**Guidelines:**

- This Request Form shall be completed by the organisation requesting technical assistance from the Climate Technology Centre & Network (CTCN), in collaboration with the National Designated Entity (NDE) of the country concerned.
- The Form shall be signed by the NDE. The updated list of NDEs is available at: http://unfccc.int/ttclear/support/national-designated-entity.html
- The Form may be submitted as a Word file with a digital signature, or as a signed and scanned PDF accompanied by an unsigned Word version.
- For requests submitted by multiple countries, the NDEs of all countries concerned shall sign identical forms before official submission to the CTCN.
- NDEs may submit requests to the CTCN in collaboration with the Green Climate Fund (GCF) National Designated Authorities (NDAs), where the request is directed to the GCF Readiness Programme.

| | |
|---|---|
| **Requesting country(ies):** | Brazil |
| **Title of the request:** | Collaborative development of low-crossover proton-exchange membranes with magnetically oriented 2D nanosheets for green hydrogen production in Brazil |
| **NDE** | Ministry of Science, Technology and Innovation (MCTI). Responsible: Márcio Rojas da Cruz, General Coordinator for Climate Science. E-mail: mrojas@mcti.gov.br \| Address: Esplanada dos Ministérios, Bloco E, room 273, 70067-900, Brasília, DF, Brazil |
| **Proponent institution:** | University of Brasília (UnB), Dean's Office for Research and Innovation (DPI), E-mail: dpi@unb.br. Principal investigator: Jorlandio Francisco Felix, Associate Professor and Research and Innovation Coordinator of the Institute of Physics. E-mail: jorlandio@unb.br \| Address: Campus Universitário Darcy Ribeiro, Asa Norte, 70910-900, Brasília, DF, Brazil |

**Climate objective:**

- ☐ Climate change adaptation
- ☒ **Climate change mitigation**
- ☐ Combination of climate change adaptation and mitigation

**Geographical scope:**

- ☐ Community level
- ☐ Subnational
- ☒ **National**
- ☐ **Multi-country**

If subnational or multi-country, describe the specific areas (states, regions, countries, etc.).

**Description of the climate change problem (up to 1 page):**

In its Nationally Determined Contribution, Brazil has committed to reducing net greenhouse gas emissions by 59 to 67 per cent by 2035 relative to 2005, and to reaching climate neutrality by 2050. A substantial share of this effort depends on decarbonising hard-to-abate sectors such as steel, fertilisers, chemicals and refining, where direct substitution by renewable electricity is not feasible. For these sectors, low-carbon hydrogen is the main available vector.

The country has exceptional conditions to produce it: a predominantly renewable electricity mix, high wind and solar capacity factors, particularly in the Northeast, and expanding port infrastructure. That advantage, however, lies in resources rather than in technology. Converting renewable electricity into hydrogen depends on electrolysers whose critical components, in particular proton-exchange membranes and membrane-electrode assemblies, are entirely imported. The perfluorinated membranes currently available on the market are expensive, depend on supply chains concentrated in a few suppliers, and face growing environmental restrictions associated with perfluorinated compounds.

There is also a technical limitation that becomes more severe precisely under Brazilian conditions. Hydrogen crossover through the membrane reduces faradaic efficiency and imposes operational safety limits, and this effect is more pronounced under partial-load and intermittent operation, exactly the profile imposed by wind and solar sources. In other words, the feature that makes Brazilian hydrogen competitive, the abundance of variable renewables, is also the one that most penalises the performance of currently available membranes.

The consequence is twofold. In climate terms, the cost of low-carbon hydrogen remains high, delaying the replacement of fossil fuels in hard-to-abate sectors and compromising the trajectory towards the NDC target. In development terms, the country tends to consolidate itself as an exporter of primary energy and an importer of technology, capturing a small share of the value chain and without building the scientific and industrial base required to sustain the transition in the long run.

