

TERMS OF REFERENCE*Long-term Resource Adequacy Mechanism to ensure the expansion of Renewable Energy Sources*

Colombia

[[Project Number]

CO-T1663

[Web link to approved document]

Support Colombia's energy transition

1. Background and Justification

- 1.1. The Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, provided specific recommendations for the modernization of the energy sector in Colombia. Although the current system has operated successfully for over 25 years, technological changes, the need to incorporate Non-Conventional Renewable Energy Sources (NCRES), the emergence of new business opportunities and new users' needs required a comprehensive review. Part of these recommendations are being implemented in various areas, including a review of the structure and the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and a review of the institutional framework.
- 1.2. However, several components of the regulation still require more in-depth studies to define the most appropriate changes that achieve the change in the energy matrix and the sector's decarbonization. Therefore, it is necessary to advance in the study of the following critical elements of regulation and planning: (i) design of short-term energy markets, (ii) improvements to design of contracts and bilateral markets, (iii) long-term resource adequacy mechanism, and (iv) improvements to transmission planning and expansion.
- 1.3. Given the complexity of the requested studies and evaluations, the support of an international consulting firm is required, with experience in the power sector regulation and planning, especially in the design of long-term adequacy mechanism and reliability charges.
- 1.4. The lack of a long-term resource adequacy mechanism in the Colombian wholesale electricity market prevents the system from getting a higher penetration of NCRES. A finite offer cap on the short-term energy market, the limited deployment of interval metering technology, and the inability to curtail only those customers that fail to purchase sufficient energy in the forward market for delivery during system scarcity conditions implies the existence of a "reliability externality." This externality arises because no individual retailer or large consumer bears the full cost of failing to purchase sufficient energy to meet demand under extreme system conditions.

This outcome justifies the need for a regulator-mandated mechanism to ensure that there will be sufficient energy at least cost available to meet demand during El Niño and other system scarcity conditions and is consistent with expectations that power system transformation will result in much higher penetration of variable energy resources, active participation by demand and more extensive digitization.

- 1.5. The Energy Transformation Mission formulated three approaches to ensure long-term resource adequacy: (i) The first approach would transition to a regulator-mandated standardized energy contracting phase that ensures that all retailers and free consumers have purchased sufficient energy in the forward market at various horizons to cover future system demand during all hours of the year. (ii) The second approach would maintain and attempt to eliminate the defects in the current firm energy-based Reliability Charge (Cargo por Confiabilidad (CxC)) mechanism revealed during the most recent El Niño event. (iii) The third approach would include reforms to the CxC mechanism but also the detailed design and impact assessment of a gradual transition to the long-term energy contracting approach.

2. Objectives

- 2.1. Support the Energy and Gas Regulatory Commission (CREG) to define the most appropriate Long-term Resource Adequacy mechanism to ensure a higher penetration of NCRES.

3. Scope of Services

- 3.1. The Consultant will carry out the following specific activities:

- 3.1.1. Review the report prepared by the Energy Transformation Mission regarding the adequacy mechanism.
- 3.1.2. Analyzed in detail the current the Reliability Charge (CxC) mechanism and determine deficiencies.
- 3.1.3. Critically evaluate each proposed approach including proposals to improve the CxC.
- 3.1.4. Prepare simulations of the market, and potential evolution of energy contracts, for each approach.
- 3.1.5. Estimate the penetration of NCRES under each scenario.
- 3.1.6. Recommend specific actions and regulations to establish the most appropriate Long-term Resource Adequacy mechanism that ensures a higher penetration of NCRES.
- 3.1.7. Prepare an initial report with the findings and recommendations. This report should be discussed with CREG.
- 3.1.8. Based on the feedback received from CREG, prepare a final report with recommended regulations and a schedule for its implementation.

4. Expected Outcome and Deliverables

- 4.1. Work plan:** Three weeks after signing the contract, the consulting firm will submit a proposal to carry out each of the activities described in these terms of reference, including the work schedule and the proposed dates for (i) visits to CREG and other stakeholders, (ii) delivery of reports, and (iii) final meeting to present the full results of the consultancy, and discuss recommendations.
- 4.2. Initial Report:** Within one hundred twenty (120) calendar days after the signing of the Contract, based on the documentation that has been made available by CREG the consulting firm must submit an Initial Report responding to the activities requested.
- 4.3. Final Report:** Within one hundred and eighty (180) calendar days after the signing of the contract, and based on the agreements reached with CREG, the consulting firm must submit the Final Report.
- 4.4.** All documents and reports will be delivered in the Spanish language.

5. Supervision and Reporting

- 5.1.** The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

- 6.1.** Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.
- 6.2.** The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
1. Work Plan	20%
2. Initial report	40%
3. Final Report	40%
TOTAL	100%

TERMS OF REFERENCE

Ministry of Mines and Energy through capacity building for economic resilience and economic empowerment of women

Colombia

[[Project Number]

CO-T1663

[Web link to approved document]

Support Colombia's energy transition

1. Antecedentes y Justificación

- 1.1.** Colombia's commitment to the Paris Agreement under the revised National Determined Contributions (NDC) aims to reduce GHG by 51% with respect to the business-as-usual scenario in 2030. Colombia's NDC is considered one of the most ambitious in Latin America and the Caribbean (LAC) and is closely aligned with the country's objective of achieving carbon neutrality by 2050. In this regard, the energy sector is at the forefront of implementing a comprehensive climate change management plan, by reducing an equivalent of 11.2 million tons of carbon dioxide (CO₂) by 2030.
- 1.2.** Colombia has made a significant effort to decarbonize its energy sector by introducing some critical legislation and regulation to promote the introduction of Non-Conventional Renewable Energy (NCRE) in the National Interconnected System and the Non-interconnected areas. These include the Renewable Energy Law (Law 1715 of 2014) that promotes the development of NCRE and energy efficiency, Decree 0570 of March 2018 (providing policy guidelines for the long-term contracting of NCRE), Law 2099 of 2021 that promotes the Energy transition, CONPES 4075 of 2022, which is the energy transition policy, and associated resolutions that establish the framework for the introduction of large-scale NCRE.
- 1.3.** The GoC has set an ambitious goal to increase NCRE installed capacity from less than 1% in 2018 to more than 16% by 2025 (equivalent to 2,400 MW). In 2019 and 2021, 2,084 MW of NCRE were awarded through auctions.
- 1.4.** The Inter-American Development Bank (IDB), through the Energy Division, in conjunction with the United Kingdom Sustainable Infrastructure Program (UKSIP), has supported the GoC to promote sustainable low-carbon infrastructure through the execution of the TC ATN/PI-17372-CO. That TC aimed to strengthen the GoC institutional, technical, and regulatory capabilities to ensure smooth adoption of large-scale Non-Conventional Renewable Energy in their electricity generation matrix.
- 1.5.** As a result, this UKSIP support was critical to strengthening Colombia's institutional, technical, and regulatory framework to ensure smooth adoption of large-scale NCRE in their electricity generation matrix. In 2019 and 2020, this TC financed technical support to design Renewable Energy Auctions focused on two key elements: (i) Risk allocation and (ii) Project finance. The IDB

also financed the Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, which provided specific recommendations for the modernization of the energy sector. Although the current system has operated successfully for over 25 years, technological changes, the emergence of new business opportunities, and new users' needs required a comprehensive review. Mission's recommendations are being implemented, including a review of the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and the institutional framework.

- 1.6. To continue with this support, a High-Level Dialogue on June 9th, 2021, was an important milestone in developing a new UKSIP technical assistance for Colombia. The GoC, represented by the National Planning Department (DNP); the International Cooperation Agency (APC); Ministry of Energy (ME); Ministry of Transport (MT); Financial Superintendence (SFC); and the Ministry of Environment (MADS), discussed with representatives from the IDB group, and UK Government (Department for Business, Energy and Industrial Strategy – BEIS and the UK Embassy in Colombia) the strategic areas of intervention. The participants agreed that Clean Energy will be a key pillar to continue the development of the energy transition strategy and to promote the economic recovery after the COVID19.
- 1.7. The energy transition includes the expansion of NCRE and new energy efficiency technologies. However, it is important to develop the regulatory framework to scale up these new technologies, such as Peer to peer (P2P), smart metering, low-carbon distributed systems, decentralization, digitalization, and electricity management demand.
- 1.8. To continue contributing to the implementation of the energy transition, this TC will support four components: (i) the implementation of key activities prioritized in the Roadmap for the implementation of the Energy Transformation Mission; (ii) developing the regulatory structure for distributed electricity generation; (iii) supporting the design of low-carbon energy generation and GHG reduction strategies; and (iv) promotion of Energy Efficiency.

