission and distribution is managed by the National Electricity Agency (ANDE). Itaipú is a world leader in the production of clean and renewable energy. With 20 generating units and 14,000 MW of installed capacity, provides about 15% of the energy consumed in Brazil and 75% of that used in Paraguay. Nevertheless, with a limited distribution network, at local scales, energy consumption is dominated by traditional biomass: wood and charcoal (50%), hydrocarbons (36%), and electricity (14%). In urban areas with electrical service, quality, as measured by service interruptions, is good, although losses in transmission and leaks in the distribution system are a concern.

Nevertheless, given the high reliance on hydro power, *Paraguay's National Development Plan (2014–2030)*, aims to diversify the country's energy resources and ensure a reliable energy supply by diversifying the energy mix to biomass, wind, and solar photovoltaic energy generation. In 2018, Paraguay received a USD\$125 million loan from the Inter-American Development Bank to modernize Acaray, one of its largest hydropower plants, however investments in smaller scale alternative renewable energy has been limited. While the country has looked to diversifying its mix of renewable energy generation, investment regulations and legislation has hindered widespread investment and uptake. The 2040 Energy Policy was developed to help guide the energy development in line with the country's social and economic development efforts.

The Energy Sector Strengthening project financed a 23% increase in energy supplied between 2014 and 2018 through 21 improved or new transmission stations. It also helped increase the quality of electricity supply by 30 percent, benefiting 2.5 million people in the Asuncion Metropolitan Area (of whom approximately 15 percent are below the national poverty line). In addition, the project was successful in helping modernize ANDE's control and communication system by financing a SCADA system and a 3,000 kilometers fiber optic network that is helping improve the quality of the electricity service.

Between 2010 and 2019, domestic energy consumption increased by 48.8%, from 180.41 PJ to 268.46 PJ, with transportation accounting for the largest concentration of final consumption. This was followed by the residential, commercial, industrial, and public sectors (Figure 2).

Figure 2: Final energy consumption in Paraguay



Source: (IRENA 2021)

## Recommendation

Paraguay can adopt and establish clear and ambitious, whilst realistic, renewable energy targets in its enhanced NDC, as official commitments set by different government levels in a cohesive way, to achieve a new amount of renewable energy within the next five years. These targets, while not sufficient on their own, need to be aligned in all sectors and end uses (including electricity, heating, transport, agriculture, and industry), related infrastructure and energy efficiency. Additionally, mid term commitments reflected in the NDC should be in-line with the long-term strategies and planning for the energy sector. Setting-up targets will require a well-coordinated effort among the different country institutions from the energy and climate sector, aligning strategies, objectives and guidelines to achieve the proposed goals.

- **Electricity:** increase the country's renewable energy pledge by 64% in 2030 through aligning this commitment to the national energy plan. The target can be backed-up by a sound legal framework and via the strengthening of institutional capabilities across Ministries. In the energy sector, it is equally important to establish certification processes for independent producers, for example, in green hydrogen projects. Lastly, there is an opportunity to be seized by developing the electrification of end-uses, such as heating and transport.
- **Transportation:** while based on a general goal to achieve energy efficiency and the modernization of vehicle fleets, the key recommendation is to continue the transition towards a low carbon sector based on renewable energy through biofuels, and electrification with renewable power. This includes enhancing Paraguay's NDC through urban sustainable and climate mobility, as well as in terms of hubs or integrated public transport.
- **Agriculture:** actions to reduce and mitigate the country's land-use (AFOLU) change-related emissions for them to plateau, might include establishing a certification program for biomass and fostering local management frameworks for sustainable biomass production that, at the same time, encompasses reforestation and forest management initiatives. The implementation of renewable energy technologies for food production can also mitigate the use of fossil fuels in the sector, enhance food security and favour a more technified and controlled land use.
- **Industry:** promote the adoption of low-carbon technologies in industrial sector, implement the Energy Agenda and formulate carbon emission control targets and action plans in key industries.



This would include to strengthen the management of carbon emissions for new projects and control GHG originating from industrial production processes; replacement of fossil fuels with renewable alternatives; and introduction of conventional energy efficiency and conservation technologies (waste heat power generation, slag crushers, air-beam coolers, separator improvement, vertical roller coal mills).

The targets may provide an important indicator of the direction the country wants to go to, particularly where enshrined in legislation. For that, these need to be specific, down to the technology level to provide some degree of policy certainty for investors and other stakeholders such as multilateral financing institutions, industry leaders, planners, and policymakers.