**Past and ongoing efforts to address the problem (up to ½ page):**

Brazil has established a dedicated public policy framework in recent years. The National Hydrogen Programme (PNH2) set out guidelines and governance for the sector, and the Legal Framework for Low-Emission Hydrogen (Law No. 14,948 of 2 August 2024) provides for the National Low-Emission Hydrogen Policy, establishes the Special Incentive Regime for Low-Emission Hydrogen Production (Rehidro) and creates the Low-Emission Hydrogen Development Programme (PHBC). Law No. 14,990 of 27 September 2024 constituted a national source of funds for the energy transition based on the use of low-emission hydrogen. North-eastern states have signed agreements for production hubs, and federal funding agencies have expanded calls addressing hydrogen and the energy transition.

In scientific and technological terms, investment in research centres and networks has been growing. The proponent institution operates in this ecosystem through LabINS, with consolidated work on van der Waals two-dimensional materials applied to hydrogen evolution catalysis, including its own scalable heterostructure production technology protected by national patent BR 10 2024 015706-0, and participates in the Centre of Excellence in Carbon Capture, Utilisation and Storage (CCUS) funded by the Brazilian Funding Authority for Studies and Projects (FINEP).

Internationally, in July 2026 the Climate Technology Centre and Network (CTCN) held the Learning Visit on Green Hydrogen Production and Fuel Cells in the Republic of Korea, with activities at KIST, KRICT and KIER. The proponent attended the event as nominated by MCTI. That activity gave rise to direct collaboration with the Korea Research Institute of Chemical Technology (KRICT), a reference group in hydrocarbon membranes for electrolysis, with sample exchange and preliminary testing already under way.

These efforts, however, do not resolve the barriers described below. National policies address incentives, certification and investment attraction, but not technological capacity building in critical components. And the international collaboration initiated lacks a structured instrument to convert it into effective knowledge transfer and installed capacity in the country.

**Specific technological barriers (up to 1 page):**[1]

**1. Absence of national capacity to develop membranes and electrolysis components.** The country has no groups with an established routine for synthesis, processing and qualification of proton-exchange membranes at pre-industrial scale. The consequence is full dependence on imports and the impossibility of adapting the component to Brazilian operating conditions.

**2. Knowledge gap in the engineering of oriented ionomeric nanocomposites.** Incorporating two-dimensional nanosheets with controlled orientation into an ionomeric matrix is a recognised route to increase tortuosity and reduce hydrogen permeation without compromising proton conductivity. Mastering this route requires simultaneous control of dispersion, surface functionalisation and magnetic-field alignment, knowledge currently concentrated in a few centres abroad and not systematised in Brazil.

**3. Lack of national qualification methodology and infrastructure.** There is no consolidated protocol in the country to measure hydrogen crossover, proton conductivity and membrane durability under intermittent operation, nor an accredited laboratory able to issue results with metrological traceability. Without this, neither national development can be validated nor imported components independently verified.

**4. Absence of a structured knowledge-transfer mechanism.** Cooperation with leading centres occurs on an ad hoc basis and depends on individual researchers' initiative, without an instrument ensuring protocol transfer, critical-mass formation and continuity.

[1] ***"any equipment, techniques, practical knowledge and skills needed for reducing greenhouse gas emissions and adapting to climate change" (Special Report on Technology Transfer, IPCC, 2000)"***

**How CTCN technical assistance will help overcome them.** The requested assistance acts directly on the four barriers: it transfers to Brazil preparation and characterisation protocols developed at an international reference centre, establishes and documents a national membrane qualification methodology, trains qualified personnel in sufficient numbers to sustain the work, and delivers to the country a component-localisation roadmap that converts the acquired knowledge into an input for public policy. In this case, the CTCN provides exactly what is missing: the institutional instrument that turns an incipient scientific collaboration into technological capacity installed in the country.

**Contribution to the CTCN Programme of Work 2023–2027:**

In line with the 3rd CTCN Programme of Work, please indicate the systemic transformation area, the key enablers and the cross-cutting themes related to the request:[2]

**Systemic transformation areas (mandatory)**

- ☐ Water–Energy–Food Nexus
- ☐ Sustainable Mobility
- ☒ Energy Systems
- ☐ Buildings and Infrastructure
- ☒ Business and Industry

**Key enablers (optional):**

- ☒ National Innovation Systems
- ☐ Digitalisation

**Cross-cutting themes (optional):**

- ☐ Gender
- ☐ Youth
- ☐ Indigenous Peoples

**Sectors:**

Please indicate the main sectors related to the request:

[2] https://www.ctc-n.org/resources/ctcn-third-programme-work-2023-2027

| | | | |
|---|---|---|---|
| ☐ Coastal zones | ☐ Early warning and environmental assessment | ☐ Human health | ☐ Infrastructure and urban planning |
| ☐ Fisheries | ☐ Water | ☐ Agriculture | ☐ Carbon fixation |
| ☒ Energy Efficiency | ☐ Forestry | ☒ Industry | ☒ Renewable Energy |
| ☐ Transport | ☐ Waste Management | | |

Add other sectors, if necessary:

**Technical assistance requested (up to 1 page):**

This request concerns a cRD&D-TA originating from the 2026 Learning Visit on Green Hydrogen Production and Fuel Cells, held by the CTCN in the Republic of Korea, and is submitted by the National Designated Entity of Brazil in coordination with the CTCN PALO office.

**Overall objective.** To develop, through collaborative research and development between Brazil and the Republic of Korea, low-crossover proton-exchange membranes based on magnetically oriented two-dimensional nanosheets, and to install in Brazil the technical capacity to produce, characterise and qualify these components, thereby reducing the country's technological dependence in the low-carbon hydrogen chain.

**Planned activities.**

1. *Diagnosis and baseline. Survey of national gaps in electrolysis components and mapping of existing laboratory capacities in the country, identifying institutions able to form a national testing network.*
2. *Collaborative development and protocol transfer. Joint work with KRICT to adapt hydrocarbon-based membranes and to incorporate functionalised two-dimensional nanosheets under magnetic-field alignment. Includes short reciprocal technical missions and documented transfer of preparation procedures.*
3. *Establishment of a qualification methodology. Assembly and validation of a protocol to measure hydrogen crossover, proton conductivity and durability under an intermittent regime representative of Brazilian conditions, with definition of the route towards ISO/IEC 17025 conformity.*
4. *Team formation and dissemination of results. Joint execution trains Brazilian researchers, technicians and graduate students in the transferred procedures, with open-access technical documentation and the participation of women and early-career researchers. On completion, the results and the component-localisation roadmap will be presented to MCTI and to the other stakeholders.*

**Expected outputs.**

1. Diagnostic report on national gaps and installed laboratory capacity.

2. Validated technical protocol for producing nanocomposite membranes with oriented nanosheets, transferred and documented in Portuguese and English.
3. National membrane testing and qualification methodology, with an accreditation route.
4. Brazilian team trained in the transferred procedures, with open-access technical documentation.
5. Component-localisation roadmap for electrolysis, with recommendations.
6. Consolidated final report and resulting scientific publications.

**Modality and resources.** It is requested that the assistance be implemented under the collaborative RD&D modality conducted by the CTCN PALO office, through direct contracting of the proponent institution by means of a Small Scale Funding Agreement (SSFA). The University of Brasília acts as proponent and implementing institution, with KRICT as international research partner.

The budget was estimated bottom-up from the activities described above, totalling USD 110,000, as follows:

| Budget line | Link to activities | Amount (USD) |
|---|---|---|
| Technical missions and researcher exchange between LabINS/UnB and KRICT for joint membrane fabrication and testing, including travel, accommodation and subsistence | Activities 2 and 4 | 40,000 |
| Inputs for nanosheet decoration and magnetic functionalisation: 2D feedstock materials (graphene, transition-metal dichalcogenides, hexagonal boron nitride), iron-oxide precursors and liquid-phase exfoliation and anchoring consumables | Activity 2 | 15,000 |
| Inputs for membrane fabrication: ionomer, water-processable matrices and casting reagents | Activity 2 | 12,000 |
| Magnetic-alignment fixtures and casting systems: opposed-magnet and Halbach assemblies, casting cells and associated instrumentation, built at LabINS | Activity 2 | 10,000 |
| Transport and structural characterisation services, contracted on a per-use basis: hydrogen permeability, in-plane and through-plane proton conductivity, X-ray scattering and polarised Raman spectroscopy | Activities 3 and 1 | 18,000 |
| Application demonstration: components and consumables for testing in a polymer-electrolyte water electrolysis cell and in a barrier configuration | Activity 3 | 15,000 |
| **Total** | | **110,000** |

Figures are indicative estimates, to be detailed when the contractual instrument is formalised. The total requested is below the ceiling applicable to an SSFA.

