

TC Document

I. Basic Information for TC

▪ Country/Region:	REGIONAL
▪ TC Name:	Hydrogen Decarbonization: Pathways for Green Recovery
▪ TC Number:	RG-T3988
▪ Team Leader/Members:	Carvalho Metanias Hallack, Michelle (INE/ENE) Team Leader; Correa Poseiro, Cecilia (INE/ENE) Alternate Team Leader; Visconti, Gloria (CSD/CCS) Alternate Team Leader; Alarcon, Arturo (INE/ENE); Angulo Rodriguez, Emilio Jose (INE/ENE); Ballon Lopez, Sergio Enrique (INE/ENE); Cubillos Prieto, Fernando (INO/EN); Eric Daza (INE/ENE); Goldenberg Lopez, Federico (INE/ENE); Gomez, Jose Ramon (INE/ENE); Greco, Maria Sofia (LEG/SGO); Juarez Olvera, Mariel (CSD/CCS); Machado Lemus, Ziza (INE/ENE); Malagon Orjuela, Edwin Antonio (INE/ENE); Marquez Barroeta, Fidel (INE/ENE); Planas Marti, Maria Alexandra (INE/ENE); Snyder, Virginia Maria (INE/ENE)
▪ Taxonomy:	Client Support
▪ Operation Supported by the TC:	N/A.
▪ Date of TC Abstract authorization:	08 Nov 2021
▪ Beneficiary:	Regional: Ecuador, Bolivia, Colombia, El Salvador, Panamá and Perú
▪ Executing Agency and contact name:	Inter-American Development Bank
▪ Donors providing funding:	Strategic Climate Fund(SCX)
▪ IDB Funding Requested:	US\$935,000.00
▪ Local counterpart funding, if any:	US\$0
▪ Disbursement period (which includes Execution period):	24 months
▪ Required start date:	January 2022
▪ Types of consultants:	Individual and Firms
▪ Prepared by Unit:	INE/ENE-Energy
▪ Unit of Disbursement Responsibility:	INE/ENE-Energy
▪ TC included in Country Strategy (y/n):	No
▪ TC included in CPD (y/n):	No
▪ Alignment to the Update to the Institutional Strategy 2010-2020:	Environmental sustainability; Institutional capacity and rule of law; Productivity and innovation

II. Objectives and Justification of the TC

- 2.1 The objective of this TC is to identify pathways for the use of hydrogen decarbonization of the energy uses in Latin America and the Caribbean (LAC) as part of the agenda of green recovery. This TC aims to promote the enabling conditions for private investment in the energy uses of Green Hydrogen (GH₂) to decarbonize the energy sector while creating sustainable jobs.

- 2.2 To achieve the objectives set out in the Paris Agreement, climate change experts have established that it will be necessary to reach net-zero CO₂ emissions around mid-century. GH₂ has the potential to contribute to the overcoming of the two main barriers to achieving such an ambition: (i) the need for power systems flexibility, and (ii) the challenge to electrify other energy services, such as heavy transportation and industry.
- 2.3 The LAC region has an immense potential for renewable generation. The massive introduction of intermittent renewables, such as solar and wind, has generated an imperative need to provide greater flexibility to electrical systems to meet demand fluctuations and preserve energy security. Hydrogen can be used as energy carrier, and it is produced from multiple processes and energy sources. The most established technology option for producing GH₂ is water electrolysis powered by renewable electricity. GH₂ can carry renewable energy for extended periods of time and from one place to another without the electricity grid. Renewable energy price reduction allows for lower GH₂ production costs, improving its economic viability.
- 2.4 Despite the progress observed in the electrification of transport and industry, the decarbonization of both sectors has challenges that GH₂ has the capability to overcome. Hydrogen can carry and store energy that can be transformed into electricity or heat, which in turn can be used by a truck, a factory, or the power system. GH₂ allows for the storing renewables and their long-distance/international trade. Consequently, GH₂ can be the carrier to develop a worldwide internal market for renewables, between countries and continents which are not connected through an integrated electricity grid. The production of green hydrogen is therefore a viable option for decarbonizing heavy transport and industrial heating. As of now, the IDB has received requests to support GH₂ related projects from several countries, including Ecuador, Bolivia, Colombia, El Salvador, Panama y Peru. This technical assistance will support these six countries in accelerating private investments and market development of the GH₂ industry. Each of these countries are in different phases in exploring their own potential of using GH₂ for the energy transition. This technical assistance will be part of the Green Hydrogen Initiative. It focuses on creating the proper environment and laying the market foundations for the GH₂ industry, leveraging significant participation of the private sector. This aims to support each country considering their specific knowledge and needs.
- 2.5 The six beneficiary countries of this TC are part of the Renewables in Latin America and the Caribbean (RELAC) initiative, and pledge to achieve the renewables targets of 70% of the electricity generated by 2030. As part of this effort, they are committed to a massive introduction of renewables, mainly non-conventional sources, to achieve the ambitious target of RELAC, which has become an energy compact in the context of the UN High Level Dialogue on Energy. As result, they are looking for a strategic positioning in the development of GH₂ as an option to accelerate the decarbonization.

