CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

Technical Assistance Response Plan – Terms of Reference

Country	**Brazil**
Request ID#	**2016000095**
Title	**Technical assistance for the internationalization of the Brazilian hydrogen energy research and development network**
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Proponent	Paulo Emílio V. de Miranda Professor COPPE - Federal University of Rio de Janeiro - Brazil The Hydrogen Laboratory Tel: +55 (21) 3938-8791 pmiranda@labh2.coppe.ufrj.br www.labh2.coppe.ufrj.br Av. Horácio Macedo, 20300 21941-970 Rio de Janeiro, RJ, Brazil

Summary of the CTCN technical assistance

Supported by national and regional clusters as well as by comprehensive public and private partnerships and funding, the development and deployment of fuel cell and hydrogen applications in Europe has significantly increased over the last decade. The European experience in grouping the right stakeholders, mobilizing and synchronizing funding streams may be transferred in an adaptive way to Brazilian stakeholders by means of CTCN's Technical Assistance. By leveraging the occasion of the 22nd edition of the World Hydrogen Energy Conference (WHEC) that will take place in Rio de Janeiro in June 2018, CTCN technical assistance will mobilize the transfer of relevant knowledge and experiences in Europe through the engagement of the European Hydrogen Association, a CTCN network member. The EHA over the last 17 years has been active in developing national and regional fuel cell and hydrogen clusters, as well as in building consortia for concrete fuel cell and hydrogen application demonstration projects. The EHA will leverage this experience to help position the Brazilian Hydrogen Association as a key multiplier of these technologies in Brazil. Therefore CTCN technical assistance will facilitate the engagement of key Brazilian organizations and stakeholders in renewable energy, transport and energy management sectors, as well as a comprehensive overview of status quo of fuel cell and hydrogen scientific research networks in Latin America. In addition potential public and private policy and financial support in Brazil will be identified to help create the right consortia for first joint projects linking Brazil's renewable energy potential to hydrogen infrastructure possibilities.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism
Name: Márcio Rojas da Cruz
Title: Coordinator of Global Climate Change
Date: June 28th 2017
Signature:

Proponent (signature of the Proponent is optional)

Name: Paulo Emílio V. de Miranda
Title: Professor
Date: June 21st 2017.
Signature:

UNFCCC Climate Technology Centre and Network (CTCN)

Name: **Jukka Uosukainen**
Title: **CTCN Director**
Date:
Signature:

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1. Background and context

Brazil over the last decades has developed a significant renewable energy matrix and a culture of non-fossil fuel utilization has already been well established. Brazil has also been active in various international platforms like the IPHE (International Partnership for Hydrogen and Fuel Cells in the Economy) and launched its first Road Map for Hydrogen Energy in 2005. Hydrogen energy related networks exist since 2004; particularly, the solid oxide fuel cells network, Rede PaCOS, has held several events in the area and promoted the interaction of researchers. However, these initiatives have not yet lead to a broad engagement of key industrial and governmental stakeholders to develop effective national and regional programs and policy actions to accelerate the uptake of fuel cell hydrogen (FCH) technologies to effectively support the transformation of Brazil's energy and transport system towards hydrogen energy -based solutions. As the EU and several of its Member States, over the last decade have succeeded to speed up deployment of FCH technologies through the creation of successful Public Private Partnerships (Joint Undertaking for Fuel cells and Hydrogen, FCH JU) and by implementing supportive legislation, Brazil and Latin American countries could benefit from an intensive exchange with European experts working in various fields to decrease dependencies on fossil fuels, by the use of hydrogen and fuel cell applications. Several hydrogen energy options have been already regulated by codes and standards in Europe, allowing controlled field experimentations. These include the production, storage in pressurized or liquid forms, distribution and local delivery of high-purity hydrogen, its successful use in fuel cells for low-power distributed generation of electric and heat energies, its use in the transportation sector in automobiles, buses, trucks, motorbikes, airplanes and boats, its utilization in small-power mobile devices, among others. The European Hydrogen Association EHA, as a CTCN network member, established in the year 2000 by 5 national associations, now representing 15 associations, has been supporting many regional deployment clusters across Europe as well the development of successful demonstration projects, will be well placed to engage with and share best practices with Brazilian institutions and companies. The EHA is committed to use this experience and its involvement in various EU research and development programs to support the CTCN Network in facilitating target oriented networks of different stakeholders to accelerate the comprehensive and sustainable introduction of fuel cell and hydrogen energy applications. The EHA will be supporting the internationalization of the Brazilian Hydrogen Association, transferring its unique experience of building national and regional network of key stakeholders, active in the deployment of clean technologies for energy production and storage, considering stationary, mobile and transport applications. In addition these activities will serve as a model for the Brazilian Hydrogen Association to become a CTCN member and also to transfer technical assistance to other institutions in Latin America.

