Climate Bonds INITIATIVE

Hydrogen Production Criteria

The Hydrogen Production Eligibility Criteria of the Climate Bonds Standard & Certification Scheme

Final for Issuance

Climate Bond Certified

Acknowledgements

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Revision	Date	Summary of Changes
Rev. 1.0	November 14 2022	Final for Issuance
Rev. 0.1	September 08 2022	Issued as draft for Consultation

Definitions

Climate Bonds Initiative (Climate Bonds): An investor focused not-for-profit organisation, promoting large-scale investments that will deliver a global low carbon and climate resilient economy. Climate Bonds seeks to develop mechanisms to better align the interests of investors, industry and government to catalyse investments at a speed and scale sufficient to avoid dangerous climate change.

Climate Bonds Standard (CBS): A screening tool for investors and governments that allows them to identify green bonds the proceeds of which are being used to deliver climate change solutions. This may be through climate mitigation impact and/or climate adaptation or resilience. The CBS is made up of two parts: the parent standard (CBS v4.0) and a suite of sector specific eligibility Criteria. The parent standard covers the certification process and pre- and post-issuance requirements for all certified bonds, regardless of the nature of the capital projects. The Sector Criteria detail specific requirements for assets identified as falling under that specific sector. The latest version of the CBS is published on the Climate Bonds website.

Climate Bonds Standard Board (CBSB): A board of independent members that collectively represents $34 trillion of assets under management. The CBSB is responsible for approving (i) Revisions to the CBS, including the adoption of additional sector Criteria, (ii) Approved verifiers, and (iii) Applications for Certification of a bond under the CBS. The CBSB is constituted, appointed, and supported in line with the governance arrangements and processes as published on the Climate Bonds website.

Climate Bond Certification: allows the issuer to use the Climate Bond Certification Mark in relation to that bond. Climate Bond Certification is provided once the independent CBSB is satisfied the bond conforms with the CBS.

Critical interdependencies: The asset or activity's boundaries and interdependencies with surrounding infrastructure systems. Interdependencies are specific to local context but are often connected to wider systems through complex relationships that depend on factors 'outside the asset fence' that could cause cascading failures or contribute to collateral system benefits.

Green Bond: A green bond is a bond of which the proceeds are allocated to environmental projects or expenditures. The term generally refers to bonds that have been marketed as green. In theory, green bonds proceeds could be used for a wide variety of environmental projects or expenditures, but in practice they have mostly been earmarked for climate change projects.

Hydrogen production assets and projects: Assets and projects relating to the acquisition, installation, management and/or operation of infrastructure for hydrogen production

Industry Working Group (IWG): A group of key organisations that are potential issuers, verifiers and investors convened by Climate Bonds The IWG provides feedback on the draft sector Criteria developed by the TWG before they are released for public consultation.

Investment Period: The interval between the bond's issuance and its maturity date. Otherwise known as the bond tenor.

Technical Working Group (TWG): A group of key experts from academia, international agencies, industry and NGOs convened by Climate Bonds. The TWG develops the Sector Criteria - detailed technical criteria for the eligibility of projects and assets as well as guidance on the tracking of eligibility status during the term of the bond. Their draft recommendations are refined through engagement with finance industry experts in convened Industry Working Groups (see below) and through public consultation. Final approval of Sector Criteria is given by the CBSB.

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1 Introduction

1.1 The Climate Bonds Standard

Investor demand for climate bonds is strong and is expected to increase in line with the delivery of quality products into the market. However, investor concerns about the credibility of green labelling are also growing. Standards, assurance & Certification will be essential to improve confidence and transparency, which in turn will enable further strong growth in the market.

Today, the Climate Bonds Standard and Certification Scheme is an easy-to-use screening tool that provides a clear signal to investors and intermediaries on the climate integrity of Certified Climate Bonds. Proposals are currently under consultation to also expand certification to entities with climate integrity.

A key part of the Standard is a suite of sector-specific eligibility Criteria. Each sector-specific Criteria sets climate change benchmarks for that sector that are used to screen assets and capital projects, and increasingly entities, so that only those that have climate integrity, either through their contribution to climate mitigation, and/or to adaptation and resilience to climate change, will be certified.

These sector-specific Criteria are determined through a multi-stakeholder engagement process, including TWG and IWG, convened and managed by Climate Bonds, and are subject to public consultation. Finally, they are reviewed and approved by the Climate Bonds Standard Board (CBSB).

The second key part of the Climate Bonds Standard (CBS) is the overarching CBS available at Climate Bonds Standard v4.0. This documents the common management of proceeds and reporting requirements that all Certified Climate Bonds must meet, in addition to meeting the sector specific Criteria.