- 2.6 In 2016, Bolivia submitted its Nationally Determined Contributions (NDC) to the UNFCCC, setting a target to reach 79% of renewable energy participation in the energy matrix by 2030. The plan also expresses the aim to achieve 13,387MW of installed capacity by 2030, using 67% of it to satisfy energy export demands with mostly renewable sources. In this context, Bolivia aims to explore its possibilities in accelerating decarbonization and in participating strategically in the economics of the energy transition and job creation. On GH₂, Bolivia is looking to assess the green hydrogen potential of the country as well as to analyze the related value chain and to design the GH₂ roadmap. The IDB has already supported the government through a training program and a sequence of technical dialogues to start the promotion of the GH₂ industry through institutional strengthening.
- 2.7 Colombia has ambitious climate change mitigation targets, the compliance of which requires substantial progress in clean energy. It was announced a renewal of the GHG emission reduction commitment under the Paris Agreement, corresponding to a 51% reduction in the country's emissions, compared to projected emissions by 2030. The Ministry of Mines and Energy has shown a great commitment in this area, embodied in its Comprehensive Management Plan for Mining-Energy Climate Change (Resolution 40807 of 2018). To articulate stakeholders and integrate the different initiatives into a national hydrogen strategy, Colombia is currently developing a roadmap for hydrogen. In this regard, the IDB is looking to support the country with the implementation of the roadmap by i) developing the economic regulation necessary to allow for the development and operation of GH₂ projects in the country, and ii) analyzing the technical needs of the country essential to promote private investments, including the identification of projects and the evaluation of needed certifications.
- 2.8 The Government of Peru (GoP), to reform the energy sector, created the Multisectoral Commission for the Reform of the Electric Subsector (CRSE). The CRSE was established MINEM to propose measures to ensure the sustainability and development of the electricity sector. The GoP has engaged in the development of a framework to support the modernization of the sectoral regulatory framework to, among others, integrate renewable energy, smart metering, distributed generation, electromobility, as well as the active participation of users in the electricity market, among others. The development of a GH₂ National Strategy will support current efforts to diversify the use of Peru's resources. GH₂ in Peru is expected to be developed by the private sector following the current strategy for the expansion and development of the energy sector in the country. Peru is looking to assess the hydrogen potential of the country as well as to design the GH₂ roadmap.
- 2.9 El Salvador has promoted a new national energy policy (PEN) 2020-2050, which will be published in Q2 2021. The main objective of the PEN is to guarantee the supply and consumption of energy resources that the country requires for its development under a sustainability approach, modernization, efficiency, safety, and carbon neutrality over the next 30 years. El Salvador is working to promote the use of alternative energies and within this framework, it is committed to introducing GH₂ into its energy matrix. The production of GH₂ is included in the strategic pillars of the PEN. In this sense, El Salvador has developed a list of concrete actions that wants to develop and is seeking support to do so. This Technical Cooperation will develop a road map and the interaction between the GH₂ Road Map and the general renewables policies and regulation.

