

IDB-KIAT Collaboration Project Proposal

Project Overview

Project Title	Towards the Green Hydrogen Economy in Paraguay		
Sector (sub-topics)	Green Hydrogen (GH)		
Country	Paraguay	Location	<i>Villa Elisa, Central Department</i>
Project Duration	18 months	Budget	USD 10 million
Association with Other Projects	• IDB (Pipeline/Presented to the NAMA Facility): NAMA Support Project “Catalyzing the Green Energy Economy in Paraguay” • IDB (Pipeline/Presented to the Green Climate Fund: GCF): “E-Mobility Program for Sustainable Cities in Latin America and the Caribbean”		

Submitter’s Information

IDB (country office)	
Name	(details to be provided when selected)
Position	
E-mail	
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Partner Country’s Implementing Organization(s)

Partner Country Contact 1	
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1. Project Background

Current Situation

- Increasing and more sophisticated human and economic activities over past decades has raised energy needs worldwide. To meet these needs, more natural resources, mainly fossil fuels, must be compromised, which led to increasing greenhouse gas (GHG) emissions. Although Paraguay has vast renewable natural resources – particularly energy resources such as hydropower and solar – it has several pending energy issues.
- The country's final energy consumption matrix is heavily dependent on imported fossil fuels (about 41% of total final energy consumption), while electricity, which is produced from almost 100% renewable sources, represents a share of only 19%¹ (VMME, 2020).
- In that context, hydrogen (H₂), as an energy vector, is a solution for long-distance cargo and passenger transport sector, both by land and river (with developing prospects for the aviation sector). By developing the H₂ economy, which in Paraguay would additionally be green H₂, the opportunity for a transition towards a clean transportation sector would be created. Now, the country poses ideal conditions for the deployment of the green H₂ economy, as projections (even the more conservative ones) still account for hydropower production surplus over the present decade² (ANDE, 2022). In addition, the government's interest in the adoption and promotion of domestic low-carbon energy sources is clear. There already is an enabling policy framework (both the PEN and the PND as the most relevant ones), as it is possible to observe in national targets and agreements subscribed in international platforms (the Nationally Determined Contributions³, the Sustainable Development Goals, among others). Furthermore, for incentivizing the acquisition of H₂ transport units, a firm precedent is given by Law No. 5183/2014, which exempts the import of electric vehicles (EVs) from customs duties and VAT.
- Despite the opportunities, several challenges can be also foreseen with the advent of the H₂ economy in Paraguay. There are still no running business models, nor established tariffs for H₂, nor for the service to be offered. Furthermore, because of the relative newness of the technology, capable human resources are also limited. There are also threats that may arise

¹ <https://www.ssme.gov.py/vmme/pdf/balance2020/Balance%20Energ%C3%A9tico%20Nacional%202020%20-%20V2.pdf>

² https://www.ande.gov.py/documentos/plan_maestro/PLAN%20MAESTRO%20DE%20GENERACION%20%202021-2040.pdf

³ http://www.mades.gov.py/wp-content/uploads/2021/07/ACTUALIZACION-DE-LA-NDC-DEL-PARAGUAY_Borrador-final_Julio-2021-1.pdf

from the introduction of this element within the energy matrix. Among these are protectionist views of different groups with the interest of maintaining the current market model, and misconception regarding the (in)security of H₂ due to the yet low awareness surrounding the technology. Additionally, there are still no incentives for the private sector to invest in H₂ and prices in the country are uncertain due to the lack of studies implemented.

- Hence, planning becomes fundamental to address opportunities and challenges regarding the H₂ economy in Paraguay: the adoption of new technologies is often expensive and on-the-field tests are necessary to demonstrate their viability and reliability to gain experience and then acceptance. An enabling legal and regulatory framework must also be built to complement existing policies. Moreover, institutional, and technical skills must be developed to scale up new technologies and the development of their associated infrastructure. Here, it is worth to mention that enabling policies⁴, specifically regarding green H₂, have already been done, and several preparatory studies are undergoing thanks to international cooperation. In that sense, it is worth to acknowledge the efforts of South Korea in the development of its hydrogen strategies to achieve carbon neutrality and dominate the hydrogen economy, with impetus after the outbreak of the coronavirus disease 2019 (COVID-19) pandemic.
- This proposal seeks to leverage the possibilities of international cooperation to create and boost the H₂ economy in Paraguay. First, the project seeks to install a pilot plant to produce green hydrogen. Demand will be created by the acquisition of H₂ transport units in the framework of the renewal of vehicle fleets of the counterpart government agencies involved in the project. This will create an ideal environment for building capacity in human resources by means of the implementation of training programs.