2. Objectives

- 2.1. Provide advice and technical assistance to the Office of Environmental and Social Affairs of the Colombian Ministry of Mines and Energy through capacity building for economic resilience and economic empowerment of women in four (4) prioritized territories. The above in line with the Territorial Development and Relationship Strategy, the Guidelines for Gender Equity and the Human Rights Policy for the Mining and Energy Sector.

3. Activities

- 3.1. To carry out the methodological design, moderation and guidance of workshops for training in:
 - Introduction to the mining-energy sector.
 - Women's human rights, labor and social rights.
 - Economic empowerment

- Conceptualization of the different types of violence against women in the communities of influence and in the mining-energy industry.
- Alternative or responsible masculinities [conscious masculinity and, ii) men's participation in the care economy].
- Development of creative capacities for businesses that allow them to diversify their income matrix through training in entrepreneurial skills and market access.

3.2. Characterize the situation of women in each prioritized territory, making visible the situation of gender-based violence and the actions being implemented by the municipality to address the needs of women.

3.3. Design monitoring and evaluation instruments (baseline) and prepare the reports of each session.

3.4. Elaborate diagrammed and didactic materials for the development of each workshop, which facilitate the understanding of the topics, considering the territorial dynamics.

4. Expected Outcome and Deliverables

4.1. Report of activity 3.1

4.2. Report of activity 3.2

4.3. Report of activity 3.3 and 3.4

5. Supervision and Reporting

5.1. The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

6.1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.

6.2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
Report of activity 3.1	20%
Report of activity 3.2	40%
Report of activity 3.3 and 3.4	40%
TOTAL	100%

Proceso de selección #CO-T1663-P00X

TÉRMINOS DE REFERENCIA

Apoyar el desarrollo de la de autogeneración a pequeña escala basada en energía solar fotovoltaica, mediante la creación de un sistema centralizado que proporcione gestión de datos e información geográfica de la capacidad instalada

País: Colombia

Número de proyecto: CO-T1663-P00X

Número de Cooperación Técnica ATNXXXXX

[Enlace web con el documento aprobado]

NOMBRE DE LA COOPERACIÓN TÉCNICA: Apoyo a la transición energética en Colombia

1. Antecedentes y Justificación

- 1.1. Misión de Transformación Energética realizada en 2019-2020, con la participación de más de 30 expertos nacionales e internacionales, aportó recomendaciones específicas para la modernización del sector energético en Colombia. Aunque el sistema actual ha funcionado con éxito durante más de 25 años, los cambios tecnológicos, la necesidad de incorporar las Fuentes de Energía Renovables No Convencionales (FNCR), el surgimiento de nuevas oportunidades de negocio y las nuevas necesidades de los usuarios exigen una revisión integral. Parte de estas recomendaciones se están aplicando en varios ámbitos, como la revisión de la estructura y las normas de competencia del mercado eléctrico, la introducción de nuevas tecnologías como el hidrógeno y la geotermia, los incentivos a la descentralización y la digitalización, y la revisión del marco institucional.
- 1.2. El GdC se ha fijado el ambicioso objetivo de aumentar su capacidad instalada de FNCR, pasando de menos del 1% en 2018 a más del 16% en 2025, alcanzando así los 2.400 MW. Para lograrlo, se han realizado dos subastas para promover las FNCR, una en 2019 y una segunda en 2021, que adjudicaron 2.084MW.
- 1.3. Por otro lado, la brecha de infraestructura energética en Colombia tiene el potencial de dar un giro como una oportunidad para apalancar la inversión del sector privado si se entregan proyectos sostenibles financiados a escala. En este contexto, el Banco Interamericano de Desarrollo (BID), a través de la División de Energía, en conjunto con el Programa de Infraestructura Sostenible del Reino Unido (UKSIP), han apoyado al Gobierno de Colombia para promover la infraestructura sostenible de bajo carbono, a través de la ejecución de la CT ATN/PI-17372-CO.
- 1.4. Un Diálogo de Alto Nivel que tuvo lugar el 9 de junio de 2021, fue un hito importante en la programación de una nueva asistencia técnica del UKSIP para Colombia. Se presentaron y discutieron las áreas estratégicas entre el Gobierno de Colombia, representado por el Departamento Nacional de Planeación (DNP); la Agencia de Cooperación Internacional (APC); el Ministerio de Minas y Energía (MME); el Ministerio de Transporte (MT); la Superintendencia

Financiera (SFC); y el Ministerio de Ambiente y Desarrollo sostenible (MADS), además de representantes del grupo BID, y del Gobierno del Reino Unido (Department for Business, Energy and Industrial Strategy – BEIS) y la Embajada del Reino Unido en Colombia. Se acordó que las Energías Limpias serán un pilar fundamental para continuar con el desarrollo de la estrategia de transición energética y promover la recuperación económica después de la COVID19.

- 1.5. Dada la necesidad que tiene el país en impulsar el desarrollo de la de autogeneración a pequeña escala basada en energía solar fotovoltaica, se requiere el apoyo de una firma consultora con experiencia en la implementación de proyectos de generación mediante FNCER y la gestión y reporte de datos de la capacidad instalada incluyendo la georreferenciación de esta.

2. Objetivos

- 2.1. Desarrollar un sistema centralizado que proporcione servicios de gestión de datos e información geográfica de la capacidad instalada, en los diferentes puntos de la red de distribución, de autogeneración a pequeña escala basada en energía solar fotovoltaica

3. Alcance de los Servicios

- 3.1. Estudio de al menos tres (3) casos internacionales sobre como se gestionan y reportan los datos de la generación distribuida.
- 3.2. Debida diligencia de los puntos de autogeneración en el país.
- 3.3. Arquitectura del sistema
- 3.4. Socialización del sistema
- 3.5. Definición de los roles y responsabilidades de la (s) entidad (es) que administrarán el sistema

4. Actividades Clave

- 4.1. *(Incluya una descripción de todas las tareas que deben completarse para la realización exitosa de este proyecto / contrato).*

5. Resultados y Productos Esperados

- 5.1. Informe de la actividad 3.1
- 5.2. Informe de la actividad 3.2
- 5.3. Informe que recoja las actividades 3.3, 3.4 y 3.5

6. Calendario del Proyecto e Hitos

- 6.1. *(Defina el calendario de entregables e hitos para este proyecto / contrato. Es imperativo que todos los hitos, tareas, y el calendario de entregables sean lo más precisos posible, ya que las firmas consultoras deberán tener en cuenta estos elementos en sus propuestas.)*

7. Requisitos de los Informes

- 7.1. Los productos serán entregados al Banco en el idioma español y en un archivo electrónico en formatos compatibles con MS Office y Adobe Reader. Las memorias de cálculo, gráficas, tablas y

o cualquier otro documento producido con motivo de esta Consultoría formaran parte de los productos al que correspondan.

8. Criterios de aceptación

- 8.1. Los productos serán aceptados por parte del Banco Interamericano de Desarrollo, con el apoyo del comité técnico conformado por entidades del Gobierno de Colombia y el Banco.
- 8.2. No se pagarán productos parciales, o productos que no sean aceptados por ambas partes.