It is important that renewable energy targets are based on a sound knowledge base, where metrics and design features are one dimensional, and where decisive contextual factors such as political, institutional and economic aspects are also considered alongside evolving climate impacts and technology assessments. Clearly articulating the objectives underlying renewable energy targets can help balance the costs and benefits of different target levels and types, while also improving the monitoring of their impacts over time. The target-setting process could also benefit from, and build upon, existing work on scenario analysis for different clean energy technologies in terms of penetration in end use sectors. At the same time, this process requires sound institutional coordination and commitment from all public stakeholders involved in energy sector.

The “Third National Communication of the Republic of Paraguay under the UNFCCC”, for instance, lacked the development of emission reduction scenarios for renewable energy technologies. The need to develop such scenarios as per the *business-as-usual baseline* was established in Paraguay’s *Second Biannual Report on Climate Change* (IBA2, 2018). With 2016’s NDC as the starting point, there are several avenues for a more ambitious target-setting moving forward.

Paraguay must determine whether a new set of targets will enhance Paraguay’s level of ambition. On that regard, an NDC that contains both a GHG intensity target and a renewable energy target might enhance the key policy drivers. The GHG Protocol Mitigation Goal Standard (WRI 2014a) and Policy and Action Standard (WRI 2014b) provide guidance on GHG accounting that can inform analysis of ambition.

Considering the promising national renewable energy resources, namely bioenergy and biofuels, the declining costs of renewables and national market conditions, renewable energy technologies can play the central role in the country’s transition towards a low carbon and sustainable future. Even though hydropower is likely to be the dominant technology in renewable energy targets in Paraguay, the rise of biomass and biofuels or green hydrogen as low-carbon technologies as well as non-conventional renewable energy (such as solar or wind) can contribute given their potential, increasing cost competitiveness and providing socioeconomic benefits such as job creation. In line with this, it would be recommended as first step to develop resource maps with the potential renewable energy resources also considering sustainability criteria, and secondly it is suggested to use national development funds for pilot projects, which could mostly target independent producers.

While renewable electricity targets are the most widespread type, heating/cooling and transport sector targets have increased significantly over the last decade and can complement Paraguay’s targets in the electricity sector. Paraguay has increasingly recognized the benefits of adopting a portfolio approach to renewable energy deployment. Targets that are exclusive related to selected technologies, such as



bioenergy or transportation, can be introduced to support specific implementation. Such targets can also sustain the development of the local value chain of selected technologies. In addition, technology-specific targets can support the diversification of the energy mix to increase energy security. As a result, technology-specific targets, such as those promoting the use of electric vehicles, have significantly increased in recent years. For example, RES-E support mechanisms' targets such as green hydrogen installation of technologies for transport and mobility systems. By encouraging the simultaneous development of a range of different renewable energy and clean energy technology options, such as green hydrogen, biomass and solar energy systems, policy makers are enabling more diversified renewable energy sectors to emerge and grow.

The technology and sector-specific targets should also be complemented by an overarching target for the energy sector, which could be directly tied to long-term national climate goals. While NDC targets can cover the medium term, it is equally critical to set them with a clear purpose and align these with other strategic and long-term policy goals, such as the National Energy Policy, to avoid contradictory outcomes. Shorter time frames allow for quicker review and adaptation, while longer targets indicate governments long-term commitment, offer positive signals to all stakeholders, and help create a stable and conducive environment to attract investments.

### 3. Integrating of renewable energy technologies in the end-use sectors

#### Background

The potential for renewable energy in the end-use sectors in Paraguay could be underestimated since it is often easier to identify opportunities in the power sector. Heating and cooling technologies in the building and industrial sector (including agro-industrial sector) offer extensive opportunities for the increased uptake of renewable energy and mitigate greenhouse gas emissions. Renewable heating can also serve as a storage solution for the integration of renewables on the power grid so that when wind and solar supply is in excess, electricity can be converted to heat for use in buildings or the industry sector. Electrical energy from renewable sources can also be used for the energy transition in the transport sector. Transport activities consume 94% of the national hydrocarbon's consumption and that comes from imports. This represents a weakness for the sector, due to the dependence on imported products and the international price of oil. Renewable heating technologies with an established potential in Paraguay include all forms of modern bioenergy, solar water heaters, solar thermal, geothermal heat pumps, and renewables-based electricity. Energy demand for space heating and water heating in either buildings sector or industrial production process is high across main areas of the country. Moreover, despite significant progress in the power sector, renewables are lagging behind for heating and cooling and transport applications. As renewable technologies mature, policy makers are confronted with new challenges. The rapid expansion of variable or non-conventional renewables, such as solar photovoltaics and wind power, requires more flexible energy systems to ensure reliable and cost-effective system integration. In general moving forward, renewable energy policy approaches will have to be more holistic and sophisticated to reflect the transformative changes induced by the energy transition on the energy sector, society and economy.