1.2 Environmental scope

Currently, certification requirements address:

- Climate change mitigation; and
- Climate adaptation and resilience; and
- Other environmental impacts

1.3 What can be certified

Subject to meeting the eligibility criteria in the following sectors, the following can be certified under these criteria:

- Use-of-Proceed (UoP)[1] bonds financing decarbonisation measures (e.g., retrofits) – ***see Section 3***
- Use-of-Proceed (UoP) bonds financing hydrogen production facilities (i.e., assets and activities) – ***see Section 4***

The following can be certified following the update of the Overarching Climate Bonds Standard v4.0[2]:

- Assets not linked to any specific financing instrument (hydrogen production facilities) – see ***Section 4***
- Entities (hydrogen production companies) and Sustainability Linked Bonds (SLBs) issued by those entities – see ***Section 5***

To demonstrate compliance with the following Criteria, in accordance with the CBS, it is the applicant's responsibility to provide the information to prove compliance with each component of these Criteria. Verifiers must include this information in the scope of verification.

[1] Use-of-Proceed (UoP) is used as shorthand throughout this document for a variety of targeted finance instruments, including green loans, repos, and asset-backed securities. Annex 1 of the Standard v3.0 details the full list of instruments that can be certified.

[2] Expected in Q1 2023.

Where the bond portfolio includes several separately identifiable projects, expenditures, or groups of assets, these criteria must be met for each separately identified project or asset grouping. Applicants should determine these project boundaries, which may be based on geographical and/or supply chain linkages.

NOTE: ***Certification of assets, entities and SLBs will not be possible until the Climate Bonds Standard v4.0 has been finalised. For entities and SLBs in particular, this is because the Standard v4.0 includes new, non-sector specific requirements that entity and SLB certifications will need to comply with in addition to the hydrogen-sector specific-criteria below.***

Please see here for more information. It is anticipated that the Standard v4.0 will be finalised by the year end.

1.4 Documents supporting this criteria

Information to support issuers and verifiers is available at Hydrogen Criteria | Climate Bonds Initiative as follows:

- Hydrogen Background paper: Contains details on why the criteria were chosen
- Hydrogen Frequently Asked Questions
- Hydrogen public consultation feedback and responses summary
- Climate Bonds Standard: contains the requirements of the overarching CBS
- The Climate Bonds Standard & Certification Scheme Brochure: provides an overview of the Climate Bonds Standard & Certification Scheme, of which these Criteria are a part

For more information on Climate Bonds and the Climate Bonds Standard and Certification Scheme, see www.climatebonds.net.

1.5 Revisions to these Criteria

These Criteria will be reviewed on a regular basis, at which point the TWG will take stock of the bonds issued to date and any developments in improved methodologies and data or advances in technologies or practices that should be reflected to increase the climate integrity of the criteria. As a result, the Criteria are likely to be refined over time, as more information becomes available. Certification will not be withdrawn retroactively from bonds certified under earlier versions of the Criteria.

2 The Scope of these Criteria

2.1 Hydrogen supply chain in scope

The Hydrogen Criteria apply to eligible assets, projects and entities relating to the production and conditioning of hydrogen. The diagram below is a simplified summary of the entire value chain and illustrates the activities in scope for hydrogen production certification[3]. Activities in scope are within the orange boundary in figure 1 below.