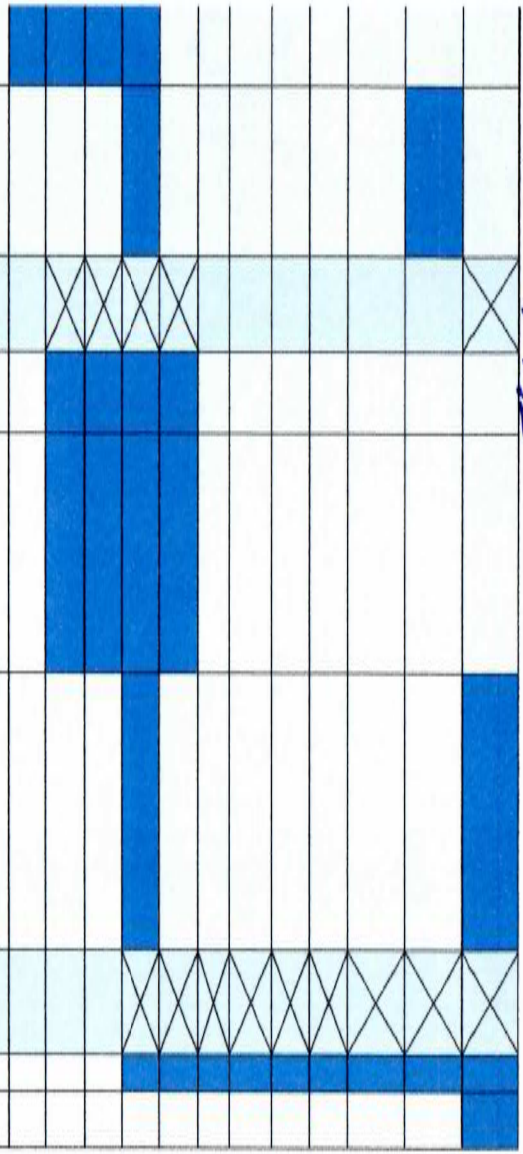
2. Problem statement

The Brazilian scientific and industrial community involved in actions related to climate change, as well as in the development of technologies and applications in the field of renewable energy and hydrogen and fuel cells, has been very active during the past years and has experienced a steady increase. However, there is a need for interconnecting these activities to foster their joint development in order to accelerate the sustainable deployment of market ready applications such as distributed generation of electricity, including energy storage and fuel cell electric mobility. For this purpose Brazil will need to keep pace with fuel cell and hydrogen deployment in the rest of the world and

stimulate Brazilian industry and financial institutions to invest and engage in market roll-out. The Brazilian Hydrogen Association, that has been recently established on April 5, 2017, could become a key aggregator and catalyst of hydrogen and fuel cell application deployment and stimulate similar developments in other Latin American countries. For this purpose strategic and expert partnerships need to be built that could benefit from similar experiences in Europe. As the first TA request of Brazil, this TA will also promote CTCN's role in connecting Latin American countries to climate technologies.