**National counterpart contribution.** Not included in the amount requested and provided by the participating institutions: the time of Brazilian and Korean researchers, the graduate scholarships already linked to the proponent group, the existing laboratory infrastructure at LabINS and KRICT, the administrative support of the University of Brasília, and the team-formation and results-presentation activities carried out on university premises.

**Link with NDE actions.** MCTI, as the National Designated Entity, nominated the proponent to attend the 2026 Learning Visit that gave rise to this request, and has followed the development of the proposal since then. The outputs of the assistance feed directly into instruments under the Ministry's responsibility, in particular the science, technology and innovation agenda of the National Hydrogen Programme and the technological capacity-building actions associated with NDC implementation. The NDE will sit on the project Steering Committee.

**Estimated duration:**

Fifteen months, consistent with the usual duration of CTCN technical assistance. The assistance covers collaborative development, protocol transfer and qualification activities. Scientific cooperation between the University of Brasília and KRICT will continue beyond that period with resources from other sources, such as projects funded by the Federal District Research Foundation (FAPDF) and proposals submitted to the National Council for Scientific and Technological Development (CNPq), in addition to KRICT's own resources, so that the full horizon of the collaboration extends beyond that of the assistance now requested.

**Gender and other expected co-benefits of the technical assistance:**

**Gender.** In Brazil, the materials and energy field shows female participation below the average for the exact sciences, narrowing progressively at more advanced career stages. The assistance adopts three concrete measures: a minimum of 40 per cent women in the Brazilian team trained during implementation; the participation of women researchers in the technical exchange missions with KRICT; and an outreach activity aimed at undergraduate students, focused on increasing women's entry into graduate programmes in the field. Participation indicators will be reported in the final report.

**Economic and industrial co-benefits.** Reduced low-carbon hydrogen production cost through gains in faradaic efficiency, with a direct effect on the viability of Brazilian projects, and creation of a technical basis for the progressive localisation of higher-value-added components.

**Safety co-benefits.** Hydrogen crossover is, beyond an efficiency loss, an operational risk factor. The qualification methodology developed contributes to the safety of Brazilian facilities.

**Social and capacity-building co-benefits.** Training of qualified human resources in a strategic technology, involving graduate students and generating qualified jobs in the medium term.

**Environmental co-benefits.** The hydrocarbon-based membrane routes investigated reduce dependence on perfluorinated compounds, which face growing international regulatory restrictions.

**International cooperation.** Consolidation of a permanent channel of technological cooperation between Brazil and the Republic of Korea, with potential for replicating the methodology in other developing countries through the CTCN network.

**Follow-up activities foreseen after completion of the technical assistance:**

The outputs of the assistance will be put to continued use through:

Dissemination of results, with NDE support, to the members of the National Hydrogen Programme, coordinated by the Ministry of Mines and Energy and composed of representatives of government, academia and the private sector to define policies and guidelines relating to the use of low-emission hydrogen.

The University of Brasília will keep the qualification methodology in operation, applying it in the training of master's and doctoral candidates and pursuing the ISO/IEC 17025 accreditation route, which will enable service provision to third parties. The national productive sector will be able to draw on the installed capacity for independent verification of components.

Scaling up is foreseen along two routes: submission of a pre-industrial development project to national funding agencies, based on the results obtained, and mobilisation of the cooperation with KRICT for subsequent scale-up stages. Should the University of Brasília's CTCN Network membership be confirmed, the methodology may be offered to other developing countries, particularly in Latin America and Africa, broadening the reach of the initial investment.