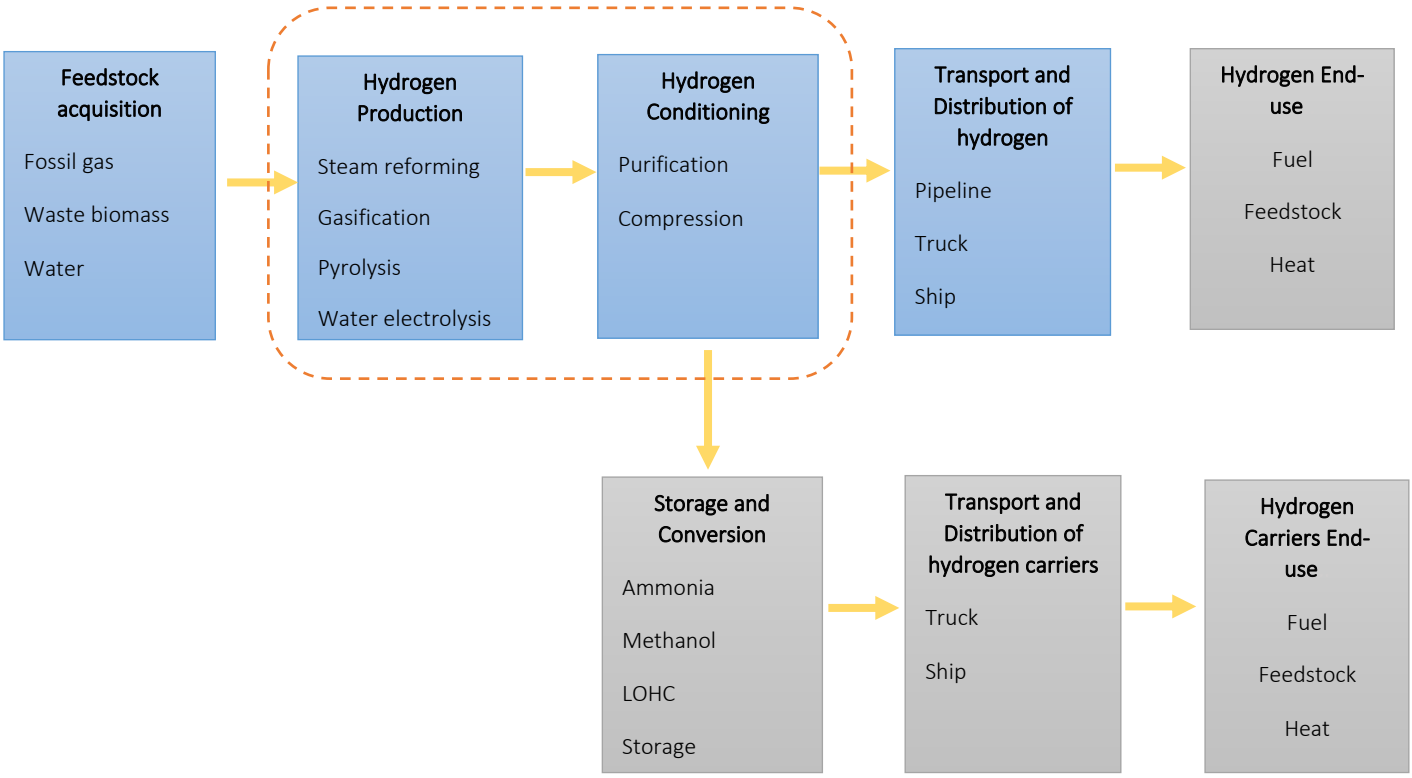

Figure 1: Simplified Representation of Hydrogen Value Chain and Activities in Scope

2.2 Production pathways that are not covered by these criteria

- Coal-based production is out of the scope of these criteria.
- Biomass from primary sources for hydrogen production is out of the scope of these criteria.[4]
- Nuclear based production will be included once Climate Bonds develop criteria for nuclear energy production.

2.3 GHG emissions in scope

Carbon emissions equivalent include all GHGs, based on the latest 6th IPCC Assessment Report (AR6). Energy values use the lower heating value (LHV).

[3] Activities for transport, distribution, conversion and storage of hydrogen will be under scope of "Transport and Distribution of hydrogen and low-carbon gases" criteria, which is under development.

[4] Only waste biomass sources are eligible

2.4 Accounting and reporting system boundaries

Life cycle GHG assessment for hydrogen production must be conducted for a cradle-to-site system boundary, which includes cradle-to-gate emissions plus any transportation emissions to the site where a product will be used. It means that the GHG accounting includes scope 1, 2 and partial scope 3 emissions. System boundaries are shown in ***Figure 2*** below.