3. Logical Framework for the CTCN Technical Assistance:

Objective: **Technical assistance for the internationalization of the Brazilian hydrogen energy research and development network**												
Outcome: The main result of the herein proposed CTCN intervention is the establishment of an effective network and business plan for the Brazilian Hydrogen Association through the transfer of technical and managerial knowledge of key European national and regional initiatives focusing on the development and deployment of fuel cell and hydrogen applications in local renewable energy and transport systems. In addition the 22nd World Hydrogen Energy Conference, that will be held in Rio de Janeiro during June 17-22, 2018, organized by the Brazilian stakeholder that is involved in the implementation of the present CTCN TA, the Hydrogen Laboratory at Coppe-Federal University of Rio de Janeiro, will offer an unique opportunity to feature the role of CTCN in connecting Latin American countries to key climate technologies like fuel cells and hydrogen. Other results will certainly include: 1) mobilization of hydrogen energy activities already being developed in Brazil in the area of transportation, with successful implementations already made of hydrogen fuel cell buses; 2) dissemination of knowledge of the role of hydrogen and fuel cells in energy and transport transition to renewable sources and stimulation of new collaborative projects, new events and financing possibilities for new scientific and technological activities; 3) to foster the use of codes and standards to facilitate and make engineering FCH implementations convenient and safe; 4) leveraging of Brazilian potential already developed on biomasses and renewable energies to establish cleaner engineering procedures for hydrogen energy associated with low-environmental impacts; and 5) increased public awareness and more especially young people on the subject to facilitate acceptance of the new technologies.												
	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Output 1: Development of implementation planning and communication documents	X	X	X	X							X	
Activity 1: i) A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organisations and detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan; ii) Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation. The monitoring and evaluation plan should apply selected indicators from the Closure and Data Collection report template and enable the lead implementer to complete the CTCN Closure and Data collection report at the end of the assignment (please refer to item iv below and section 14 in the Response Plan); iii) A two-page CTCN Impact Description formulated in the beginning of the technical assistance and update/revised once the technical assistance is fully delivered (a template will be provided);												

iv) A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided).	
Deliverable 1: i) Detailed work plan ii) Monitoring and evaluation plan iii) CTCN Impact Description iv) Closure and Data Collection report	
Output 2: Internationalization of the Brazilian Hydrogen Association (ABH2): preparation and implementation of its Organization and Activities Plan for 3 years.	
Activity 2.1: Collection of relevant European experiences in cluster building and key fuel cell and hydrogen project results.	
Activity 2.2: Identification of Key Players and Potential Members for the Brazilian Hydrogen Association: - Collection of relevant Brazilian and European players from the public and private sectors and related initiatives in 5 areas of fuel cell and hydrogen applications: production, storage and distribution of hydrogen, development and production of fuel cells and their components, socio economic issues. - Identification of Brazilian natural resources and key players for hydrogen production and the related technologies, either already available, or still on development, or potential ideas for R&D in Brazil.	
Deliverable 2: 3 year business plan for the Brazilian Hydrogen Association including list of established cooperation with key Brazilian organizations in the renewable energy, power systems, grid management and transport and urban mobility field **Deliverable 3:** EHA will engage key European FC and H2 industry interest in the WHEC as well as European and Brazilian Associations (EHA/ABH2)	
Output 3: EHA/ABH2's Workshop at the WHEC 2018 in Rio de Janeiro from June 17-22 named: **"Connecting Countries to Climate Technology Solutions, a Global Interaction and the Use of Natural Resources for the Hydrogen Production"**.	
Activity 3.1: Workshop organization, venue preparation, invitations, speakers	
Deliverable 4: EHA/ABH2's/WHEC 2018 Workshop and Report	

4. Resources required and itemized budget:

Activities and Outputs	Input: Human Resources	Input: Travel	Inputs: Meetings/events	Input: Equipment/Material	Estimated cost	
					Minimum	Maximum
Output 1: : Development of implementation planning and communication documents						
Activity 1.1: Detailed work plan	*EHA/Coppe 5 working days*	*NA*	*Skype/ telcon*	*NA*	*1500*	*2000*
Activity 1.2: Monitoring and evaluation plan	*EHA/Coppe 3 working days*	*NA*	*Skype/telcon*	*NA*	*800*	*1000*
Activity 1.3: CTCN Impact Description	*EHA/Coppe 2 working days*	*NA*	*Skype/telcon*	*NA*	*600*	*800*
Activity 1.4: Closure and Data Collection report	*EHA/Coppe 5 working days*	*NA*	*Skype/telcon*	*NA*	*1000*	*1200*
Output 2: Internationalization of the Brazilian Hydrogen Association: preparation and implementation of its Organization and Activity Plan for 3 years						
Activity 2.1: Collection of relevant European experiences	*EHA , 5 working days*	*NA*	*Desktop*	*NA*	*1500*	*2000*
Activity 2.2: Identification of Key Brazilian Players and Potential Members	*EHA/ Coppe 5 working days*	*NA*	*Desktop, calls*	*NA*	*1500*	*2000*
Output 3: CTCN Workshop at the WHEC 2018						
Activity 3.1: Workshop organization, venue preparation, invitations, speakers - Identification and contact with the countries in South	*EHA/Coppe 10 working days*	*3 expert trips -Europe to Brazil*		*Promotion material*	*15.000*	*17.000*