- 2.10 The Government of Panama has been implementing important reforms aimed at promoting energy security and diversification of the energy matrix, through the promotion of Energy Efficiency (EE), Renewable Energy (RE) and regional integration. In this context, the IDB has been supporting the government in developing a comprehensive sectoral vision and planning, which actively considers renewable technologies. In terms of decarbonization of the economy, the introduction of hydrogen into the energy matrix might represent a big opportunity for reducing emissions in some of the most polluting sectors, such as Transport. In 2019, the transportation sector was the main energy consumer (46%), followed by industry (21%), commerce (17%) and residential (15.5%). The great dependence of the transport sector on petroleum products is one of the most important problems to be solved to reduce the use of fossil fuels. For this reason, the transition of this sector towards the use of hydrogen would be key in the process of decarbonization of the Panamanian economy and the achievement of its climate goals. Hydrogen is significantly attractive, especially for large-scale and long-distance transportation, given its high energy density. In June 2020, Panama's National Secretariat of Energy published the Strategic Guidelines for the Energy Transition Agenda 2020-2030, which includes several strategies. In such, the Government of Panama considers hydrogen a technology that can achieve a high potential in the country that, due to its geographic position and experience in logistics, favor it to become the hydrogen energy center in the region. To have a better understanding of the potential impact of the hydrogen economy for Panama, it is necessary to analyze the potential worldwide hydrogen production, demand, and storage. It is important to estimate the potential generation of resources that GH2 economy can generate for the canal and what they need to adapt to benefit the most from this new international trade.
- 2.11 The Government of Ecuador aim to achieve at the energy transition, considering both mitigation and adaptation to climate change. The energy transition policies reinforce the commitments acquired through the NDC, according to the Paris Agreement. Currently, 23 % of the energy comes from renewable resources, most of that is hydroelectricity. For energy transition in the context of economic recovery, investment in renewables is an important element of energy policy in Ecuador. To improve renewables, it is key to increase the system flexibility, in this context, the Electricity Corporation of Ecuador (CELEC EP) is in the process of identifying and quantifying the potential surplus energy in NCRE generation plants of the National Interconnected System and the flexibility services that can be provided through storage systems of Energy. In this context, it is intended to evaluate different storage technologies such as green hydrogen, synthetic methane, compressed air, hydraulic pumping, batteries, among others. For this purpose, the Ministry of Energy and Non-Renewable Natural Resources, through the Vice Ministry of Electricity and Renewable Energy, is in the design and planning phase of the development of green hydrogen in Ecuador, this will allow meeting the relevant objectives within the decarbonization process. It will include a roadmap and the National Strategy for the production and use of green hydrogen in Ecuador.

- 2.12 **Strategic alignment.** This TC is consistent with the Second Update to the Institutional Strategy (AB-3190-2) and is aligned with the development challenges of Productivity and Innovation since it supports the development of the green hydrogen ecosystem as an innovative energy carrier. It is also aligned to the cross-cutting themes of: (i) Climate Change and Environmental Sustainability, by promoting the use of GH₂ as an energy carrier that will contribute to the decarbonization of the economies; and (ii) Institutional Capacity and the Rule of Law by supporting the development of GH₂ strategies, roadmaps, and regulation. The TC is also aligned with the Corporate Results Framework (GN-2727-12) with the indicators of Productivity and Innovation as it will contribute to growth of rate of number of people employed, and with the indicator of Climate Change and Environmental Sustainability as it aims at reducing the amount of CO₂ emissions from fuel combustion. The TC is also aligned with the Energy Sector Framework (GN-2830-8), by supporting the diversification of energy resources by the use renewable energies to substitute the use of fossil fuels in different industries; the Science and Technology Sector Framework (GN-2791-8); and the Climate Change Sector Framework (GN-2835-8) by promoting innovation, a sustainable economic growth, and the reduction of greenhouse gas emissions.
- 2.13 The development of Hydrogen industry is strongly aligned with the IADB 2025 vision which includes regional integration and strengthening value chains; support for small and medium-sized businesses; digitalization and the digital economy; work toward gender equality; and action on climate change.
- 2.14 This TC is aligned with Bolivia's Country Strategy (CS) (AB-3190-2) by supporting activities that will contribute with the diversification of the economy. It is aligned with Panama's CS (GN-3055) by supporting quality public services based on environmental sustainability criteria. It is aligned with Peru's CS (GN-2889) by promoting a new technology that will contribute with the environment through the decarbonization of the energy sector and economy. It is aligned with Colombia's CS (GN-2832) by improving the quality of infrastructure to improve the productivity. It is aligned with Ecuador's CS (GN-2924) by supporting the energy sector reform and increase participation of clean energy. It is aligned with El Salvador's CS (GN-3046-1) by supporting sustainable economic revival and promoting resilient restructuring of production.