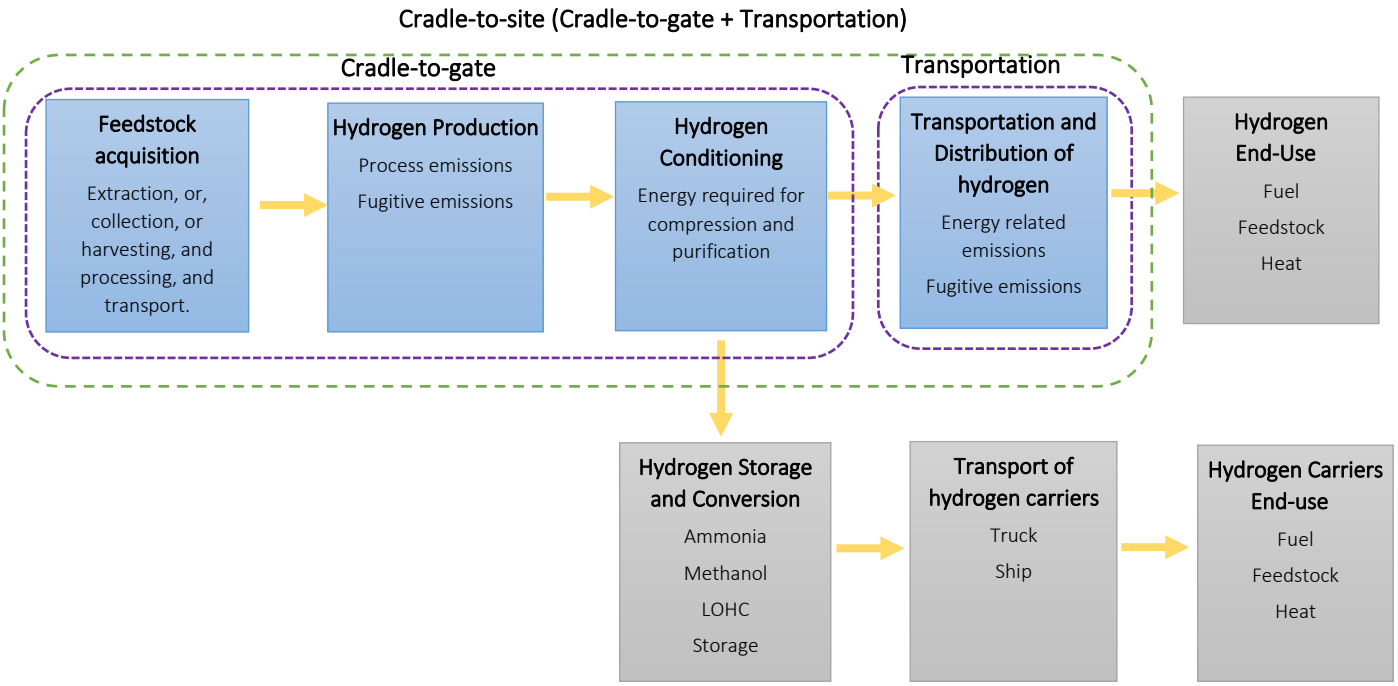

Figure 2: Systems Boundaries for GHG Accounting.

2.5 Alignment with other sector criteria

In respect of UoP bond certifications, where the proceeds will be allocated to multiple sectors, proof of compliance with multiple sector criteria may be required across the portfolio. For example, if the UoP bond is financing both hydrogen activities and steel activities, then the applicant would have to prove compliance with the Hydrogen Criteria in respect of the former and the Steel Criteria in respect of the latter.

In respect of SLB and entity certifications, where the SLB or entity Performance Targets span multiple activities within the entity, all those activities will need to be assessed against the appropriate sector criteria and an overall 'pass threshold' reached. See the Climate Bonds Standard v4.0 ***Part D Section 2.3*** for more information on this.

In some cases, it may not immediately be clear whether activities, facilities or projects might fall under these criteria or other sector criteria. The possible overlaps, and appropriate sector criteria to be used, are clarified in ***Table 1***.

Table 1: Assets or projects covered by other sector criteria

Potential Use-of-Proceeds	Sector Criteria
Use of hydrogen for steel, cement, and ammonia production	Steel, Cement, Basic Chemicals criteria.
Renewable energy generation including Solar, Wind, Marine Renewable, Hydropower and Geothermal energy	Relevant corresponding energy sector criteria
Use of biomass for hydrogen production	Bioenergy criteria

3 Criteria for Decarbonisation Measures within Facilities Producing Hydrogen

These criteria cover capital investments (decarbonisation measures) within production facilities. This differs from an investment that would finance the cost of a whole facility in that it is focused on measures or specific areas of improvement within a production facility.

3.1 Mitigation Criteria

Table 2 lists decarbonisation measures, retrofitting projects, and activities eligible for certification due to their climate mitigation potential, and any associated eligibility criteria specific to those investments. These are classified in three categories:

- Various, which includes diverse activities and decarbonisation measures.
  - Manufacture of equipment and component to produce hydrogen
  - Carbon capture and storage
  - Carbon capture and utilisation
  - Electrification

- Relating to feedstock use
  - Using biomass
  - Using manure
  - Using landfill gas

- Relating to electricity source for electrolytic production
  - Using renewable energy
  - Using electricity grid

Table 2: Mitigation criteria for eligible decarbonisation measures, retrofitting activities, and projects

Area	Activity	Mitigation criteria
Various		
Manufacture of equipment and components to produce low-carbon hydrogen	Electrolysers, hydrogen generators, compressors, etc.	Equipment and components must be utilised only for the production of low-carbon hydrogen that meets the carbon intensity benchmark in ***Table 4***. Manufacturer must demonstrate the low-carbon hydrogen production end-use.
Carbon Capture and Storage	Infrastructure related to CO2 capture of emissions from the hydrogen production, transportation, and storage	• The minimum capture rate from process and energy emission streams should be 90%.[5] • Issuers must present a quantitative performance report of the CCS operations, including the following information[6]: ○ Intended capture rate capacity, maximum capture rate capacity, annual capture of CO2, annual transport of CO2, annual storage of CO2.[7] • Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leaks on site and upstream.[8] • There is evidence[9] that demonstrates the CO2 will be suitably transported and stored in line with the criteria below: **Transport[10]** 1. The CO2 transported from the installation where it is captured to the injection point does not lead to CO2 leakages above 0.5 % of the mass of CO2 transported. 2. Appropriate leakage detection systems are installed, and a monitoring plan is in place, with the report verified by an independent third party.