There is growing demand for space cooling in the country as more people are able to afford modern housing, electricity and personal transport. In these regions, Solar PV could be a technology solution to



meet energy demand for heating and cooling. Although there is important potential to deploy direct use of renewable energy for heating and cooling in buildings and industries, the challenge is that in most cases, modification and retrofit of existing buildings and production processes will be required. Paraguay is experiencing rapid urbanization with fast-growing building stocks and expansion of urban areas. In order to avoid future costs of modification and retrofit, renewable heating and cooling systems need to be fully integrated into urban infrastructure development. Additionally, utilising renewable energy in the agri-food sector can contribute to the modernisation of industrial processes and the enhancement of food security in the country. Developing industrial plans for the utilisation of renewable energy in agriculture and food production have a high potential to contribute to the mitigation of emissions and improve the land use in the country. Substantial efforts in Paraguay are still required to scale-up deployment of renewable energy in the end use sectors (together with energy efficiency) to meet climate objectives. To this end, a combination of policy measures and cross-sectoral plans are needed, focusing on direct support (deployment), integration and enabling environment.

The incorporation of electric mobility could benefit the country in economic and environmental terms. The potential of renewable energy to power electric vehicles can reduce CO<sub>2</sub> emissions, improve resource efficiency and be accompanied by a greater use of clean electrical energy produced nationally. It is likely that additional electricity generation in isolated areas will be needed in Paraguay to cater for the extra demand from the transport sector that can be supplied by non-conventional energy renewable sources. It would also be advisable to evaluate the use of hydrogen (H<sub>2</sub>) as a fuel for long distance transportation, since the characteristics of natural resources and energy production in Paraguay may favor the implementation of Green Hydrogen.

## Recommendation

Government intervention is needed to facilitate strategic planning as well as deployment for modern renewable energy solutions. However, the focus should move on a whole energy vision, encompassing H&C, industry, transport, and direct uses of renewable energy. Effective policies and regulations are needed to create an enabling environment for renewables deployment in the whole energy sector.

Direct policy support for renewable energy has to be increased in the power and end-use sectors in Paraguay, which both account for large shares in final energy consumption as well as energy related CO<sub>2</sub> emissions. The power sector has high technology concentration with 99.9% of total dispatched electricity produced in three hydropower plants. The renewable energy in the end-use is composed mainly by biomass for cooking and heating. The public sector gets 2% of its total energy consumption from renewable energy, transport 7% (biofuels), residential and commercial 61% (biomass only) and industry 84% (biomass only)<sup>4</sup>. Meanwhile, enabling policies are needed to ensure effective operating conditions for renewables in energy systems and markets. As such, policy makers should make sure that renewable energy technologies can operate in the system on a level playing field with other technologies, facilitating innovation, supply and consumption of renewable energy in all end-uses.

Renewable energy needs to be integrated into the daily life of consumers and prosumers, as well as into the institutional framework, to allow them to be part of the overall energy transition. Integrating policies, in this context, are those measures that allow the full integration in the energy system: for example,

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<sup>4</sup> SIEN Paraguay.

measures to encourage behavioural change (through raising awareness programmes) and policies to couple renewable energy technologies with livelihoods (in the access context).

The improvement of long-term energy planning practices is also key to promote the decarbonization of the end use sectors. Planning practices in the country should cover all the end use sectors and evaluate the renewable energy potentials, setting clear targets that give a holistic pathway of development for the energy sector. The long-term predictability of targets and policies is key to ensuring investor confidence and sustained growth. At the same time, policies need to continuously adapt to changing market conditions, to achieve greater cost-competitiveness and improved integration of renewables into the system. To ensure that the energy transition accelerates, greater attention must be paid to the transformative impact on society, institutions, financing, ownership structures and the wider economy. This requires ensuring effective engagement and ownership by all stakeholders.