- 2.15 Furthermore, the proposal will support the development of technology that will contribute to retaining energy-intensive industries through more reliable and affordable energy and therefore retain formal jobs. In this context the development of green hydrogen industry opens enormous opportunity for gender equality policies and progress. In LAC, the gender gaps in the energy sector are wider – women represent 19.7% of the total energy sector employees, 9% of all directors and 17% of managers in power and utilities companies. By nature, this TC will contribute to gender equality as IRENA (International Renewable Energy Agency) had identified that renewables tend to have higher gender equality. This TC will enhance social sustainability by designing a Green Hydrogen Initiative to promote gender equality and inclusion by prioritizing the participation of women and the LGBT communities. The prefeasibility analysis will include gender equality analysis when possible and the knowledge dissemination and dialogues events will advocate for gender equality in the creation of the GH₂ market and related policies. In previous studies, we had concluded that the inclusion of gender equality during training is a key tool for the development of the emerging energy industry. Also, the design of the GH₂ will promote local industries and the engagement of local communities.
- 2.16 Finally, the IDB has a hydrogen initiative with the objective of supporting the development of green hydrogen in LAC countries through 4 pillars: (i) Training, Knowledge and dialogue; (ii) Support for the development of strategies, plans, regulations, institutions, business models until a pre-feasibility study; (iii) Support for scalable pilot projects; (iv) Support for commercial projects, starting with soft financing. This regional TC is part of this strategy, and together with other TCs will produce the knowledge needed to promote a regional strategy for LAC countries to advance in the development of the hydrogen market. This TC will complement and consider lessons learned from existing TCs such as “Promotion of the Green Hydrogen Market in LAC Countries” (ATN/OC-18386-RG), benefiting Trinidad and Tobago and Uruguay; “Support for the Creation of a Hydrogen Ecosystem in Uruguay: Promoting a Sustainable Mobility System” (ATN/OC-17723-UR) that supports; “Promotion for the Development of a Green Hydrogen Market in Chile” (ATN/JF-18347-CH) that supports Chile; and “A Green Hydrogen Facility to accelerate Latin America and the Caribbean decarbonization through green recovery” (ATN/AC-18948-RG, ATN/MC-18949-RG, ATN/OC-18947-RG) that supports Bolivia, Panamá, Perú and Paraguay. The proposed TC will complement and apply lessons learned from these projects, such as the importance of (i) contributing with the developing of regulatory framework for the development of the technology, (ii) promoting the dissemination of knowledge to contribute to technically sound decision making and greater acceptance, and (iii) fostering the articulation of the different stakeholders.

III. Description of activities/components and budget

- 3.1 **Component I: GH₂ potential and roadmap in Ecuador.** This component will finance the development of the national green hydrogen roadmap. The component will include: a diagnosis of the potential for GH₂ in Ecuador, including the identification of the industrial demand and potential exports. It will finance the technical study to identify the interaction between green hydrogen plan and renewable policies and regulation framework.