[5] A minimum capture rate must be demonstrated only for specific investments on CCS or CCU infrastructure. Entire facilities certification does not need to meet this requirement if the facility meet the carbon intensity benchmark in table 4.

[6] CCS performance report must be verified by an independent party

[7] Zhang et al, 2021. https://pubs.acs.org/doi/pdf/10.1021/acs.estlett.2c00296

[8] Additional guidance can be found in the report Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector. Monitoring, Reporting and Verification (MRV) and Mitigation. United Nations Economic Commission for Europe. 2019 https://unece.org/fileadmin/DAM/energy/images/CMM/CMM_CE/Best_Practice_Guidance_for_Effective_Methane_Management_in_the_Oil_and_Gas_Sector_Monitoring_Reporting_and_Verification_MRV_and_Mitigation-_FINAL_with_covers_.pdf

[9] Either directly from the issuer or through contracts or agreements with a third party

[10] From the technical screening criteria for qualifying as contributing substantially to climate change mitigation for "Transport of CO_2" in Annex 1 of the Commission Delegated Regulation (EU) 2021/2139

Area	Activity	Mitigation criteria
		Storage[11] 1. Characterisation and assessment of the potential storage complex and surrounding area, or exploration[12] is carried out to establish whether the geological formation is suitable for use as a CO2 storage site. 2. For operation of underground geological CO2 storage sites, including closure and post-closure obligations: a) Appropriate leakage detection systems are implemented to prevent release during operation; b) A monitoring plan of the injection facilities, the storage complex, and, where appropriate, the surrounding environment is in place, with the regular reports checked by the competent national authority. 3. For the exploration and operation of storage sites, the activity complies with ISO 27914:2017225[13] for geological storage of CO2. Furthermore, the use of the following certification schemes is encouraged: U.S. EPA Class VI well certification, which includes reservoir characterization[14]. The DNV GL certification framework to verify compliance with the ISO 27914:2017 Carbon dioxide capture, transportation, and geological storage – Geological storage .
Carbon Capture and Utilisation	Infrastructure related to capture, transportation, and utilisation of CO2 emissions from the hydrogen production.	• The minimum capture rate from process and energy emission streams should be 90%.[15] • Issuers must present a quantitative performance report of the CCS operations, including the following information[16]: o Intended capture rate capacity, maximum capture rate capacity, annual capture of CO2, annual transport of CO2, annual utilisation of CO2. • Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leaks on site and upstream[17]. • There is evidence[18] that demonstrates the CO2 will be suitably transported in line with the criteria below:

[11] From the technical screening criteria for qualifying as contributing substantially to climate change mitigation for "Underground permanent geological storage of CO_2" in Annex 1 of the Commission Delegated Regulation (EU) 2021/2139

[12] 'exploration' means the assessment of potential storage complexes for the purposes of geologically storing CO2 by means of activities intruding into the subsurface such as drilling to obtain geological information about strata in the potential storage complex and, as appropriate, carrying out injection tests in order to characterise the storage site

[13] ISO Standard 27914:2017, Carbon dioxide capture, transportation and geological storage — Geological storage (version of [adoption date]: www.iso.org/standard/64148.html).

[14] www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-co2

[15] A minimum capture rate must be demonstrated only for investments on CCS or CCU infrastructure. Entire facilities certification does not need to meet this requirement if the facility meet the carbon intensity benchmark in table 4.

[16] CCS performance report must be verified by an independent party

[17] www.dnv.com/news/dnv-gl-launches-certification-framework-and-recommended-practice-for-carbon-capture-and-storage-ccs--108096 Monitoring alternatives include satellite-based or drone-based measurement. Additional guidance can be found in the report Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector. Monitoring, Reporting and Verification (MRV) and Mitigation. United Nations Economic Commission for Europe. 2019 https://unece.org/fileadmin/DAM/energy/images/CMM/CMM_CE/Best_Practice_Guidance_for_Effective_Methane_Management_in_the_Oil_and_Gas_Sector__Monitoring__Reporting_and_Verification__MRV__and_Mitigation-_FINAL__with_covers_.pdf

[18] Either directly from the issuer or through contracts or agreements with a third party