9. Otros Requisitos

- 9.1. *(Describa los requisitos especiales, como los requisitos de seguridad, cualquier restricción de acceso /requisitos de TI o el tiempo de inactividad del sistema/de mantenimiento si es necesario.)*

10. Supervisión e Informes

- 10.1. *La supervisión de informes y productos se hará por parte del Banco.*

11. Calendario de Pagos

- 11.1. Las condiciones de pago se basarán en los hitos o entregables del proyecto. El Banco no espera hacer pagos por adelantado en virtud de contratos de consultoría a menos que se requiera una cantidad significativa de viajes. El Banco desea recibir la propuesta de costos más competitiva para los servicios descritos en el presente documento.
- 11.2. La Tasa de Cambios Oficial del BID indicada en el SDP se aplicará para las conversiones necesarias de los pagos en moneda local.

Plan de Pagos	
Entregables	%
1. Informe de la actividad 3.1	25%
2. Informe de la actividad 3.2	25%
3. Informe que recoja las actividades 3.3, 3.4 y 3.5	50%
TOTAL	100%

TÉRMINOS DE REFERENCIA

Desarrollo de una metodología que calcule la capacidad de atención (hosting capacity) de la generación distribuida

País: Colombia

Número de proyecto: CO-T1663-P00X

Número de Cooperación Técnica ATNXXXXX

[\[Enlace web con el documento aprobado\]](#)

NOMBRE DE LA COOPERACIÓN TÉCNICA: *Apoyo a la transición energética en Colombia*

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- 1.2.** El GdC se ha fijado el ambicioso objetivo de aumentar su capacidad instalada de FNCR, pasando de menos del 1% en 2018 a más del 16% en 2025, alcanzando así los 2.400 MW. Para lograrlo, se han realizado dos subastas para promover las FNCR, una en 2019 y una segunda en 2021, que adjudicaron 2.084MW.
- 1.3.** Por otro lado, la brecha de infraestructura energética en Colombia tiene el potencial de dar un giro como una oportunidad para apalancar la inversión del sector privado si se entregan proyectos sostenibles financiables a escala. En este contexto, el Banco Interamericano de Desarrollo (BID), a través de la División de Energía, en conjunto con el Programa de Infraestructura Sostenible del Reino Unido (UKSIP), han apoyado al Gobierno de Colombia para promover la infraestructura sostenible de bajo carbono, a través de la ejecución de la CT ATN/PI-17372-CO.
- 1.4.** Un Diálogo de Alto Nivel que tuvo lugar el 9 de junio de 2021, fue un hito importante en la programación de una nueva asistencia técnica del UKSIP para Colombia. Se presentaron y discutieron las áreas estratégicas entre el Gobierno de Colombia, representado por el Departamento Nacional de Planeación (DNP); la Agencia de Cooperación Internacional (APC); el Ministerio de Minas y Energía (MME); el Ministerio de Transporte (MT); la Superintendencia Financiera (SFC); y el Ministerio de Ambiente y Desarrollo sostenible (MADS), además de representantes del grupo BID, y del Gobierno del Reino Unido (Department for Business, Energy and Industrial Strategy – BEIS) y la Embajada del Reino Unido en Colombia. Se acordó que las Energías Limpias serán un pilar fundamental para continuar con el desarrollo de la estrategia de

transición energética y promover la recuperación económica después de la COVID19.

- 1.5. Dada la necesidad que tiene el país en impulsar el desarrollo de la de autogeneración a pequeña escala basada, se requiere el apoyo de una firma consultora con experiencia en el desarrollo de una metodología que calcule la capacidad de atención de la generación distribuida.

2. Objetivos

- 2.1. Desarrollar una metodología que calcule la capacidad de atención (hosting capacity) de la generación distribuida

3. Alcance de los Servicios

- 3.1. Estudiar la topología del sistema de generación distribuida (longitud total, ramificaciones, diseño radial o enmallado)
- 3.2. Revisar el Comportamiento de la demanda del sistema
- 3.3. Evaluar las características y comportamiento de la fuente de generación
- 3.4. Elegir un parámetro a evaluar (e.g. regulación de tensión) y uno o más índices de desempeño
- 3.5. Determinar, seleccionar o definir un límite o límites adecuados
- 3.6. Calcular el índice o índices de desempeño en función de la cantidad de GD
- 3.7. Obtener la capacidad de atención.

4. Actividades Clave

- 4.1. *(Incluya una descripción de todas las tareas que deben completarse para la realización exitosa de este proyecto / contrato).*

5. Resultados y Productos Esperados

- 5.1. Informe de las actividades 3.1, 3.2 y 3.3
- 5.2. Informe de las actividades 3.4 y 3.5
- 5.3. Informe que recoja las actividades 3.6 y 3.7

6. Calendario del Proyecto e Hitos

- 6.1. *(Defina el calendario de entregables e hitos para este proyecto / contrato. Es imperativo que todos los hitos, tareas, y el calendario de entregables sean lo más precisos posible, ya que las firmas consultoras deberán tener en cuenta estos elementos en sus propuestas.)*

7. Requisitos de los Informes

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8. Criterios de aceptación

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- 8.2. No se pagarán productos parciales, o productos que no sean aceptados por ambas partes.

9. Otros Requisitos

- 9.1. *(Describa los requisitos especiales, como los requisitos de seguridad, cualquier restricción de acceso /requisitos de TI o el tiempo de inactividad del sistema/de mantenimiento si es necesario.)*

10. Supervisión e Informes

- 10.1. *La supervisión de informes y productos se hará por parte del Banco.*

11. Calendario de Pagos

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Plan de Pagos	
<i>Entregables</i>	%
4. Informe de las actividades 3.1, 3.2 y 3.3	25%
5. Informe de las actividades 3.4 y 3.5	25%
6. Informe que recoja las actividades 3.6 y 3.7	50%
TOTAL	100%

Selection process CO-T1663-PXXX

TERMS OF REFERENCE

Design of Short-Term Markets

Colombia

[[Project Number]

CO-T1663

[Web link to approved document]

Support Colombia's energy transition

1. Background and Justification

- 1.1.** The Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, provided specific recommendations for the modernization of the energy sector in Colombia. Although the current system has operated successfully for over 25 years, technological changes, the need to incorporate Non-Conventional Renewable Energy Sources (NCRES), the emergence of new business opportunities and new users' needs required a comprehensive review. Part of these recommendations are being implemented in various areas, including a review of the structure and the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and a review of the institutional framework.
- 1.2.** However, several components of the regulation still require more in-depth studies to define the most appropriate changes that achieve the change in the energy matrix and the sector's decarbonization. Therefore, it is necessary to advance in the study of the following critical elements of regulation and planning: (i) design of short-term energy markets, (ii) improvements to design of contracts and bilateral markets, (iii) long-term resource adequacy mechanism, and (iv) improvements to transmission planning and expansion.
- 1.3.** Given the complexity of the requested studies and evaluations, the support of an international consulting firm is required, with experience in the power sector regulation and planning, especially in the design of short-term energy markets.
- 1.4.** The short-term markets for energy and ancillary services in Colombia require substantial modification to improve economic efficiency, reduce the impact of market power, improve price formation, improve planning and valuation of new generation and transmission projects, and support the integration of new resource types, such as Non-Conventional Renewable Energy Sources (NCRES), demand response, energy storage, and distributed energy resources.
- 1.5.** Since CREG has an advanced design for short-term market modernization, which is expected to improve efficiency and price formation, a reasonable approach to short-term market improvement is to continue these reforms while introducing some new elements, notably nodal pricing, in a parallel process. These planned reforms consist of implementation of the binding firm dispatch in each market interval, intraday markets, and a balancing market, co-optimizing energy with ancillary services. These improvements will allow renewable generation to manage

production variability more efficiently by correcting forecasts and commercial positions during the day of operation. Considering that the binding firm dispatch is based on modelling the network in detail, these reforms should also be accompanied by calculation of nodal prices indicatively so that the participants become familiar with this pricing model and the benefits clarified. This will also allow the regulator to formulate alternatives to calculate appropriate prices for the demand that is not active, to design a reference market for contract prices, the mechanism for the transition from current uninodal prices to a fully nodal model, the identification and remuneration of congestion and how the scarcity price would be calculated to activate Firm Energy Obligations.