America, to motivate them to attend the Workshop at the WHEC						
Estimated range of costing for the entire Response Plan					**$ 21,900**	**$ 26,000**

5. Profile and experience of experts

Experts required
FC and H2 Technology expert
FCH Association manager
Event organizer
Web/App developer

6. Intended contribution to impact over time

The technical assistance to be given through CTCN will create actions directly related to the energy sector in Brazil because it is involved with the introduction and fostering of the utilization of hydrogen energy. Hydrogen energy activities are mainly associated with the distributed generation of electric energy with emphasis on renewable energies and biomass utilization and the electrification of the transport system. These sectors are able to contribute with mitigation of climate change both in urban metropolitan areas that concentrate an important portion of the Brazilian population and also in rural areas, where Brazil is very active on agribusiness and where sustainable farming methods will represent a great environmental contribution. This action will be facilitated because of the existence of a varied legal framework already established in Brazil that is expressed by Law 12.187 from Dec. 29th, 2009 that establishes the National Politics on Climate Change, as well as several laws of the electrical energy sector to foster the utilization of renewable energies and to regulate tariffs, distribution, concessions, transmissions, such as Laws: 10.438 from April 26th, 2002; 10.762 from Nov. 11th, 2003; 12.212 from Jan. 20th, 2010; 12.782 from Jan. 11th, 2013 and 13.360 from Jan. 17th, 2016. The work to be developed through CTCN and the European Hydrogen Association will find a fertile environment on renewable energies in Brazil, being able to positively impact actions related to climate change in both medium and long terms.
Impact/Contribution to the CTCN activities:

1) The EHA/ABH2's Workshop at the WHEC 2018 with topic "Connecting Countries to Climate Technology Solutions, a Global Interaction and the Use of Natural Resources for the Hydrogen Production", and the fact that Brazil is closer, will motivate countries in South America to:
   - Attend the EHA/ABH2's workshop at the WHEC 2018.
   - Be more active in submitting Technical Assistance Requests and to look for Climate Technology Solutions.
   - Contribute to other countries' expertise by disseminating their knowledge and experiences in all areas of Climate Technologies. The dissemination of experiences and knowledge contribute to generate similar initiatives in all areas of Climate Change Technologies.
2) The Development of a Youth/Student activity alongside the workshop shall:
   - Improve communication and good relationship and partnership among countries
   - Promote the exchange of experience and knowledge on Climate Technology Solutions
   - Support CTCN on its dissemination and communication activities

Involve the Youth Community on the CTCN's and Global's efforts of "Connecting Countries to Climate Technology Solutions".

7. Relevance to NDCs and other national priorities

The Brazilian NAMAs – National Appropriate Mitigation Actions – from the United Nations Framework Convention on Climate Change – UNFCCC – are well specified in the following:

http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/brazilcphaccord_app2.pdf
http://www.mmechanisms.org/document/NAMA/NAMA_LCA15_brazil_EN.pdf
https://unfccc.int/files/focus/mitigation/application/pdf/brazil_namas_and_mrv.pdf

As well as giving a particular emphasis on alternative energy sources; energy efficiency; biofuels and farming, which are several of the activities very much impacted by the adoption of hydrogen energy technologies. Such Brazilian priorities are also supported by the legal framework already established in Brazil that is expressed by Law 12.187 from Dec. 29th, 2009 that establishes the National Politics on Climate Change, as well as several laws of the electrical energy sector to foster the utilization of renewable energies and to regulate tariffs, distribution, concessions, transmissions, such as Laws: 10.438 from April 26th, 2002; 10.762 from Nov. 11th, 2003; 12.212 from Jan. 20th, 2010; 12.782 from Jan. 11th, 2013 and 13.360 from Jan. 17th, 2016.