A set of coordinated policies and the technologies are key to satisfy short-term objectives that will be consistent with longer-term ambitions. Paraguay's government must enhance support to investment in renewable energy technologies and emphasize the importance of investing in a diverse generation mix that, while meeting demand growth, also satisfies the need for affordability, environmental protection, energy security, and strongly contribute to climate action.. The development of cross-sectoral strategies with clear objectives and responsibilities among the different national institutions beyond the energy sector, could facilitate the penetration of renewable technologies in the end-use sector and look to developed new potential industrial areas in zones rich with the renewable resources. Cross-sectoral strategies should also consider the impact to local communities, favouring their local economies, addressing the sustainable development goals, and looking to enhance the climate action.

Diversifying the generation mix supports emission reductions by slowing down coal-fired capacity additions. Increasing ambition for renewable generation should be a priority to reduce coal growth regions with an existing dependence on coal, as well as in regions where substantial coal growth is anticipated.

There is significant potential for Paraguay to expand the penetration of renewables in its end-use sector power mix. This potential has been illustrated in the enhanced low carbon action scenarios, which have a high dependence on coal in the power system. Increasing generation from renewables, combined with improving energy efficiency would reduce coal generation as well as an emission reduction.

## 4. Enhancing institutional coordination to achieve climate ambitions

### Background

The effectiveness of clear and ambitious renewable energy targets depends on the ability of governments and institutions to lead the process of setting targets, establishing dialogue with key stakeholders, and ensuring that cross-cutting goals are achieved. Leading institutions should oversee the whole process when developing renewable energy targets and also guarantee its implementation, aiming to bring these targets to reality. The renewable energy targets should also be align with the emissions mitigation ambition at national level and favour Paraguay's climate commitments under the Paris Agreement. Additionally, leading institutions should be able to coordinate the different stakeholders along this process, avoiding conflicts and delays, and guaranteeing common agreement among the participating Institutions.



Preliminary findings of IRENA’s ongoing *Renewable Readiness Assessment* (RRA) for Paraguay have found that, in order to ensure renewable energy targets are achieved, there is a need for both long-term planning via the development of strategies and action plans as well as for a leading institution to provide a roadmap for deployment based on an assessment of resources and acknowledging the current status of technology development and deployment in the country. On that regard, target-setting would be a first step; challenges linked to their implementation remain key, which is why a strengthened institutional framework is required to successfully overcome such challenges and to achieve policy goals.

## Recommendation

Strengthening the institutional coordination of the sector is key to ensure a successful achievement of objectives part of any energy policy. Country examples show that rather than being motivated by one single overarching objective, governments are increasingly fostering overarching institutional frameworks in the energy sector to meet multiple interconnected objectives such as energy security, environmental sustainability, and socio-economic benefits. It is important that energy governance be based on a sound knowledge base, where metrics and design features are one dimensional, and where decisive contextual factors such as political, institutional, economic, and social aspects are also considered.

Paraguay’s government may benefit from the immediate creation of a committee or secretariat to both study the creation and ministerial reordering of such key institution. Infrastructure objectives require long-term policy planning, with long-term strategic policy frameworks that exceed political cycles and are built on wide political consensus. A stable Renewable Energy Committee focused on the Energy Policy’s strategic pillars, is key to gain traction, if complemented by adequate regulation and assessment to any short-to-medium approach regarding the current resource allotment for institutions such as the Vice Ministry of Mines and Energy (VMME) which have been in charge of renewable energy policy implementation thus far. Nevertheless, this needs to be a body with Ministers and advisors with expertise in energy issues, as stated in the Sustainable Energy Agenda 2019-2023.

Nevertheless, while national targets often attribute primary responsibility to a line ministry, institution or agency, in practice, successful implementation depends on other ministries and organizations and requires the sharing of efforts and financial resources, as well as inter-institutional dialogue. In the case of renewable energy targets, clarity regarding accountability and responsibilities are intricately linked to the specific design modalities of targets, which is key in terms of adopting a “mutual accountability” approach (OECD, 2007), which may be mutually beneficial as well. Thus, aligning and constructive dialogue is relevant to coordinate and accelerate actions, commitments and indicators.