2. Objectives

- 2.1.** Support the Energy and Gas Regulatory Commission (CREG) to design short-term markets to allow NCRES manage intermittent energy more efficiently.

3. Scope of Services

- 3.1.** The Consultant will carry out the following specific activities:

- 3.1.1. Review existent and planned regulation regarding short-term energy markets.
- 3.1.2. Design a nodal pricing model (LMP) with prices for marginal energy, marginal congestion, energy arbitrage, primary frequency response, and marginal losses.
- 3.1.3. Propose market participation models for new types of resources, considering minimum resources sizes, minimum bid increments, energy storage, and other relevant operational requirements.
- 3.1.4. Analyze the benefits and disadvantages of the two implementation processes proposed by the Energy Transformation Mission: Phased reforms vs Accelerated reforms.
- 3.1.5. Prepare a preliminary report with the findings and recommendations to establish a short-term market that allow NCRES manage intermittent energy more efficiently. This report should be discussed with CREG.
- 3.1.6. Based on the feedback received from CREG, prepare a final report with recommended regulations and a schedule for its implementation.

4. Expected Outcome and Deliverables

- 4.1. Work plan:** Three weeks after signing the contract, the consulting firm will submit a proposal to carry out each of the activities described in these terms of reference, including the work schedule and the proposed dates for (i) visits to CREG and other stakeholders, (ii) delivery of reports, and (iii) final meeting to present the full results of the consultancy, and discuss recommendations.
- 4.2. Initial Report:** Within one hundred twenty (120) calendar days after the signing of the Contract,

based on the documentation that has been made available by CREG the consulting firm must submit an Initial Report responding to the activities requested.

4.3. Final Report: Within one hundred and eighty (180) calendar days after the signing of the contract, and based on the agreements reached with CREG, the consulting firm must submit the Final Report.

4.4. All documents and reports will be delivered in the Spanish language.

5. Supervision and Reporting

5.1. The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

6.1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.

6.2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
7. Work Plan	20%
8. Initial report	40%
9. Final Report	40%
TOTAL	100%

Selection process CO-T1663-PXXX

TERMS OF REFERENCE

Improvements to the Design of Contracts and Bilateral Markets

Colombia

[[Project Number]

CO-T1663

[Web link to approved document]

Support Colombia's energy transition

1. Background and Justification

- 1.1. The Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, provided specific recommendations for the modernization of the energy sector in Colombia. Although the current system has operated successfully for over 25 years, technological changes, the need to incorporate Non-Conventional Renewable Energy Sources (NCRES), the emergence of new business opportunities and new users' needs required a comprehensive review. Part of these recommendations are being implemented in various areas, including a review of the structure and the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and a review of the institutional framework.
- 1.2.
- 1.3. However, several components of the regulation still require more in-depth studies to define the most appropriate changes that achieve the change in the energy matrix and the sector's decarbonization. Therefore, it is necessary to advance in the study of the following critical elements of regulation and planning: (i) design of short-term energy markets, (ii) improvements to design of contracts and bilateral markets, (iii) long-term resource adequacy mechanism, and (iv) improvements to transmission planning and expansion.
- 1.4.
- 1.5. Given the complexity of the requested studies and evaluations, the support of an international consulting firm is required, with experience in the power sector regulation and planning, especially in the design of contracts and bilateral markets to promote access to NCRES.
- 1.6.
- 1.7. A liquid, transparent and standardized market for hedging at time horizons necessary for the new entry to compete for energy supply is essential to promote competition in the short-term market and facilitate the access of new generation capacity, particularly NCRS.
- 1.8.
- 1.9. New plants typically require fixed-price or indexed long term forward contracts for a significant share of the expected output of the plant in order obtain the necessary up-front financing to

construct the plant. Existing plants sign fixed-price or indexed forward contracts to reduce their exposure to short-term prices and reduce the volatility of their financial results. These contracts supplement the revenues earned from the existing reliability charge mechanism. Generation unit owners and retailers also participate in the bilateral over-the-counter (OTC) market to hedge their medium-term price risk, typically 2 to 3 years into the future. The OTC market in Colombia, which represents the only viable alternative to government sponsored auctions, presents the following weaknesses: (i) negotiated prices are not available to the public; this creates a barrier entry of capacity from new market participants that do not have access to this information; (ii) prices for the unregulated demand in Colombia are typically well below prices for the regulated demand; (iii) there is a lack of anonymity, because bilateral contract price depends on the counterparty, (iv) there are an extreme diversity of types of contracts traded; this lack of standardization can create an obstacle for the eventual use of this data to construct a credible forward curve for energy; (v) non-vertically integrated retailers and generation unit owners and small participants have limited access to bilateral contracts.

2. Objectives

- 2.1.** Support the Energy and Gas Regulatory Commission (CREG) to improve the design of contracts and bilateral markets to promote access to new generation capacity.

3. Scope of Services

- 3.1.** The Consultant will carry out the following specific activities:

- 3.1.1. Review current regulation regarding contracts and bilateral markets.
- 3.1.2. Propose parametrization of incentives for agents to participate in the Anonymized and Standardized Markets (MAEs, for their Spanish initials), including a review of pass-through mechanisms (prices and costs) to regulated demand, and MAE's credit requirements.
- 3.1.3. Recommend actions to ensure alignment between MAEs and other markets.
- 3.1.4. Propose mechanisms to promote competition from retailers and allow users to know prices of basic services from different retailers.
- 3.1.5. Determine regulation to guarantee ample transparency and facilitate switching providers for final users.
- 3.1.6. Prepare an initial report with the findings and recommendations. This report should be discussed with CREG.
- 3.1.7. Based on the feedback received from CREG, prepare a final report with recommended regulations and a schedule for its implementation.

4. Expected Outcome and Deliverables

- 4.1. Work plan:** Three weeks after signing the contract, the consulting firm will submit a proposal to

carry out each of the activities described in these terms of reference, including the work schedule and the proposed dates for (i) visits to CREG and other stakeholders, (ii) delivery of reports, and (iii) final meeting to present the full results of the consultancy, and discuss recommendations.

4.2. Initial Report: Within one hundred twenty (120) calendar days after the signing of the Contract, based on the documentation that has been made available by CREG the consulting firm must submit an Initial Report responding to the activities requested.

4.3. Final Report: Within one hundred and eighty (180) calendar days after the signing of the contract, and based on the agreements reached with CREG, the consulting firm must submit the Final Report.

4.4. All documents and reports will be delivered in the Spanish language.

5. Supervision and Reporting

5.1. The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

6.1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.

6.2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
1. Work Plan	20%
2. Initial report	40%
3. Final Report	40%
TOTAL	100%

TERMS OF REFERENCE*Improvements to the Transmission Planning and Expansion Mechanisms**Colombia**[[Project Number]**CO-T1663**[Web link to approved document]**Support Colombia's energy transition***1. Background and Justification**

- 1.1.** The Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, provided specific recommendations for the modernization of the energy sector in Colombia. Although the current system has operated successfully for over 25 years, technological changes, the need to incorporate Non-Conventional Renewable Energy Sources (NCRES), the emergence of new business opportunities and new users' needs required a comprehensive review. Part of these recommendations are being implemented in various areas, including a review of the structure and the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and a review of the institutional framework.
- 1.2.** However, several components of the regulation still require more in-depth studies to define the most appropriate changes that achieve the change in the energy matrix and the sector's decarbonization. Therefore, it is necessary to advance in the study of the following critical elements of regulation and planning: (i) design of short-term energy markets, (ii) improvements to design of contracts and bilateral markets, (iii) long-term resource adequacy mechanism, and (iv) improvements to transmission planning and expansion.
- 1.3.** Given the complexity of the requested studies and evaluations, the support of an international consulting firm is required, with experience in the power sector regulation and planning, especially in transmission planning and expansion mechanisms.
- 1.4.** The Energy Transformation Mission indicated that the lack of rules for regional transmission expansion is affecting the penetration of NCRES and storage. The integration of options such as photovoltaic solar generation, small and medium hydroelectric power plants, energy storage, and bidirectionality of the network due to the "prosumers" makes the Regional Transmission System (STR) expansion a critical factor. STR expansion is necessary to guarantee competition, the participation of new entrants, and the intelligence of networks, thus changing its function because it will no longer be for a few users but the entire market. Therefore, it is of great

importance to introduce competition in its expansion.