**Key stakeholders:**

Please list the stakeholders that will be involved in implementing the technical assistance requested from the CTCN and describe their role during implementation. For example: government agencies and ministries, academic institutions and universities, private sector, community organisations, civil society, among others.

| Stakeholders | Role in implementation |
|---|---|
| National Designated Entity (MCTI) | Sits on the project Steering Committee, monitors implementation and results, and facilitates the dissemination of results to the members of the National Hydrogen Programme |

| | |
|---|---|
| Graduate students of UnB (PPGFIS and PPGCIMA) | Implementation of experimental activities under the proponent's supervision, participation in technical missions to KRICT and training in the transferred procedures |
| University of Brasília (proponent), represented by Jorlandio Francisco Felix, Associate Professor and Research and Innovation Coordinator of the Institute of Physics, E-mail: jorlandio@unb.br | Host of the installed laboratory capacity; technical coordination and implementation of activities |
| KRICT (Republic of Korea) | International research partner; protocol transfer and hosting of technical missions |
| Dean's Office for Research and Innovation, UnB | Institutional support, management of the contractual instrument and internal coordination |

**Alignment with national priorities (up to 2000 characters including spaces):**

Brazil's NDC (2024) sets out, among its mitigation priorities in the energy sector, the development of markets for low-carbon hydrogen as an alternative to the use of fossil fuels [1, p. 15], and records that the country seeks to overcome technological gaps and welcomes international collaboration, from both public and private actors, to build endogenous technological capacities [1, p. 17]. This request responds directly to both points.

The Legal Framework for Low-Emission Hydrogen (Law No. 14,948/2024) provides for the National Low-Emission Hydrogen Policy, establishes Rehidro and creates the PHBC, and Law No. 14,990/2024 constituted a national source of funds for the energy transition based on low-emission hydrogen [1, p. 31; 2; 3]. CNPE Resolution No. 2/2021 places hydrogen among seven priority themes for RD&I funding in the energy sector [1, p. 31; 4]. The New Industry Brazil programme includes Mission 5 on bioeconomy, decarbonisation and energy transition and security [1, p. 17; 5].

The Technology Needs Assessment (TNA_BRAZIL, 2021) assessed hydrogen technologies, including fuel-cell electric vehicles, which were not among the twelve prioritised owing to their low technological maturity, a criterion that penalised less mature options in the ranking [6]. That outcome predates the legal framework and the National Hydrogen Programme [7] and evidences the very gap this request addresses: without endogenous technological development, hydrogen technologies will remain at a maturity stage insufficient for prioritisation and diffusion in the country.

The requested assistance acts on a critical component of the hydrogen production chain, today entirely imported, and converts international cooperation into capacity installed in Brazil, in line with the NDC guidelines and with the national low-emission hydrogen policy.

[1] BRAZIL. Brazil's NDC: National determination to contribute and transform. Nationally Determined Contribution, November 2024. Available at: https://unfccc.int/sites/default/files/2024-11/Brazil_Second%20Nationally%20Determined%20Contribution%20(NDC)_November2024.pdf. Accessed on: 23 September 2026.

[2] BRAZIL. Law No. 14,948 of 2 August 2024. Establishes the legal framework for low-emission hydrogen and provides for the National Low-Emission Hydrogen Policy. Available at: https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/l14948.htm. Accessed on: 23 September 2026.

[3] BRAZIL. Law No. 14,990 of 27 September 2024. Constitutes a source of funds for the energy transition based on the use of low-emission hydrogen, under the Low-Emission Hydrogen Development Programme (PHBC). Available at: https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/l14990.htm. Accessed on: 23 September 2026.

[4] NATIONAL COUNCIL FOR ENERGY POLICY (CNPE). Resolution No. 2 of 10 February 2021, amended in February 2025. Sets guidelines on research, development and innovation in the energy sector. Available at: https://www.gov.br/mme/pt-br/assuntos/noticias/cnpe-inclui-novos-setores-prioritarios-na-resolucao-sobre-pesquisa-desenvolvimento-e-inovacao-com-foco-na-transicao-energetica. Accessed on: 23 September 2026.

[5] MINISTRY OF DEVELOPMENT, INDUSTRY, TRADE AND SERVICES. New Industry Brazil: Action Plan for Neo-industrialisation 2024-2026. Available at: https://www.gov.br/mdic/pt-br/composicao/se/cndi/plano-de-acao/nova-industria-brasil-plano-de-acao-2024-2026-1.pdf. Accessed on: 23 September 2026.