Area	Activity	Mitigation criteria
		Transport[19] • The CO2 transported from the installation where it is captured to the injection point does not lead to CO2 leakages above 0.5 % of the mass of CO2 transported. • Appropriate leak detection systems are applied and a monitoring plan is in place, with the report verified by an independent third party. **Utilisation** • CO2 must be used for the manufacture of durable products (e.g. construction materials stored in buildings, or recyclable products that will not be incinerated as a final disposal alternative). • CO2 should not be used for products that release the CO2 immediately when the products are used (such as in urea, carbonated beverages, or fuels) • CO2 is not used for enhanced oil recovery, and the production of other forms of fossil energy sources.
Electrification of processes	Revamps, modifications and acquisition of equipment and other infrastructure necessary for electrification of the processes	Automatically eligible
Relating to feedstock used		
Using biomass as a feedstock	Infrastructure to produce hydrogen using biomass Refurbishment and retrofitting of facilities to use biomass Acquisition of equipment to produce hydrogen using biomass	The biomass used complies with the criteria applicable for biomass sourcing set out in the Climate Bonds Bioenergy criteria[20]. Only secondary organic streams are eligible. Wood and other dedicated crops are not eligible.
Using landfill gas as a feedstock	Infrastructure to produce hydrogen using landfill gas	Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leakages on site and upstream[21].

[19] From the technical screening criteria for qualifying as contributing substantially to climate change mitigation for "Transport of CO_2" in Annex 1 of the Commission Delegated Regulation (EU) 2021/2139

[20] Bioenergy Criteria Document Mar 2021 (climatebonds.net)

[21] Monitoring alternatives include satellite-based or drone-based measurement. Additional guidance can be found in the report Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector Monitoring Reporting and Verification MRV and Mitigation- FINAL with covers .pdf (unece.org)

Area	Activity	Mitigation criteria
	Refurbishment and retrofitting of facilities using landfill gas as a feedstock Acquisition of equipment to produce hydrogen using landfill as a feedstock	Landfill gas complies with the Climate Bonds waste management criteria for landfill gas recovery[22].
Using manure- biomethane	Infrastructure to produce hydrogen using manure biomethane Refurbishment and retrofitting of facilities using manure biomethane Acquisition of equipment to produce hydrogen using manure biomethane	Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leaks. Manure biomethane complies with the Climate Bonds waste management criteria for composting[23].
Relating to electricity source		
Using Wind, solar, hydro, geothermal energy-based electricity	Infrastructure to produce hydrogen using renewable energy sources Refurbishment and retrofitting of facilities using renewable energy sources Acquisition of equipment to produce electrolytic hydrogen using renewable energy sources	Renewable energy produced on site must comply with the most up to date Climate Bonds criteria for the relevant source of energy.[24] [25] [26] [27] Issuers must demonstrate the use of only additional renewable electricity. To do that, issuers can implement the following options: a) Renewable-based[28] captive power generation, OR b) A power purchase agreement demonstrating a commercial link of the electrolyser with new renewable power capacity; OR c) Excess of renewable-based electricity that would have been otherwise curtailed. Further, temporal and geographical correlation between the additional renewable electricity generation and the electrolyser electricity consumption must be demonstrated. See Box 1 for more details.

[22] Climate Bonds Waste Management Criteria (climatebonds.net)

[23] Climate Bonds Waste Management Criteria (climatebonds.net)

[24] Geothermal www.climatebonds.net/standard/geothermal

[25] Hydropower www.climatebonds.net/standard/hydropower

[26] Solar energy www.climatebonds.net/standard/solar

[27] Wind energy www.climatebonds.net/standard/wind

[28] Energy produced from renewable sources such as wind, solar, and small hydropower generation

Area	Activity	Mitigation criteria
Using low-carbon electricity	Infrastructure for the production of hydrogen using electricity from the grid.	The carbon intensity of the electricity grid must ensure that the production process is in compliance with the total carbon intensity benchmark in ***Table 4***.

Box 1: Notes for demonstrating additionality

a) A power purchase agreement demonstrating a commercial link of the electrolyser with new renewable power capacity: Issuers must show that the renewable power plant started operation simultaneously or after the electrolyser installation. The total electricity consumption cannot be higher than the electricity supplied by the new renewable power plants. A producer can use more than one PPA to cover the entire electricity requirements of its electrolysers.

b) Excess of renewable-based electricity that would have been otherwise curtailed: Flexible hydrogen production projects focusing on times of high renewable generation and low emission factor. Issuers must demonstrate that the electrolyser uses renewable energy from an existing renewable plant only during those hours of the year when surpluses occur.

c) Temporal correlation: Issuers must demonstrate that the electricity is produced and used simultaneously, on a monthly basis, using telemetry measurement techniques. Renewable electricity that has been locally stored can be used as well.

d) Geographic correlation: Issuers must demonstrate physical capacity to transport the electricity from the renewable generation plant to the electricity consumption site. The electricity must not pass a zone of grid congestion[1].