2. Objectives

- 2.1.** Support the Energy and Gas Regulatory Commission (CREG) and the Energy Planning Unit (UPME) to establish regulations that promote competition in the Regional Transmission System expansion.

3. Scope of Services

- 3.1.** The Consultant will carry out the following specific activities:

- 3.1.1. Review the current process to expand the regional transmission system, including i) speculative positions in the queue of connection requests, ii) requested guarantees that project promoters must present for the approval of the connection of projects, iii) delays in the approval of technical viability, iv) difficulties or delays that network operators impose to projects that require expansion of their networks.
- 3.1.2. Analyze the benefits of allowing generation projects with a capacity lower than 20 MW to share the same connection without having an obligation to be dispatched centrally, achieving greater economic efficiency and less social and environmental impact.
- 3.1.3. Evaluate the advantages of creating a single window managed by UPME to grant free access to the network to generation projects greater than 5 MW for interested parties to submit their connection requests.
- 3.1.4. Review the deadlines that the UPME has in place to study and approve a regional connection and propose options to reduce said deadlines.
- 3.1.5. Prepare an initial report with the findings and agree with CREG and UPME the main constraints to expand the STR, which need to be modified.
- 3.1.6. Based on the feedback received from CREG and UPME, prepare a final report with recommended specific actions and regulations to promote competition in the Regional Transmission System expansion.

4. Expected Outcome and Deliverables

- 4.1. Work plan:** Three weeks after signing the contract, the consulting firm will submit a proposal to carry out each of the activities described in these terms of reference, including the work schedule and the proposed dates for (i) visits to CREG, UPME and other stakeholders, (ii) delivery of reports, and (iii) final meeting to present the full results of the consultancy, and discuss recommendations.
- 4.2. Initial Report:** Within one hundred twenty (120) calendar days after the signing of the Contract, based on the documentation that has been made available by CREG the consulting firm must

submit an Initial Report responding to the activities requested.

4.3. Final Report: Within one hundred and eighty (180) calendar days after the signing of the contract, and based on the agreements reached with CREG, the consulting firm must submit the Final Report.

4.4. All documents and reports will be delivered in the Spanish language.

5. Supervision and Reporting

5.1. The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

6.1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.

6.2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
1. Work Plan	20%
2. Initial report	40%
3. Final Report	40%
TOTAL	100%

TERMS OF REFERENCE*pre/feasibility study for a green hydrogen project**Colombia**[[Project Number]**CO-T1663**[Web link to approved document]**Support Colombia's energy transition***1. Background and Justification**

- 1.1.** Colombia's commitment to the Paris Agreement under the revised National Determined Contributions (NDC) aims to reduce GHG by 51% with respect to the business-as-usual scenario in 2030. Colombia's NDC is considered one of the most ambitious in Latin America and the Caribbean (LAC) and is closely aligned with the country's objective of achieving carbon neutrality by 2050. In this regard, the energy sector is at the forefront of implementing a comprehensive climate change management plan, by reducing an equivalent of 11.2 million tons of carbon dioxide (CO₂) by 2030.
- 1.2.** Colombia has made a significant effort to decarbonize its energy sector by introducing some critical legislation and regulation to promote the introduction of Non-Conventional Renewable Energy (NCRE) in the National Interconnected System and the Non-interconnected areas. These include the Renewable Energy Law (Law 1715 of 2014) that promotes the development of NCRE and energy efficiency, Decree 0570 of March 2018 (providing policy guidelines for the long-term contracting of NCRE), Law 2099 of 2021 that promotes the Energy transition, CONPES 4075 of 2022, which is the energy transition policy, and associated resolutions that establish the framework for the introduction of large-scale NCRE.
- 1.3.** The GoC has set an ambitious goal to increase NCRE installed capacity from less than 1% in 2018 to more than 16% by 2025 (equivalent to 2,400 MW). In 2019 and 2021, 2,084 MW of NCRE were awarded through auctions.
- 1.4.** The Inter-American Development Bank (IDB), through the Energy Division, in conjunction with the United Kingdom Sustainable Infrastructure Program (UKSIP), has supported the GoC to promote sustainable low-carbon infrastructure through the execution of the TC ATN/PI-17372-CO. That TC aimed to strengthen the GoC institutional, technical, and regulatory capabilities to ensure smooth adoption of large-scale Non-Conventional Renewable Energy in their electricity generation matrix.

- 1.5. As a result, this UKSIP support was critical to strengthening Colombia's institutional, technical, and regulatory framework to ensure smooth adoption of large-scale NCRE in their electricity generation matrix. In 2019 and 2020, this TC financed technical support to design Renewable Energy Auctions focused on two key elements: (i) Risk allocation and (ii) Project finance. The IDB also financed the Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, which provided specific recommendations for the modernization of the energy sector. Although the current system has operated successfully for over 25 years, technological changes, the emergence of new business opportunities, and new users' needs required a comprehensive review. Mission's recommendations are being implemented, including a review of the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and the institutional framework.
- 1.6. To continue with this support, a High-Level Dialogue on June 9th, 2021, was an important milestone in developing a new UKSIP technical assistance for Colombia. The GoC, represented by the National Planning Department (DNP); the International Cooperation Agency (APC); Ministry of Energy (ME); Ministry of Transport (MT); Financial Superintendence (SFC); and the Ministry of Environment (MADS), discussed with representatives from the IDB group, and UK Government (Department for Business, Energy and Industrial Strategy – BEIS and the UK Embassy in Colombia) the strategic areas of intervention. The participants agreed that Clean Energy will be a key pillar to continue the development of the energy transition strategy and to promote the economic recovery after the COVID19.
- 1.7. The energy transition includes the expansion of NCRE and new energy efficiency technologies. However, it is important to develop the regulatory framework to scale up these new technologies, such as Peer to peer (P2P), smart metering, low-carbon distributed systems, decentralization, digitalization, and electricity management demand.
- 1.8. To continue contributing to the implementation of the energy transition, this TC will support four components: (i) the implementation of key activities prioritized in the Roadmap for the implementation of the Energy Transformation Mission; (ii) developing the regulatory structure for distributed electricity generation; (iii) supporting the design of low-carbon energy generation and GHG reduction strategies; and (iv) promotion of Energy Efficiency.

2. **Objectives**

- 2.1. Conduct at least one pre/feasibility study for a green hydrogen project to be chosen from a group of prioritized projects, resulting from a call for projects led by the Colombian Fund for Non-Conventional Energy and Energy Management (FENOGE). The purpose behind such studies is to help identify mature viable projects which may then turn eligible for using possible blended finance resources including CIF-REI concessional resources.

3. Scope of Services

3.1. The Consultant will carry out the following specific activities:

- 3.1.1. Legal, regulatory and permitting analysis
- 3.1.2. Resources and technology assessment
- 3.1.3. Evaluation of environmental and social aspects
- 3.1.4. Basic engineering
- 3.1.5. Costs, revenue streams and financial assessment
- 3.1.6. Risk assessment
- 3.1.7. Final business case.

4. Expected Outcome and Deliverables

- 4.1. Work plan:** Three weeks after signing the contract, the consulting firm will submit a proposal to carry out each of the activities described in these terms of reference, including the work schedule and the proposed dates for (i) visits to CREG, UPME and other stakeholders, (ii) delivery of reports, and (iii) final meeting to present the full results of the consultancy, and discuss recommendations.
- 4.2. Initial Report:** Within one hundred twenty (120) calendar days after the signing of the Contract, with the scope services 3.1.1., 3.1.2. and 3.1.3.
- 4.3. Final Report:** Within one hundred and eighty (180) calendar days after the signing of the contract, with the scope services 3.1.4 -3.1.7.
- 4.4.** All documents and reports will be delivered in the Spanish language.

5. Supervision and Reporting

- 5.1.** The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

- 6.1.** Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.