- 3.2 **Component II: GH₂ regulatory adaptation and value chain in Bolivia.** This component will support the application of the GH₂ National Roadmap by: (i) developing the economic and legal regulation necessary to allow for the development and operation of GH₂ projects in the country; (ii) analyzing the technical needs of the country essential to promote private investments, including the identification of the best incentives' mechanisms, identification of potential projects and the evaluation of needed certifications; and (iii) to evaluate the technical, economic and social inputs, including a gender analysis to identify opportunities to promote the gender equality in the sector, to develop the GH₂ value chain in the country and the analysis and proposal of business models that would enable investment in GH₂ and its related job creation, and the identification of regulatory barriers for the implementation of these potential projects.
- 3.3 **Component III: GH₂ regulatory adaptation in Colombia.** This component will finance part of the implementation of the existing GH₂ roadmap in Colombia by (i) developing the economic and legal regulation necessary to allow for the development and operation of GH₂ projects in the country, and (ii) analyzing the technical needs of the country essential to promote private investments, including the identification of the best incentives' mechanism, identification of potential projects and the evaluation of needed certifications.
- 3.4 **Component IV: GH₂ roadmap, regulation, and policies in El Salvador.** This component will finance the development of the national green hydrogen roadmap in El Salvador. The component will include (i) a diagnosis of the potential for GH₂ in El Salvador, including the identification of the industrial demand and potential exports; (ii) a characterization of the GH₂ industry; and (iii) the identification of needs for research and development of knowledge around GH₂. It will also finance a technical study that will identify the interaction between the green hydrogen plan and renewable policies and regulation frameworks.
- 3.5 **Component V: GH₂ roadmap for international hub in Panama.** This component will develop the studies necessary to promote a roadmap for an international GH₂ hub in Panama. The main objective is to prepare technical, economic, and legal feasibility studies for the development of an international hub for trading of GH₂ based in Panama. The component will consider the country's geographical position, the Panama Canal, and vast experience in logistic activities. It will analyze the technical needs, mechanisms, and certifications necessary.
- 3.6 **Component VI: GH₂ application of the roadmap in Peru.** This component will support the application of the GH₂ National Roadmap by: (i) developing the economic and legal regulation necessary to allow for the development and operation of GH₂ projects in the country, and (ii) analyzing the technical needs of the country essential to promote private investments, including the identification of the best incentives' mechanisms, identification of potential projects and the evaluation of needed certifications.
- 3.7 All components will finance studies, workshops and dissemination material supporting the inclusion of GH₂.

3.8 The TC's total budget is US\$935,000.

Indicative Budget

Activity/Component	IDB/Fund Funding	Total Funding
Component 1: GH ₂ potential, roadmap and value chain in Ecuador	US\$100,000.00	US\$100,000.00
Component 2: GH ₂ regulatory adaptation and value chain in Bolivia	US\$250,000.00	US\$250,000.00
Component 3: GH ₂ regulatory adaptation in Colombia	US\$150,000.00	US\$150,000.00
Component 4: GH ₂ roadmap, regulation, and policies in El Salvador	US\$155,000.00	US\$155,000.00
Component 5: GH ₂ roadmap for international hub in Panama	US\$155,000.00	US\$155,000.00
Component 6: GH ₂ potential and roadmap in Peru	US\$125,000.00	US\$125,000.00
Total	US\$935,000.00	US\$935,000.00

- 3.9 Since this is a regional project executed by the IDB, a Bank-led supervision and approval scheme will be used, where country representatives will actively participate in the contracting and report review processes, following the provisions of the consultant selection policies (GN-2765-4) and the operational guidelines (OP-1155-4). The IDB has identified consulting companies in the market that have the necessary experience for these consultancies.
- 3.10 The output of the six components should have the following results: (i) GH₂ National Roadmap for Ecuador; (ii) Regulatory framework for GH₂ in Bolivia and a report on the analysis of value chains for Bolivia; (iii) Regulatory framework for GH₂ in Colombia; (iv) GH₂ National Roadmap for El Salvador; (v) GH₂ National Roadmap for Panama as an international hydrogen hub, and (vi) Regulatory framework for GH₂ in Peru.
- 3.11 The team will ensure that the knowledge generated as a result of this TC is transmitted to all interested areas of the Bank through workshops and technical notes.