Relevant National Development Plans, Policies, and Strategies

- The [Energy Policy of the Republic of Paraguay 2040](#) (PEN) and [National Development Plan Paraguay 2030](#) (PND) recognize the need for an energy transition with greater share of energy use coming from domestic and renewable sources is highlighted. Moreover, these policies emphasize that, to accelerate the transition, the mobility and transportation sector must be prioritize, as it denotes the largest share of energy consumption in the country. For instance, the PND aims at reducing demand of imported hydrocarbons by 20% in 2030, while

⁴ https://www.ssme.gov.py/vmme/pdf/H2/H2%20Marco_Conceptual_DIGITAL.pdf

the PEN sets goals⁵ for the promotion of electric mobility and the use of domestic fuels in the transportation sector.

- There already is an enabling policy framework (both the PEN and the PND as the most relevant ones), as it is possible to observe in national targets and agreements subscribed in international platforms (the [Nationally Determined Contributions](#), the Sustainable Development Goals, among others). Furthermore, for incentivizing the acquisition of H2 transport units, a firm precedent is given by Law No. 5183/2014, which exempts the import of electric vehicles (EVs) from customs duties and VAT.

Association with Other Projects/Programs

- *IDB (Pipeline/Presented to the NAMA Facility): NAMA Support Project “Catalyzing the Green Energy Economy in Paraguay” –Budget: \$22,590 million Euros in grant and approximately \$30 million Euros from counterpart funds from both the public and private sectors, Implementation: 60 months.*
- *IDB (Pipeline/Presented to the Green Climate Fund: GCF): “E-Mobility Program for Sustainable Cities in Latin America and the Caribbean” –Budget: approximately US\$11million USD in grant funds and approximately US\$28 million USD in future loans for pre-identified projects, Implementation: 60 months.*

2. Project Objectives

- General Objective
 - Contribute to the development and implementation of green hydrogen technologies in Paraguay as an innovative alternative towards an energy and technological transition that improves the country’s productivity while focusing on sustainability.
- Specific Objectives
 - To implement a pilot project for installing a production plant of green hydrogen in Paraguay oriented to supply the transport sector.
 - To acquire hydrogen transportation units that will represent the demand for the pilot plant.
 - To train professionals with skills to design, build and operate hydro-generators and hydrogen production plants, promoting the participation of men and women (gender diversity).
 - Identify mechanisms to develop local employment of supplies in the value chain of green technologies for the decarbonization of the transportation sector.

⁵ These involves the integration of electric vehicles within the vehicle fleet from ANDE (the public electric utility) by 10%, 50% and 100% in the short-, medium-, and long-term, respectively; and from the overall public sector by 10%, 20% and 50% in the short-, medium-, and long-term, respectively.

- Lay the foundations for Paraguay's role and international positioning as a hub for potential green land and river transport routes, respectively, in the southern cone between the Pacific and Atlantic oceans and between Chile, Argentina, Brazil and Uruguay

3. Project Components

- **Component 1. Development of a Pilot Plan Green Hydrogen Demonstration (USD 9.800.000):** This Course of Action aims to develop a pilot project for the production and use of Green H₂ to promote its use through a progressive consumption plan.
- The project will serve to demonstrate the technical feasibility of green hydrogen (produced by using renewable energy, based on Paraguay's hydroelectric resources) for use as a fuel to replace Diesel Oil. This will avoid transport-related CO₂ emissions, improve air quality in areas with the highest density of road traffic and avoid the country's dependence on fuel imports. The project will also enable the collection of data and information useful for socioeconomic evaluations of hydrogen use scenarios in the country and could include a laboratory for the analysis of new hydrogen technologies, promoting collaboration in research and development. Under this collaboration, existing hydrogen technologies could be studied for use in land mobility.
- **Component 2. Training of the Green Hydrogen Technology (USD 200.000):** The training of specialized technical personnel prepared for the jobs created.
- The hydrogen economy, with all its benefits, has great potential for job creation, and by taking advantage of the country's demographic bonus, it could offer young people secure jobs and a good outlook. However, for the most part, the young population is an unskilled labor force, so training is a critical aspect for them to take advantage of these new opportunities. In addition, human capital is important for this package of projects that aims to promote the use and generation of hydrogen technologies.
- To accompany the processes, clear actions will be needed for Skills Building and Human Resources Training. This will be an important demonstration to investors of the government's commitment to promoting the hydrogen economy. Curricular programs will be updated with topics related to hydrogen, both in universities and in training institutes for specialized technicians, in the areas of assembly and operation of plant-stations, and associated technologies such as FCEV type vehicles, compressors, tanks, etc. Also, emergency response personnel, such as firefighters, paramedics, among others, should be trained since this type of technology presents new challenges in terms of procedures and safety.