- 6.2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
1. Work Plan	20%
2. Initial report	40%
3. Final Report	40%
TOTAL	100%

TERMS OF REFERENCE

Identification of options to achieve the financial closure of offshore wind energy projects

Colombia

[[Project Number]

CO-T1663

[Web link to approved document]

Support Colombia's energy transition

1. Background and Justification

- 1.1.** Colombia's commitment to the Paris Agreement under the revised National Determined Contributions (NDC) aims to reduce GHG by 51% with respect to the business-as-usual scenario in 2030. Colombia's NDC is considered one of the most ambitious in Latin America and the Caribbean (LAC) and is closely aligned with the country's objective of achieving carbon neutrality by 2050. In this regard, the energy sector is at the forefront of implementing a comprehensive climate change management plan, by reducing an equivalent of 11.2 million tons of carbon dioxide (CO₂) by 2030.
- 1.2.** Colombia has made a significant effort to decarbonize its energy sector by introducing some critical legislation and regulation to promote the introduction of Non-Conventional Renewable Energy (NCRE) in the National Interconnected System and the Non-interconnected areas. These include the Renewable Energy Law (Law 1715 of 2014) that promotes the development of NCRE and energy efficiency, Decree 0570 of March 2018 (providing policy guidelines for the long-term contracting of NCRE), Law 2099 of 2021 that promotes the Energy transition, CONPES 4075 of 2022, which is the energy transition policy, and associated resolutions that establish the framework for the introduction of large-scale NCRE.
- 1.3.** The GoC has set an ambitious goal to increase NCRE installed capacity from less than 1% in 2018 to more than 16% by 2025 (equivalent to 2,400 MW). In 2019 and 2021, 2,084 MW of NCRE were awarded through auctions.
- 1.4.** The Inter-American Development Bank (IDB), through the Energy Division, in conjunction with the United Kingdom Sustainable Infrastructure Program (UKSIP), has supported the GoC to promote sustainable low-carbon infrastructure through the execution of the TC ATN/PI-17372-CO. That TC aimed to strengthen the GoC institutional, technical, and regulatory capabilities to ensure smooth adoption of large-scale Non-Conventional Renewable Energy in their electricity generation matrix.
- 1.5.** As a result, this UKSIP support was critical to strengthening Colombia's institutional, technical,

and regulatory framework to ensure smooth adoption of large-scale NCRE in their electricity generation matrix. In 2019 and 2020, this TC financed technical support to design Renewable Energy Auctions focused on two key elements: (i) Risk allocation and (ii) Project finance. The IDB also financed the Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, which provided specific recommendations for the modernization of the energy sector. Although the current system has operated successfully for over 25 years, technological changes, the emergence of new business opportunities, and new users' needs required a comprehensive review. Mission's recommendations are being implemented, including a review of the competition rules of the electricity market, the introduction of new technologies such as hydrogen and geothermal, decentralization and digitalization incentives, and the institutional framework.

- 1.6. To continue with this support, a High-Level Dialogue on June 9th, 2021, was an important milestone in developing a new UKSIP technical assistance for Colombia. The GoC, represented by the National Planning Department (DNP); the International Cooperation Agency (APC); Ministry of Energy (ME); Ministry of Transport (MT); Financial Superintendence (SFC); and the Ministry of Environment (MADS), discussed with representatives from the IDB group, and UK Government (Department for Business, Energy and Industrial Strategy – BEIS and the UK Embassy in Colombia) the strategic areas of intervention. The participants agreed that Clean Energy will be a key pillar to continue the development of the energy transition strategy and to promote the economic recovery after the COVID19.
- 1.7. The energy transition includes the expansion of NCRE and new energy efficiency technologies. However, it is important to develop the regulatory framework to scale up these new technologies, such as Peer to peer (P2P), smart metering, low-carbon distributed systems, decentralization, digitalization, and electricity management demand.
- 1.8. To continue contributing to the implementation of the energy transition, this TC will support four components: (i) the implementation of key activities prioritized in the Roadmap for the implementation of the Energy Transformation Mission; (ii) developing the regulatory structure for distributed electricity generation; (iii) supporting the design of low-carbon energy generation and GHG reduction strategies; and (iv) promotion of Energy Efficiency.

2. Objectives

- 2.1. Develop a proposal that identifies options to achieve the financial closure of offshore wind energy projects, taking into account the particularities of the Colombian case, which does not have subsidies and develops other renewable sources at lower prices.

3. Scope of Services

3.1. The Consultant will carry out the following specific activities:

- 3.1.1. Analysis of energy policy and market mechanisms for the participation of offshore wind energy in the Colombian energy matrix in the 2030, 2040 and 2050 scenarios.
- 3.1.2. Study on the potential of linking offshore wind energy in production and sustainability processes for Colombia, as well as analysis of possible synergies between offshore wind energy and other offshore activities.
- 3.1.3. Identification of alternatives to encourage the development of the wind turbine production chain in Colombia. To this end, take into account international experiences and interviews with world leading companies in this equipment.

4. Expected Outcome and Deliverables

- 4.1. Work plan:** Three weeks after signing the contract, the consulting firm will submit a proposal to carry out each of the activities described in these terms of reference, including the work schedule and the proposed dates for (i) visits to CREG, UPME and other stakeholders, (ii) delivery of reports, and (iii) final meeting to present the full results of the consultancy, and discuss recommendations.
- 4.2. Initial Report:** Within one hundred twenty (120) calendar days after the signing of the Contract, with the scope services 3.1.1. and 3.1.2.
- 4.3. Final Report:** Within one hundred and eighty (180) calendar days after the signing of the contract, with the scope services 3.1.3.
- 4.4.** All documents and reports will be delivered in the Spanish language.

5. Supervision and Reporting

- 5.1.** The IDB's Energy Division (INE/ENE) will be the technical unit coordinating and executing this consultancy. The responsible specialist will be Alexandra Planas (ALEXAPLA@IADB.ORG), Lead Energy Specialist, based in Washington D.C.

6. Schedule of Payments

- 6.1.** Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.
- 6.2.** The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
4. Work Plan	20%
5. Initial report	40%
6. Final Report	40%
TOTAL	100%

Proceso de selección #CO-T1663-P00X

TÉRMINOS DE REFERENCIA

Desarrollar un análisis de los programas de respuesta a la demanda utilizando datos de los sectores residencial, comercial e industrial mediante el uso de inteligencia artificial

País: Colombia

Número de proyecto: CO-T1663-P00X

Número de Cooperación Técnica ATNXXXXX

[\[Enlace web con el documento aprobado\]](#)

NOMBRE DE LA COOPERACIÓN TÉCNICA: Apoyo a la transición energética en Colombia

1. Antecedentes y Justificación

- 1.1. Misión de Transformación Energética realizada en 2019-2020, con la participación de más de 30 expertos nacionales e internacionales, aportó recomendaciones específicas para la modernización del sector energético en Colombia. Aunque el sistema actual ha funcionado con éxito durante más de 25 años, los cambios tecnológicos, la necesidad de incorporar las Fuentes de Energía Renovables No Convencionales (FNCR), el surgimiento de nuevas oportunidades de negocio y las nuevas necesidades de los usuarios exigen una revisión integral. Parte de estas recomendaciones se están aplicando en varios ámbitos, como la revisión de la estructura y las normas de competencia del mercado eléctrico, la introducción de nuevas tecnologías como el hidrógeno y la geotermia, los incentivos a la descentralización y la digitalización, y la revisión del marco institucional.
- 1.2. El GdC se ha fijado el ambicioso objetivo de aumentar su capacidad instalada de FNCR, pasando de menos del 1% en 2018 a más del 16% en 2025, alcanzando así los 2.400 MW. Para lograrlo, se han realizado dos subastas para promover las FNCR, una en 2019 y una segunda en 2021, que adjudicaron 2.084MW.
- 1.3. Por otro lado, la brecha de infraestructura energética en Colombia tiene el potencial de dar un giro como una oportunidad para apalancar la inversión del sector privado si se entregan proyectos sostenibles financiados a escala. En este contexto, el Banco Interamericano de Desarrollo (BID), a través de la División de Energía, en conjunto con el Programa de Infraestructura Sostenible del Reino Unido (UKSIP), han apoyado al Gobierno de Colombia para promover la infraestructura sostenible de bajo carbono, a través de la ejecución de la CT ATN/PI-17372-CO.
- 1.4. Un Diálogo de Alto Nivel que tuvo lugar el 9 de junio de 2021, fue un hito importante en la programación de una nueva asistencia técnica del UKSIP para Colombia. Se presentaron y discutieron las áreas estratégicas entre el Gobierno de Colombia, representado por el Departamento Nacional de Planeación (DNP); la Agencia de Cooperación Internacional (APC); el Ministerio de Minas y Energía (MME); el Ministerio de Transporte (MT); la Superintendencia Financiera (SFC); y el Ministerio de Ambiente y Desarrollo sostenible (MADS), además de representantes del grupo BID, y del Gobierno del Reino Unido (Department for Business, Energy