## 5. Tackle barriers through establishing incentives and tax mechanisms

### Background

Paraguay’s dependence on hydropower can affect the country’s energy security by no later than 2030, according to predicted scenarios. In order to diversify the current technological concentration in electricity production, a new technology portfolio could be established as based on large private-sector investments and foreign investment. Such liberalized approach bears several difficulties even for the most potential projects, typically in terms of lengthy delays, risk due to political, administrative or legal impediments and barriers such as existing state-owned service providers, contradictory government authorities, and unclear or slow and costly award procedures. This is true as well for small and medium enterprises (SMEs) when it comes to scaling their model or seeking financing (GIZ, 2011). Mobilising the



private sector funding via clear targets, appropriate regulation and active involvement by institutional investors, is essential in bridging the infrastructure funding gap.

Technological change and long-term energy planning have been credited with explaining a substantial share of economic growth and fostering a dynamic investment environment that can critically enhance innovation. Countries that have managed to attract large international investors and companies into their infrastructure sectors, such as the energy market, have done so by instituting basic reform measures. They implemented a policy framework that allows for an effective implementation of private infrastructure projects in a way that meets investor needs as well as the social and political objectives of governments. As a matter of fact, the diversification of the energy matrix, by fostering demand or promoting the electrification of specific sectors, requires a significant reform effort by the government, an endeavor that cannot be replaced by ad hoc measures whenever problems arise in the preparation of individual projects.

New energy markets in Paraguay may typically encounter barriers and constraints such as energy tariffs for independent power producers, scarce incentives for SMEs and technology adoption, and financing constrictions. Although Paraguay's Energy Policy establishes instruments that carry tax credits and incentives, an expanded framework of incentives and tax mechanisms devoted to support the diversification of the energy matrix is key if economies of scale are to be achieved in application of the updated NDC's renewable energy targets. This reform framework could potentially accelerate growth of installed renewable capacity and rising investments in renewables, provide an opportunity to decarbonize end-use sector through electrification with renewable power.

### Recommendation

The existing legal framework needs to be reviewed to identify beforehand potential stumbling blocks for private infrastructure investments as linked to non-conventional renewable energy. General and sectoral laws and regulations need to appropriately address the specific requirements of both equity investors and lenders to make project finance transactions feasible. For example, rather than amending and rewriting multiple pieces of legislation, several countries have opted to adopt specific concession legislation to provide one comprehensive and overarching legal framework. One such example of this is found in Paraguay's Sustainable Energy Agenda 2019-2023 objectives, where such legal framework is aimed to favor the development of the renewable energy sector.

This has typically reduced investor risk substantially by improving the transparency of the implementation and concession award process, while providing a coherent presentation of all the key elements relevant to such projects. A favourable basis for establishing infrastructure providers is not enough. Governments also need to design a regulatory framework that can determine the future operating environment of any service provider in a market-private as well as public-based on technical criteria and independent of political interference. This requires to create a regulatory body and for this to be politically independent and equipped with the necessary technical expertise to consistently balance the interests of governments, investors, and consumers in a neutral manner.

Renewable energy incentives, when complemented with alternative options such as dedicated funds, non-reimbursable funds, donations, loans, guarantees and mechanisms have played a significant role in informing investment decisions. When backed by supportive policy and investment frameworks, they can provide long-term visibility to industry, a critical element in stimulating deployment at scale. Renewable energy incentives and mechanisms contribute to developing a clearer vision for the development of the sector and enable stakeholders to allocate resources more effectively. They are also instrumental in

indicating the envisioned trajectory of market growth, thereby helping to anchor medium and long-term expectations. By giving a sense of trajectory and growth, they can contribute to lowering deployment costs and establishing a supply chain utilizing local industry. In this perspective, these mechanisms can help drive valuable knowledge and local skills development given the long-time frames involved in building human capacity.

## 6. Capacity building and finance for enhanced climate action

### Background

Capacity building is central to the UNFCCC's workstream. The ability of organizations, government, and civil society to address the principal challenges of climate-friendly patterns and to achieve the key parameters of NDC targets must be reinforced. Without the necessary capacity, countries like Paraguay with economies in transition will be unable to identify and solve their own sustainable development problems, particularly those related to climate change, GHG emissions reductions, carbon mechanisms and the energy sector.