[6] MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATIONS. Report on the technology needs assessment for the implementation of climate action plans in Brazil: mitigation. Brasília, 2021. Available at: https://unfccc.int/ttclear/TNA/BRA-TNA-TNA_Mitigation_2021.pdf. Accessed on: 23 September 2026.

[7] NATIONAL COUNCIL FOR ENERGY POLICY (CNPE). Resolution No. 6 of 23 June 2022. Establishes the National Hydrogen Programme (PNH2). Official Gazette of the Union, 4 August 2022, issue 147, section 1, p. 6. Available at: https://www.in.gov.br/en/web/dou/-/despacho-do-presidente-da-republica-419972141. Programme guidelines available at: https://www.gov.br/mme/pt-br/assuntos/noticias/mme-apresenta-ao-cnpe-proposta-de-diretrizes-para-o-programa-nacional-do-hidrogenio-pnh2/HidrognioRelatriodiretrizes.pdf. Triennial Work Plan 2023-2025 available at: https://www.gov.br/mme/pt-br/assuntos/noticias/PlanodeTrabalhoTrienalPNH2.pdf. Accessed on: 23 September 2026.

[8] UNFCCC. Long-term strategies portal. Available at: https://unfccc.int/process/the-paris-agreement/long-term-strategies. Accessed on: 23 September 2026.

[9] Concept note submitted to PALO/CTCN in July 2026, entitled “Magnetically oriented 2D nanosheets in proton-exchange membranes for low-crossover green hydrogen production and storage” (attached).

| Reference document (including document date) | Excerpt (including chapter, page number, etc.) |
|---|---|
| Brazil's Nationally Determined Contribution (NDC), November 2024 [1] | Section "Mitigation Guidelines, Objectives and Priorities", energy sector, p. 15: Brazil will prioritise the expansion of energy efficiency actions and the development of markets for low-carbon hydrogen as an alternative to the use of fossil fuels. |
| Brazil's Nationally Determined Contribution (NDC), November 2024 [1] | Section "Low-carbon, climate-resilient industrial development", p. 17: the country seeks to overcome technological gaps, understanding that the climate emergency cannot be tackled without advances in specific technologies, and welcomes international collaboration, from both public and private actors, to build endogenous technological capacities. Same section, p. 17: New Industry Brazil, Mission 5. Section "Energy transition", p. 31: Law No. 14,948/2024, Law No. 14,990/2024 and CNPE Resolution No. 2/2021. |
| Report on the technology needs assessment for the implementation of climate action plans in Brazil: mitigation (TNA_BRAZIL), 2021 [6] | Table 16, p. [insert page] (ranking of technology needs): hydrogen technologies assessed and ranked in the lowest positions owing to low technological maturity. Table 18, p. [insert page] (twelve prioritised technologies): does not include hydrogen technologies. This request does not concern a technology prioritised in the TAP and addresses the maturity gap that led to that ranking. The report predates the Legal Framework for Low-Emission Hydrogen and the National Hydrogen Programme. |
| National Adaptation Plans (NAPs) | Not applicable. This request has climate change mitigation as its objective. |
| GCF Country Programme | Not applicable to this request. |
| Long-Term Low Emission Development Strategies (LT-LEDS) | Not applicable. Brazil has not yet submitted its LT-LEDS to the UNFCCC [8]. The Brazil 2050 Strategy is under preparation. |
| CNPE Resolution No. 2 of 2021 [1, p. 31; 4] | Section "Energy transition" of the NDC, p. 31: through CNPE Resolution No. 2/2021 the CNPE defined a set of seven priority themes for the country, including hydrogen, directing RD&I resources operationalised by the energy sector regulatory agencies. |
| New Industry Brazil programme, January 2024 [1, p. 17; 5] | Section "Low-carbon, climate-resilient industrial development" of the NDC, p. 17: Mission 5, "bioeconomy, decarbonisation and energy transition and security to guarantee resources for future generations". |
| National Hydrogen Programme (PNH2), CNPE Resolution No. 6 of 23 June 2022, approved by Presidential Order of 3 August 2022 (Official Gazette of 4 August 2022, issue 147, section 1, p. 6) [7] | Article 3, items IV and VI: the principles of the PNH2 include valuing and encouraging national technological development and seeking synergies and coordination with other countries. Article 4, items I, II and VI: the programme is structured along six axes, among them strengthening the scientific and technological base, human resources training and international cooperation. Article 6, item IV: the Management Committee is responsible for promoting hydrogen as a priority theme for research, |

| | |
|---|---|
| | development and innovation investment. This request addresses those three axes and the principles cited. |