and Industrial Strategy – BEIS) y la Embajada del Reino Unido en Colombia. Se acordó que las Energías Limpias serán un pilar fundamental para continuar con el desarrollo de la estrategia de transición energética y promover la recuperación económica después de la COVID19.

- 1.5. Dada la necesidad que tiene el país en disminuir su emisión de gases efecto invernadero, se requiere el apoyo de una firma consultora con experiencia en el uso de inteligencia artificial aplicada al comportamiento de la demanda de energía.

2. Objetivos

- 2.1. Desarrollar un análisis de los programas de respuesta a la demanda utilizando datos de los sectores residencial, comercial e industrial mediante el uso de inteligencia artificial

3. Alcance de los Servicios

- 3.1. Estudiar el comportamiento de la demanda de los sectores residencial, comercial e industrial en Colombia.
- 3.2. Analizar los datos del punto anterior y presentar las acciones que se deben adelantar con el objetivo de ajustar la oferta y definir medidas para la gestión de la demanda.
- 3.3. Socializar los resultados a las entidades del gobierno definidas

4. Resultados y Productos Esperados

- 4.1. Informe de la actividad 3.1
- 4.2. Informe de la actividad 3.2
- 4.3. Informe de la actividad 3.3

5. Requisitos de los Informes

- 7.1. Los productos serán entregados al Banco en el idioma español y en un archivo electrónico en formatos compatibles con MS Office y Adobe Reader. Las memorias de cálculo, gráficas, tablas y o cualquier otro documento producido con motivo de esta Consultoría formaran parte de los productos al que correspondan.

6. Criterios de aceptación

- 6.1. Los productos serán aceptados por parte del Banco Interamericano de Desarrollo, con el apoyo del comité técnico conformado por entidades del Gobierno de Colombia y el Banco.
- 6.2. No se pagarán productos parciales, o productos que no sean aceptados por ambas partes.

7. Supervisión e Informes

- 7.1. *La supervisión de informes y productos se hará por parte del Banco.*

8. Calendario de Pagos

- 8.1.** Las condiciones de pago se basarán en los hitos o entregables del proyecto. El Banco no espera hacer pagos por adelantado en virtud de contratos de consultoría a menos que se requiera una cantidad significativa de viajes. El Banco desea recibir la propuesta de costos más competitiva para los servicios descritos en el presente documento.
- 8.2.** La Tasa de Cambios Oficial del BID indicada en el SDP se aplicará para las conversiones necesarias de los pagos en moneda local.

Plan de Pagos	
<i>Entregables</i>	%
10. Informe de la actividad 3.1	25%
11. Informe de la actividad 3.2	50%
12. Informe de la actividad 3.3	25%
TOTAL	100%

TERMS OF REFERENCE

Hydrogen production pilots for industry and transport applications

Colombia

CO-T1663-PXXX

Technical Cooperation Number]

[Web link to approved document]

Support Colombia's energy transition

1. Background and Justification

1. Colombia's commitment to the Paris Agreement under the revised National Determined Contributions (NDC) aims to reduce GHG by 51% with respect to the business-as-usual scenario in 2030. Colombia's NDC is considered one of the most ambitious in Latin America and the Caribbean (LAC) and is closely aligned with the country's objective of achieving carbon neutrality by 2050. In this regard, the energy sector is at the forefront of implementing a comprehensive climate change management plan, by reducing an equivalent of 11.2 million tons of carbon dioxide (CO₂) by 2030.
2. Colombia has made a significant effort to decarbonize its energy sector by introducing some critical legislation and regulation to promote the introduction of Non-Conventional Renewable Energy (NCRE) in the National Interconnected System and the Non-interconnected areas. These include the Renewable Energy Law (Law 1715 of 2014) that promotes the development of NCRE and energy efficiency, Decree 0570 of March 2018 (providing policy guidelines for the long-term contracting of NCRE), Law 2099 of 2021 that promotes the Energy transition, CONPES 4075 of 2022, which is the energy transition policy, and associated resolutions that establish the framework for the introduction of large-scale NCRE.
3. The GoC has set an ambitious goal to increase NCRE installed capacity from less than 1% in 2018 to more than 16% by 2025 (equivalent to 2,400 MW). In 2019 and 2021, 2,084 MW of NCRE were awarded through auctions.
4. The Inter-American Development Bank (IDB), through the Energy Division, in conjunction with the United Kingdom Sustainable Infrastructure Program (UKSIP), has supported the GoC to promote sustainable low-carbon infrastructure through the execution of the TC ATN/PI-17372-CO. That TC aimed to strengthen the GoC institutional, technical, and regulatory capabilities to ensure smooth adoption of large-scale Non-Conventional Renewable Energy in their electricity generation matrix.
5. As a result, this UKSIP support was critical to strengthening Colombia's institutional, technical, and regulatory framework to ensure smooth adoption of large-scale NCRE in their electricity generation matrix. In 2019 and 2020, this TC financed technical support to design Renewable Energy Auctions focused on two key elements: (i) Risk allocation and (ii) Project finance. The IDB also financed the Energy Transformation Mission conducted in 2019-2020, with the participation of more than 30 national and international experts, which provided specific recommendations for the modernization of the energy sector. Although the current system has operated successfully for over 25 years, technological changes, the emergence of new business opportunities, and new users' needs required a comprehensive review.

6. Mission's recommendations are being implemented. In this regard, in 2021 the Ministry of Mines and Energy and the Interamerican Development Bank published the Hydrogen Road Map where the following goals are established for 2030: (i) to deploy 1-3 GW of electrolysis capacity, accompanied by 1.5 to 4 GW in NCRE generating capacity (ii) to achieve competitive green hydrogen (GH2) production costs of 1.7 USD/kg, (iii) to produce at least 70 kt / year of GH2 and 50 kt / year of blue hydrogen by capturing CO2 in existing plants or new plants for storage or use, (iv) to deploy a fleet of at least 1,000 - 1,500 heavy-duty fuel cell vehicles for both passenger and cargo transport, and (v) a network of at least 100-150 public access hydrogen fueling stations.
7. Considering Colombia's large NCRE potential (e.g. 50 GW in offshore wind alone Vs. 17.7 GW current overall power installed capacity, and average irradiation levels of 4,5 kWh/m2/day for PV production), GH2 production and derived e-fuels (e.g. ammonia, methanol and similar) may progressively substitute the use of fossil fuels in industry and transport sectors, contributing to the indirect electrification of these hard to decarbonize sectors, while providing future export possibilities to meet sustainable energy requirements of regions and countries such as Asia, Europe and the US.
8. To achieve these goals and ambitions, both pilot and first industry scale projects for the production, transport, handling, storage and use of GH2 need to be supported, so the technology can be locally appropriated while following an accelerated learning curve which allows for successful escalation and replication of these projects to take place. Given current high technology costs, lack of technical experience and track record, same as local commercial representativeness, technical and financial assistance which IDB and international donors provide plays a key role in enabling the development of these projects.