3.2 Adaptation and Resilience Criteria

This section describes the Adaptation & Resilience (A&R) Component of the eligibility Criteria for decarbonisation measures. To demonstrate compliance, all measures must satisfy the requirements of the checklists detailed below in ***Table 3***.

The checklist is a tool to verify that the applicant has implemented sufficient processes and plans in the design, planning and decommissioning phases of a measure to ensure that the operation and construction of the asset minimises environmental harm and the asset is appropriately adaptive and resilient to climate change and supports the adaptation and resilience of other stakeholders in the surrounding system, if applicable.

All elements of the checklist must be addressed, and appropriate evidence provided that these requirements are being met or are not applicable in respect of the specific measure(s) linked to the bond. It is expected that the applicant's evidence will encompass a range of assessment and impact reports and associated data, including but not limited to those reports required to meet national and local licensing and approval processes. This might include Development Consent Orders, planning regulations adhered to, Environmental Impact Assessments, Vulnerability Assessments, and associated Adaptation Plans.

It is the applicant's responsibility to provide the relevant information to the verifier. Verifiers must include this information in the scope of verification.

For each question in the scorecard:

- A 'yes' indicates sufficient proof given.
- A 'no' indicates insufficient proof.
- In case of a 'n/a,' please justify why the question is not applicable.

Table 3 Adaptation and Resilience Checklist for Decarbonisation Measures in facilities producing hydrogen

No.	Adaptation and Resilience checklist for Decarbonisation Measures in facilities producing Hydrogen	Proof Given	Overall Assessment
		For verifier to complete	
1.	**Section 1:** Clear boundaries and critical interdependencies between the measure and the system it operates within are identified.		
1.1	Boundaries of the measure are defined using: 1. a listing of all assets and activities associated with the use of the bond proceeds, 2. a map of their location, and 3. identification of the expected operational life of the activity, asset or project.		
1.2	Critical interdependencies between the measure(s) and the system within which it operates are identified. Identification of these interdependencies should consider the potential for adverse impacts arising from, but not limited to: 1. relationships of the measure(s) to nearby flood zones; 2. relationships of the measure(s) to surrounding water bodies and water courses; 3. reduction in biodiversity or High Conservation Value[29] habitat; 4. dust and other practices that affect air quality; 5. appropriation of land or economic assets from nearby vulnerable groups[30];		
2.	**Section 2** Clear boundaries and critical interdependencies between the measure and the system it operates within are identified.		
2.1	Key physical climate risks and indicators of these risks are identified in line with the following guidelines:		

[29] High Conservation Value (HCV) habitat criteria in accordance with www.hcvnetwork.org

[30] According to IFC Performance Standards

No.	Adaptation and Resilience checklist for Decarbonisation Measures in facilities producing Hydrogen	Proof Given	Overall Assessment
		For verifier to complete	
	• Risks are identified based on (a) a range of climate hazards, and (b) information about risks in the current local context, including reference to any previously identified relevant hazard zones, e.g., flood zones. In order to be confident that measures are robust and flexible in the face of climate change uncertainties, it is essential that the climate risks being assessed and addressed cover those that are of greatest relevance to industrial facilities and infrastructure such as hydrogen production plants and other infrastructure. The physical characteristics of climate change that must be considered in the risk assessment include: • Temperature rise o High temperatures can impact the operation and efficiency of certain types of equipment. • Increasing intense precipitation events o Heavy rainfall can result in flash pluvial flooding, which could significantly impact industrial assets. o Drought may alter or reduce availability of water with temperature increase. • Changes in cloud cover, wind speed or increasing temperature extremes o Poses risks to the availability of reliable energy, both electrical or thermal. • Sea-level rises o Potential for flooding of coastal infrastructure and assets at risk from storm surge events. • Increased soil erosion o Risks to the availability of raw materials. o Risk to transport routes for supply chains. Guidance for carrying out Risk Assessments: • Users should apply climate scenarios based on representative concentration pathway (RCP) 4.5 and 8.5 or similar/ equivalent to ensure consideration for worst case scenario. • Risk assessments should use both top-down methods and bottom-up methods that look at inherent system vulnerabilities in local context. • A broad range of models can be used to generate climate scenarios. • For risk assessment, the TCFD The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities is recommended.		
3.	**Section 3:** The measure is suitable to climate change conditions over its operational life		
3.1	The equipment must be tolerant to the range of climate hazards identified in item 2 of this checklist and not lock-in conditions that could result in maladaptation.		
3.2.	Risk reduction actions/strategies must be tolerant to a range of climate hazards and not lock-in conditions that could result in maladaptation.		
4.	**Section 4:** The measure does no harm to the climate resilience of the defined system it operates within, as indicated by the boundaries of and critical interdependencies with that system as identified in item 1 in this checklist.		
4.1	The equipment itself does not pose significant risk of harm to the system it is located within or others' natural, social, or financial assets according to the principle of best available evidence during the investment period, taking into account the boundaries and critical interdependencies as defined in item 1 in this checklist. Harm is defined as an adverse effect on any of the following items: 1. Adverse effects on local water bodies and water courses;		