**Development of the request** (up to 2000 characters including spaces):

This request originates from the 2026 CTCN Learning Visit on Green Hydrogen Production and Fuel Cells, held in the Republic of Korea in July 2026, in which the proponent participated as the Brazilian representative nominated by the Ministry of Science, Technology and Innovation (MCTI), acting as the National Designated Entity (NDE).

During the learning visit, participants were invited by the CTCN to submit concept notes on collaborative research, development and demonstration (cRD&D) in green hydrogen. In this context, the proponent developed and submitted a bilateral concept note jointly with a principal researcher from the Korea Research Institute of Chemical Technology (KRICT). The concept builds on an ongoing technical exchange between the parties, including the transfer of polymer samples for preliminary testing in Brazil.

Following a positive preliminary screening by the CTCN, the proponent formally engaged with the NDE. The NDE conducted a technical review of the concept note to assess its alignment with CTCN modalities and national priorities. Subsequent consultations with the CTCN, including its PALO office, confirmed that the appropriate modality for support is collaborative RD&D technical assistance (cRD&D-TA).

The NDE subsequently guided the preparation of the present request, in accordance with CTCN procedures.

**Reference documents and other relevant information for the request (include a link to the publication, preferably in English where available):**

1. Brazil's Nationally Determined Contribution (2024). https://unfccc.int/sites/default/files/2024-11/Brazil_Second%20Nationally%20Determined%20Contribution%20(NDC)_November2024.pdf
2. National Hydrogen Programme (PNH2), CNPE Resolution No. 6 of 23 June 2022. https://www.in.gov.br/en/web/dou/-/despacho-do-presidente-da-republica-419972141
3. Legal Framework for Low-Emission Hydrogen, Law No. 14,948 of 2 August 2024. https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/l14948.htm
4. Report on the technology needs assessment for the implementation of climate action plans in Brazil: mitigation (TNA_BRAZIL), 2021. https://unfccc.int/ttclear/TNA/BRA-TNA-TNA_Mitigation_2021.pdf
5. Concept note submitted to PALO/CTCN in July 2026, entitled "Magnetically oriented 2D nanosheets in proton-exchange membranes for low-crossover green hydrogen production and storage" (attached).
6. Documentation of the 2026 CTCN Learning Visit on Green Hydrogen Production and Fuel Cells.

This request was not developed with the support of the CTCN Request Incubator.

**OPTIONAL: Links with the Green Climate Fund (GCF) Readiness and Preparatory Support**

Not applicable to this request

☐ Initial engagement: The GCF NDA of the requesting country was involved in the design of this request and will be involved in the subsequent process leading to a formal agreement to access GCF Readiness support.

☐ **Advanced engagement (preferred):** The GCF National Designated Authority (NDA) of the requesting country was directly involved in the design of this request and is a co-signatory to it, the signature indicating provisional agreement to the use of national readiness resources to support implementation of the technical assistance.

NDA name:

Date:

Signature:

**Monitoring and impact of the assistance:**

By signing this request, I confirm that processes are in place in the country to monitor and evaluate the technical assistance provided by the CTCN. I understand that these processes will be explicitly identified in the CTCN Response Plan and will be used in-country to monitor implementation of the technical assistance, following standard CTCN procedures. This includes active engagement, as NDE, together with the main project proponent/beneficiary, in regular project governance and monitoring meetings.

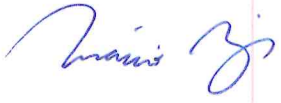
I understand that, upon completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short-, medium- and long-term impacts in the country. This includes completing NDE feedback and post-implementation evaluation forms.

**Signature:**

NDE name: Márcio Rojas da Cruz

Date: September 29, 2026

Signature:



**THE COMPLETED FORM SHALL BE SENT TO THE CTCN@UNEP.ORG**

The CTCN is available to answer any questions and to provide guidance on the request process.