2. Objectives

The objective of the pre-investment studies to be hired based on these ToR will be either of the following, depending on the particular case:

- i. To conduct a pre-feasibility study covering technical, economic, financial, environmental and social dimensions of the proposed project, which shall draw conclusions on the overall preliminary viability of the project, same as provide inputs and recommendations for further project development stages.
- ii. To conduct a feasibility study covering the technical, economic, financial, environmental and social dimensions of the proposed project, including preparation of inputs required for any processing of any necessary permits and licenses, same as a bankable blueprint for its development considering the existing market, applicable governing laws and regulations.

3. Scope of Services

Services to be provided by the consultant will include:

i. For Pre-feasibility study:

The pre-feasibility study to be performed shall investigate the preliminary technical and economic viability of the project, including also all legal, regulatory, environmental and social aspects which shall allow for

decisions to be made regarding the scope and appropriateness of a project development before proceeding with its feasibility and detailed engineering design stages.

The scope of the pre-feasibility study shall include the analysis of possible alternatives taking into account specific technologies, locations where infrastructure is to be deployed, and associated characteristics such as resource availability, environment, topography, geotechnical and socio-economic factors, among other possibly relevant ones.

Alternatives should also be compared for various combinations of e.g. level-of-service standards for electrolysis equipment and / or other parameters identified to have an impact on the project pre-feasibility assessment stage.

Order-of-magnitude estimates ($\pm 25\%$) of direct costs (e.g. land, construction and maintenance) shall be sufficient at this stage, while equipment and infrastructure estimate costs shall be better obtained from potential supplier or subcontractor quotes.

ii. For Feasibility study:

The feasibility study shall thoroughly analyze both the technical, economic, financial, environmental and social viability of the project, including all legal and regulatory associated requirements, and the processing of required permits and/or licenses so the project may proceed to its development stage.

The scope of the feasibility study shall include the in depth assessment of preliminary alternatives and options recommended from the pre-feasibility stage, same as determine a suitable commercial business model and structure which balances the commercial and strategic risk which may be identified.

Factors to be assessed in detail in the feasibility study of GH2 based projects shall include electricity sourcing and generation technology, product handling, storage, transportation and final use technology and infrastructure, equipment operation and maintenance, taxes, times of delivery, and other associated costs, permits and licenses, required training, socialization process, environmental impact, life cycle assessment, climate change resiliency needs, economic evaluation meeting project developer needs, stakeholder involvement, risk identification, assessment and mitigation actions formulation and recommendation, among any other which may be found to be relevant thought the project structuring process.

Detailed lifetime cost estimates ($\pm 15\%$) and detailed engineering may be required as part of the study.

4. Key Activities

The consultant shall develop and complete following activities, hereby classified as follows (based on complete feasibility study):

Technical:

- Conduct research and due diligence on the specific segment in which the proposed project is to be developed (e.g. GH2, ammonia and fertilizer production, or incorporation of hydrogen fuel cell buses for public massive transportation of passengers).
- Analyze the commercially available technologies and equipment, selecting the most appropriate option/s for the proposed project, indicating possible sizes, capacities and main characteristics fitting project requirements.
- Identify or validate most suitable location for project deployment considering appropriate resource availability (e.g. including electrical connection, suitable water source and other necessary resources). If possible, a comparative economical assessment of various sites shall be run with respect, but not limited, to such available resources (e.g. water, electricity, environmental aspects, infrastructure etc.).
- Develop conceptual process and instrumentation design diagrams and recommend infrastructure requirements, balance of plant, and cost estimates.
- Develop a process map indicating materials required for every stage of production (e.g. from GH2 to the fertilizer production).

Economic and financial:

- Develop conceptual investment cost (CAPEX) required and operating expenditures (OPEX).
- Develop a twenty-year financial model and economic analysis for operation of the project and its revenue projections, including at least project cash flows, Net Present Value calculations, Internal Rate of Return for the proposed project, payback period and sensitivity analysis for at least 3 key variables. Any assumptions shall be consulted with the project's developer and clearly stated.
- Define manpower requirements to operate the project and proposed operational and management structure and roles.
- Conduct a Life Cycle Cost Analysis (LCCA) and recommend target costs to be achieved. The LCCA shall assess the total anticipated lifetime capital and operating cost for the project to develop, design, build, operate and maintain all aspects of the project. Such cost shall include, but not be limited to; warranties, depreciation, operation, maintenance, acquisition, installation, refurbishment, and disposal cost that could be encountered throughout the life of the project.
- Identify potential sources/models/approaches for funding and suitable partnerships and ownership (equity).

Legal and environmental:

- Carry a legal and regulatory study, including a thorough review of legal and regulatory requirements relevant to the implementation of the project.
- Carry out preliminary environmental and social impact assessment studies, including identification of environmental aspects such as waste, noise levels, air pollution, vibrations etc. associated with the project.
- Carry out a life cycle analysis (LCA) and identify appropriate mitigation measures to reduce any undesired impact, clearly defining the associated costs. Findings and mitigation measures shall be incorporated in the technical design for implementation.

Risks and other analyses:

- Undertake a Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis, same as the five porter forces and risk analyses for the project, including following categories: technology, location, design, delivery and operations, safety and environmental, commercial risk, resource risk, social risk.
- Identify risks clearly highlighting the transferable risks and possible mitigation strategies.
- Assess and advise on occupational health and safety (OHS) processes in relation to the project development.

5. Expected Outcome and Deliverables

As a result of conducting required technical assessment activities, the consulting firm is expected to present documented analyses concluding on proposed technology and equipment specifications based on previously defined options, location validation or proposal based on the comparison of different alternatives, process design, infrastructure requirements and equipment specifications.

As a result of economic and financial assessment activities to be performed, the consulting firm will provide an economic and financial documented section accompanied by the twenty-year financial model used / developed, including all cost related analyses, inputs and results. All lifecycle costs involved in the development and operation of the project shall be there included, same as funding proposal recommended for final implementation.

As a result of legal and environmental activities, the consulting firm shall report on all environmental related context, findings and carried studies, including corresponding life cycle assessment and formulated mitigation strategies recommended for implementation, indicating its associated costs.

As a result of other activities performed in regard to risk and health and safety analyses, the consulting firm shall present the result of the conducted risk assessment, including proposed mitigation actions and resulting residual risk, same as the SWOT and five porter forces analyses.

6. Project Schedule and Milestones

The following basic schedule and milestones are required to be fulfilled for the successful completion of the required study:

No.	Milestone	Description	Expected time
1	Submission of Inception report	Report describing the plan of action and timeline to be followed throughout the next 8 months of execution of the contract.	1 month after kick-off meeting
2	Submission of 1 st Draft Study Report	1 st Draft version of the Study report, including technical plus economic and financial analyses completed sections.	4 months after kick-off meeting
3	Submission of 2 nd Draft Study Report	2 nd Draft version of the Study report, including Legal and Environmental analyses,	6 months after

		including risk and complementary assessments, in completed versions.	
4	Presentation of Final Study Report	Complete, complemented Final Study Report.	9 months after kick-off meeting

7. Reporting Requirements

1. The Consulting firm will be required to submit its reports in English language, in digital format, in both word and pdf versions. Any annex files shall be enclosed in formats which can be assessed through Microsoft office or open access applications.

8. Acceptance Criteria

1. The acceptance of deliverables will be granted by the Bank, but will be subject to the approval of the proposed project's developer.

9. Other Requirements

1. (Describe any special requirements, such as security requirements, any IT access restrictions/requirements or system downtime/maintenance if required.)

10. Supervision and Reporting

1. Specify to whom the consulting firm will be reporting to, meetings, frequency, who will give comments to any reports, approve reports, documents, work, and give comments or any instructions for changes. It shall be Firm's responsibility for ensuring that such meetings are conducted and such reports are submitted to the Bank.

11. Schedule of Payments

1. Payment terms will be based on project milestones or deliverables. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described herein.
2. The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

Payment Schedule	
<i>Deliverable</i>	%
1. Inception Report	15%
2. 1st Draft Feasibility Study Report	25%
3. 2 nd Draft Feasibility Study Report	30%
4. Final Feasibility Study Report	30%

TOTAL	100%
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