IV. Executing agency and execution structure

- 4.1 At the request of the beneficiary countries, considering this is a regional TC and there is an absence of a regional entity for its execution, and in accordance with the guidelines established in the TC Operational Guidelines (GN-2629-1), the Bank through its Energy Division (INE/ENE) will execute this TC. In accordance with OP-619-4 the Bank may execute TC following the exceptional case of Regional Technical Cooperation where a regional entity with legal capacity to execute the TC can't be identified. The Bank will carry out the contracting of consultants in accordance with the GN-2765-4 vis a vis the sustainability of the implementation of the project and will provide its experience and close relationship with the authorities of the countries to enable a successful implementation of the TC. The Bank, as an executing agency, will lead the structuring of the GH2 which will allow for a better organization of the support given to the countries and facilitate the articulation among the different countries, stakeholders, and donors of the region. The Bank will contribute to the harmonization of the activities at a regional level, by providing a linkage between existing projects, and guaranteeing that experience and lessons learned from the project are shared with all countries.
- 4.2 These countries are included for this TC because they secured the financing and requested the bank's assistance to execute the components. The IDB execution allows the coordination of the studies for the roadmaps, regulatory and value chain studies for the different contexts. The direct beneficiary in Bolivia is the Minister of Hydrocarbons and Energy; the direct beneficiary in Panama is the National Energy Secretariat of Panama; and the direct beneficiary in Peru is the Minister of Energy and Mining. The direct beneficiary of Colombia is the Minister of Mines and Energy. The direct beneficiary in El Salvador is the National Energy Council. The direct beneficiary in Ecuador is Ministry of Energy and Non-Renewable Natural Resources. The direct beneficiary in Peru is the Minister of Mines and Energy.
- 4.3 Activities at the country level will be coordinated by the field ENE specialist. This coordination will be formalized with letters of request and no-objection from the countries, which have been requested by the Bank. No activity will be initiated unless the letters of request from the corresponding ministry has been received.
- 4.4 All activities to be executed under this TC have been included in the Procurement Plan (Annex IV) and will be contracted in accordance with Bank policies as follows: (a) AM-650 for Individual consultants; (b) GN-2765-4 and Guidelines OP-1155-4 for Consulting Firms for services of an intellectual nature; and (c) GN-2303-28 for logistics and other related services.
- 4.5 As per SCX guidelines related to the Technical Assistance Facility, which will finance the project, the MDBs will develop a detailed results framework with sector-specific indicators for each project respecting the MDB's own project management approach. Project results frameworks should include reference to sex-disaggregated results indicators, including number and percentage of women and men trained with support of TAF financing, and/or other gender indicators, as relevant.

- 4.6 The regional coordination of this TC will (i) improve the knowledge dissemination, thus it can simultaneously benefit different countries and projects; (ii) promote cross-country lessons and knowledge transfer; and (iii) promote collaboration and trade, and it can help establish some regional value chain benefiting of potential scale economy and infrastructures, such as pipelines and the development of harmonized sustainable certification.
- 4.7 All knowledge products derived from this Technical Cooperation will be the Bank's intellectual property.

V. Major issues

- 5.1 The main implementation risk of this TC is potential difficulties to organize and canalize the interest of different countries and the private sector in the GH₂. This risk will be mitigated with permanent contact with the country representatives and with the structuring of a multidisciplinary team from the bank that will include members from the different Bank's focal points with the financing institutions, IDB Invest and IDB Lab.
- 5.2 Another risk is the difficulty to maintain the priorities of the countries even if there are changes of governmental authorities. This risk will be mitigated by constant communication with the beneficiary countries and by assigning a focal point with a technical background who might be more likely to surpass political cycles.
- 5.3 There is a potential risk of lack of appropriation and actual usage of the products from this TC by the governments/companies/beneficiaries. This risk is mitigated by creating frameworks that are applicable at country level and by working with the private sector, the public sector, and the regulators.
- 5.4 Also, the current COVID situation could delay some of the procurement process. For risk mitigation related to COVID, there is an established procurement process that has proven successful during COVID which would be the standard for all procurement related to the TC. Additionally, potential companies have already been identified from procurement processes with similar purpose, that is hydrogen analysis in other countries. The risk is also mitigated by the already established international network.

VI. Exceptions to Bank policy

- 6.1 This project will not require any exception to the Bank's policy.

VII. Environmental and Social Strategy

- 7.1 According to the OP-703 the environmental and social classification for this operation has been assigned as category C. Given that no significant environmental and social risks and impacts have been identified, no environmental assessment studies or consultations are required for this Category operation.

Required Annexes:

[Request from the Client - RG-T3988](#)

[Results Matrix - RG-T3988](#)

[Terms of Reference - RG-T3988](#)

[Procurement Plan - RG-T3988](#)