In order to accomplish that, Paraguay needs to acquire the necessary skills and institutional infrastructure by building capacity that will enable organizations, groups and individuals to improve their performance and achieve their development objectives. Capacity building for enhanced climate action and SDG includes strengthening the processes, systems and rules that influence collective and individual behavior and performance in all development endeavors. And it means enhancing people's technical ability and willingness to play new developmental roles and adapt to new demands and situations.

Most of low- and medium-income countries have indicated capacity building as a condition for implementing their nationally determined contributions (NDCs) under the Paris Agreement. This is in the context of shortfalls in past initiatives on capacity building under different bilateral and multilateral agencies including bodies of the United Nations Framework Convention on Climate Change (UNFCCC), which can be largely attributed to their short-term, ad-hoc, supply-driven, and project-based nature. Article 11 of the Paris Agreement points to a potentially new paradigm for capacity building. For the next round of NDCs, low- and medium-income countries must be more explicit and specific in their demands and approaches to capacity building (Khan, Mfitumukiza, and Huq 2019). In order to achieve that, and to foster innovation, countries need to overcome limited institutional and professional capacities as well as to boost interinstitutional coordination, including monitoring, reporting and verification systems (MRVs) that are key for SDGs.

Rapid development of technology leaves renewable energy as one of the key priority sectors for capacity building in NDCs, which spillover to SDGs as well. The energy sector-related capacity building needs in the NDCs often focus on areas such as increasing access, increasing the share of renewable energy, enhancing energy efficiency, and expanding energy infrastructure.

Paraguay, like some countries in the Latin American region, does have the necessary capacity in place, although limited, when it comes to providing technical assistance in non-conventional renewable energy and energy efficiency developments; the process of NDC implementation can complement this and address gaps as required, such as those that arise on the professional and research fields, and those related to knowledge and experience in the installation and maintenance of nontraditional energy

systems, or certification of technologies and processes for the production, transport, and consumption of renewable energy.

Paraguay's INDC in 2015 did not identify any specific areas where international technical support could be necessary. The country's renewable energy experience revolves around deployment and maintenance of hydropower and know-how and familiarity with other clean energy technologies (renewables and energy efficiency) are very limited in both the public and private sector. The VMME require additional operational and technical capabilities to lead actions for the implementation of the Energy Policy and promote multisectoral commitments; implement national energy programs and provide technical assistance in the design of business models, installation, maintenance, and certification of renewable-energy technologies. On the other hand, the leadership that the VMME can take in long-term energy planning will be contingent on strengthening its capacities to guide the work of multisectoral committees. Therefore, the enhanced NDC of the country must specify and highlight key areas and topics where international support would be needed to enhance capabilities for Paraguayan stakeholders. This might include training in coordination with multilateral institutions, the National Professional Promotion Service (SNPP), the National System of Labor Training and Education (SIANFOCAL), energy-sector companies, and the VMME.

Specific technical trainings should also be aligned with any ongoing capacity building process as related to achieving SDGs. Even where external support is needed initially, countries have to include a balanced mix of capacity-building in all technical assistance (e.g. institutional capacity, technical capacity, relational capacity and strategic capacity), so that implemented actions contribute to building and strengthening a self-sustaining, autonomous system in the country. Countries may benefit from an initial comprehensive review of capacity requirements and the subsequent development of a capacity-building plan, which could be integrated into the wider NDC implementation plan.

On that regard, climate finance could be a key element for capacity building and implementation of the NDC as well as achieving climate mitigation and adaptation goals. While the inclusion of finance-related contents in an INDC is voluntary, many countries chose to do so in their first NDCs as finance needs for NDC implementation, including finance gaps and support needs, or as policy actions to align finance flows with climate goals. This can encompass creating enabling environments through economic and regulatory policies, addressing organizations' ability to adapt or maximizing the benefits of participation, knowledge exchange and ownership.

Generally, there are potential benefits of including finance elements: they can demonstrate the country's readiness for NDC implementation, as well as any finance gaps; facilitate CTU of NDCs; signal clear policy goals and foreseeable courses of action; and thereby attract support and investments.

## Recommendation

There is a need to improve the technical and coordination capacities of the institutions concerned with energy, and specifically non-conventional renewable energy sources, as well as broader public-sector institutions. An essential first step in this direction could be a set of capacity needs assessment studies aimed at different stakeholders (public institutions, private sector, academia, among others).

For Paraguay, additional capacity will need to be built in a range of areas to support its updated NDC implementation. In this context, capacity means having the financial and human resources needed, together with the ability to apply skills, knowledge and tools and building momentum to deliver change.