4. Project Location, Period, and Estimated Cost

- **Timeline.** The project will be executed in 18 months
- **Location:** Villa Elisa, Central Department, Paraguay. This location has been selected because it corresponds to a property owned by PETROPAR, a public/state owned entity, and a key institutional partner of the project. There is suitable space in the property for the construction of the pilot plant, and it is located in close proximity to the Paraguay River and ANDE's power network.
- **Budget:** Total US\$ 10 million (USD) associated with two different components shown in the next table:

Table 1: Costs by Component

Components	Budget (USD)
1. Development of a Pilot Plan Green Hydrogen Demonstration	9.800.000,00
2. Training of the Green Hydrogen technology	200.000,00

Component	Amount (US\$)
• Construction of H2 production plant and charging station (200 kg/day)	2,000,000.00
• H2 cell for electricity generation	50,000.00
• Technical oversight and documentation	110,000.00
• Land acquisition	500,000.00
• Vehicle acquisition – FCEV type	6,160,000.00
• Contingencies	980,000.00
• Training	200,000.00
Total	10,000,000.00

	Unit Cost (USD)	Quantity	Total Cost (USD)
Vehicle acquisition – FCEV type	-	-	6,160,000.00
Light vehicles / Sedans	90,000.00	12	1,080,000.00
Utility vehicles	90,000.00	12	1,080,000.00
Buses / Trucks	1,000,000.00	4	4,000,000.00

Component 1 – Basic Characteristics	
H2 production plant and charging station (200 kg/day)	Production of 200 kg/day of H2 with electricity load of 450 kW
H2 cell for electricity generation – 20 kW	Electricity supply to a 20-kW load with roughly 5-kg H2 consumption
Light vehicles / Sedans	5-kg H2 consumption for 500 km
Utility vehicles	2-kg H2 consumption for 350 km
Buses / Trucks	45-kg H2 consumption for 350 km

Component 1 – CAPEX calculations for the H2 production plant			
Description	Investment (USD)	Installation (USD)	Total (USD)
Alkaline electrolyzer 200 kg H2/day	427,500.00	65,000.00	492,500.00
Water treatment 250 liters/hour	8,290.00	1,243.00	9,533.00
Storage 450 bar	268,000.00	26,800.00	294,800.00
H2 station	949,335.00	113,920.00	1,063,255.00
Sub-total			1,860,088.00
Import fees			50,000.00
Planning (5%)			55,803.00
Contingencies (2%)			37,202.00
Total			2,003,092.00

5. Project Implementing Organization

- The IDB will:
 - Supervise the implementation of Project by **VMME**.
 - Creating synergies between **VMME**, **VMT**, **PETROPAR**, **ANDE** and **IDB**
 - Supports the project through the establishment of a cooperative network with the **VMME** and **Petroleos Paraguayos (PETROPAR)**.
- Relevant participants of the project are:
 - **PETROLEOS PARAGUAYOS (PETROPAR)**, because it is the national company responsible for the fuel supply with sustainable criteria, and green hydrogen is considered one.
 - **VICEMINISTERIO DE MINAS Y ENERGÍA (VMME)**, The Vice Ministry of Mines and Energy, because through green hydrogen it will be achieving some of its purposes related to the energy transition.

- **VICEMINISTERIO DE TRANSPORTE (VMT)**, The Vice Ministry of Transport, because new transport technologies could be introduced thanks to green hydrogen, that could improve the quality of the system.
- **ADMINISTRACIÓN NACIONAL DE ELECTRICIDAD (ANDE)**, The National Administration of Electricity (ANDE), the main resource required to produce green hydrogen is electricity from renewable sources, hence sales will drastically increase and ANDE will have the possibility to test new technologies for energy storage and to manage demand.

6. Required Coordination at National/Regional Level

N.A.

7. Risks and Opportunities

- Risks: Bureaucracy can affect timely investments and purchases associated with the commissioning and construction of the pilot plant. Droughts could also delay the importation of necessary equipment (most of the material/equipment imported arrives to Paraguay via fluvial transport). This could ultimately change the initial schedule.
- Opportunities: Paraguay embraces green H2 to foster the energy transition in its transport sector. As such, the energy matrix itself becomes greener, more sustainable by reducing the dependence on imported fossil fuels, which currently is 40%. By doing so, Paraguay takes a stand to become a carbon-neutral economy in the long term, since electricity generation is already green, and is planned to remain, 100% clean and renewable. In addition, the development of the H2 economy brings opportunities for sector diversification, job creation, boosting knowledge and skills of the country's human talent.