This demonstrates that the technical assistance within the present CTCN project is very well consistent with the documented Brazilian priorities.

8. Linkages to relevant parallel on-going activities:

The CTCN assistance will contribute to:
- improve the Brazilian and the South American countries efforts on Climate Change
- Connect more countries in South America for Climate Technology Solutions
- Promote the dissemination of climate technology existing projects and lessons learned in Europe and worldwide to developing countries (www.h2euro.org)
- Promote the worldwide dissemination of climate technology existing projects and its lessons learned in Brazil and in South American countries

9. Anticipated follow up activities after this technical assistance is completed:

The activities described on the Work Plan attached will have the following Outcomes and Deliveries:
1) Internationalization of the Activities of the Brazilian Hydrogen Association
2) Organization and Implementation of a EHA/ABH2's Workshop at the WHEC 2018 called "Connecting Countries to Climate Technology Solutions, a Global Interaction and the Use of Natural Resources for the Hydrogen Production".
3) Development of a Youth/Student activity alongside the workshop: award for the creation of an App with FC and H2 information that is suitable for global use. This App shall improve communication and good relationship and partnership among countries and also promote the exchange of experience and knowledge on Climate Technology Solutions.

10. Main in-country stakeholders in implementation of the technical assistance activities:

In country stakeholder	Role in implementation of the technical assistance
Hydrogen Laboratory – COPPE – Federal University of Rio de Janeiro	-Coordinate the creation of the Brazilian Hydrogen Association and the internationalization of hydrogen energy activities together with EHA. -Help EHA and CTCN to organize the EHA/ABH2's Workshop at the WHEC 2018.

11. SDG Contributions:

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	The introduction of new technologies and technology transfer activities generate new business opportunities and create new jobs contributing to the reduction of poverty.
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	The deployment of no-emissions technologies reduces greenhouse gases and local pollution, mitigating health problems for all people living in big cities at all ages.
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	The introduction of new technologies and technology transfer activities enhance capacity building, promote training, and create expertise and

		know-how.
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	Isolated areas can benefit from the introduction of new technologies in the areas of energy generation, where conventional technologies are not accessible.
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	Hydrogen energy activities are mainly associated with the distributed generation of electric energy with emphasis on renewable energies and biomass utilization and the electrification of the transport system.
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	The European Union countries have accumulated in the course of the last decades the world most important and varied knowledge and experiences on developing hydrogen energy technologies, devices, standards and utilization methodologies. The European Hydrogen Association is depositary of the European knowledge and experiences in this area and is able to provide to the Brazilian Hydrogen Association and to Brazilian institutions technical assistance to develop a sustainable and target oriented network, in order to support the dissemination of knowhow, information and experiences, stimulate cooperation among projects, organizations and experts and to identify funding for joint projects.
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	

11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	
	13.2 - Integrate climate change measures into national policies, strategies and planning	The Brazilian NAMAs – National Appropriate Mitigation Actions – from the United Nations Framework Convention on Climate Change – UNFCCC give particular emphasis on alternative energy sources; energy efficiency; biofuels and farming, which are several of the activities very much impacted by the adoption of hydrogen energy technologies.
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	The introduction of new technologies and technology transfer activities enhance capacity building, promote training, create expertise and know-how.
	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable	The exchange of information, know-how, lessons learned and experience

	development	strength international partnerships for sustainable development.

12. Classification of technical assistance:

Please tick off the relevant boxes below	Primary	Secondary
☐ 1. Technology identification and prioritisation	☐	☐
☐ 2. Research and development of new climate technologies	☐	☒
☐ 3A. Feasibility studies for specific known climate technology options	☐	☐
☐ 3B. Piloting of known technologies in local conditions	☐	☐
☐ 4A. Law, policy and regulatory reform recommendations	☐	☐
☐ 4B. Sector specific roadmap or strategy design	☐	☐
☐ 5. Finance facilitation and market creation	☒	☐