Capacity applies in several aspects, including: (i) institutional capacity for governance and coordination; (ii) technical capacity on planning, modelling and evaluation, including sectoral expertise; (iii) relational capacity to build partnerships and invest time in processes; and (iv) strategic capacity for systemic policy design and implementation. While all four aspects apply in their own right, enabling relevant actors to develop all of them together is likely to lead to a self-sustaining system.

Any capacity-building plans for Paraguay will benefit from following the UNFCCC Capacity Building Frameworks. These set out the guiding principles to be followed, such as capacity-building being country-driven, involving learning by doing, and being supported by existing national institutions. In addition, the Paris Agreement established the Paris Committee on Capacity Building, which will identify capacity needs and gaps, and help facilitate global cooperation on capacity-building initiatives and ideas. Countries can engage with this process to help steer their capacity-building efforts in a strategic and synergistic manner. For example, imparting knowledge and developing skills, while focusing on organizational performance and capabilities to assess specific needs and priorities, and including guidance on the support of financial and technical resources to be addressed by multilateral financing institutions such as GEF or GCF. There is a clear need for an effective link between the scientific community and policy makers. Capacity-building also encompasses civil society and countries should consider the UNFCCC's Action for Climate Empowerment agenda, which focuses on education, public awareness, and access to data.

Furthermore, capacity-building plans for Paraguay may include capacity needs assessments and stakeholder capacity-building requirements, as well as capacity development strategies. Training courses must be aligned with the overall training strategy and be suitable for their audience, including support for policymakers in decision-making. This can be linked to raising awareness campaigns and learning exchanges between neighbouring countries with notable best-practices in the deployment of renewable energy such as Uruguay and Brazil. This process should nonetheless include Paraguay's commercial banks' capacity building to access green funds and finance non-conventional renewable energy and energy efficiency projects (WRI/UNDP, 2020).

In that sense, for Paraguay to achieve its clear and ambitious targets for renewables and energy efficiency, the country will need international support in capacity building on several fronts, as well as financing. Lack of awareness about renewables remains a challenge in many government departments and ministries, which often leads to roadblocks in policy development and delays in securing funding and approvals for clean energy projects. In this context, support from international donors and development banks could be targeted to organize regular capacity-building efforts in government ministries and departments such as transport. These efforts can be expanded to include representatives from the private sector to foster a productive public-private dialogue among all stakeholders in the field.

While Paraguay can use existing exchange platforms to promote regional cooperation with neighbouring countries and to take advantage of its geographical location, these efforts must be aligned with transnational cooperation for sustainable development. At the same time, international support for capacity building in the energy sector's new or revamped institutions could focus on topics such as cost competitive renewables, technical issues in the integration of variable renewable energy in the grid, economic management of a system with significant shares of renewables and introduction of flexibility mechanisms such as storage and demand-side management, electromobility, and green hydrogen. On the policy-making front, the country can benefit from international support in capacity building focused on areas such as the design of renewable energy targets, renewable energy auctions design, design and



implementation of feed-in tariffs and net-metering etc. IRENA is already contributing to this effort to help build capacity in the local public and private sector with dissemination activities which can potentially focus on target setting, auctions design and resource assessments.

Although climate finance flows are increasing, challenges still exist in accessing them and large-scale investments are required to significantly reduce emissions, adapt and build climate resilience. The specific funding criteria and access requirements differ between financing sources, but there are common underlying principles that countries can address to increase financial flows and improve their readiness for financing. Many climate funds have specific requirements (e.g. relating to gender, fiduciary criteria and/or environmental and social safeguards), as well as seeking demonstrated synergies between climate projects and national development priorities. Capacity building for climate finance and NDC achievement should address these requirements and knowledge gaps.

Additionally, by putting forward an ambitious, rigorous, and comprehensive conditional renewable energy target in the enhanced NDC, Paraguay's decision-makers can make a strong case for securing a more significant share for climate finance and multilateral finance to support renewable energy deployments in the next decade (IRENA and CPI 2020; IRENA 2016). To ensure the financial sustainability of clean energy projects these capacity-building programs can also focus on the financial sector of the country. A more informed banking sector might be more open to extending low-cost capital for the renewable energy sector. The presence of clean energy and livelihood focused microcredit industry can help ensure that small scale renewable and energy efficiency projects can find financing at manageable costs.



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