No.	Adaptation and Resilience checklist for Decarbonisation Measures in facilities producing Hydrogen	Proof Given	Overall Assessment
		For verifier to complete	
	2. Air pollution from dust and other pollutants; 3. Relationships of the measure to nearby flood zones; 4. Reduction in biodiversity or High Conservation Value[31] habitat; 5. Appropriation of land or economic assets from nearby vulnerable groups[32].		

[31] High Conservation Value (HCV) habitat criteria in accordance with HCV Network

[32] According to IFC Performance Standards

4 Criteria for Facilities Producing Hydrogen

For certification, the facility must meet:

- Hydrogen production mitigation criteria (see ***Section 4.1***); AND
- Adaptation and resilience criteria (see ***Section 4.2***); AND
- Cross-cutting mitigation criteria (see ***Section 6***);

4.1 Hydrogen mitigation criteria: carbon intensity thresholds

- Hydrogen production must meet specific carbon intensity thresholds over the term of the bond. These thresholds are listed in ***Table 4***.
- To demonstrate compliance with any of the emissions intensity thresholds set in ***Table 4***, issuers are required to carry out a life cycle assessment as described in ***Box 2*** below.

Table 4: Hydrogen carbon intensity thresholds

Asset Type	Criteria			
	2022	2030	2040	2050
Production of hydrogen	3 kgCO2e/kgH2	1.5 kgCO2e/kgH2	0.6 kgCO2e/kgH2	0 kgCO2e/kgH2

Box 2: Methodological notes for Life Cycle Assessment (LCA)

a) The life cycle assessment should follow the latest releases of ISO std[33] (ISO 14040, ISO 14044 for life-cycle assessment, and ISO 14067 for product carbon footprint). The Recommendation 2013/179/EU will be acceptable for assets located in the EU. Results should be verified by an independent third party.

b) GHG emissions must be estimated for a purity of 99.9% vol, and a gauge pressure of at least 3 MPa using correction factors. For pressures higher than 3 MPa, additional energy compression emissions must be included as well.

c) The methodology factor in a Global Warming Potential for a period of 100 years (GWP100) for methane should be 30[34].

d) GHG emissions accounting:

$$Etotal = E1 + E2 + E3 + E4 + E5 - E6 + E7 + E8$$

E total: Total emissions

E1: Upstream feedstock related emissions (including sourcing[35], processing, transport and storage)

E2: Upstream energy related emissions (including sourcing, processing, transport and storage)

E3: Fugitive emissions (Including hydrogen emissions)

E4: Process emissions

E5: CCS emissions related to energy consumption and leakages

E6: Carbon emissions captured

E7: Compression and purification emission (Energy required to compress and purify hydrogen)

E8: Transportation emissions to the site where hydrogen will be used (energy and electricity related emissions, and fugitive emissions during transportation)[36]

Additional Guidance for different production pathways up to the point of production[37]:

The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) methodology working paper contains guidelines to a calculation method for GHG accounting for the following production pathways up to the point of production[38]:

- Steam Methane Reforming combined with CCS: **Appendix P1 of IPHE working document**
- Biomass as a feedstock combined with CCS: **Appendix P5 of IPHE working document**
- Manure-based production: **P5.4** Biodigestion
- Land fill gas-based production: **P5.4** Biodigestion
- Biomass from secondary sources: **P.5.5** Biomass gasification.
- The IPHE working document also has guidelines for emission sources and allocation for biomass-based production:
  - Emissions sources in Biomass-Based Hydrogen Routes/CCS: **Appendix P.5.6**
  - Allocation for the Biomass/CCS pathway: **Appendix P.5.7**

[33] ISO standards available at: www.iso.org/standard/38498.html; www.iso.org/standard/37456.html

[34] Sixth Assessment Report — IPCC

[35] Depending on the feedstock, it can be extraction, cultivation, or collection

[36] Transportation infrastructure emissions are not included

[37] The IPHE methodology will develop guidelines for transport emissions accounting in the coming months.

[38] www.iphe.net/_files/ugd/45185a_6159cefcd88f4d9283ab0e60f4802cb4.pdf

Box 3: Methodological notes for meeting the emissions intensity threshold

Applicants issuing a UoP bond

Applicants may either:

- Calculate the **average** facility-level emissions intensity threshold over the term of certification, and demonstrate that the facility meets that average threshold at the time of certification; OR
- Meet the threshold **at the time of certification and commit to 3 yearly assessments** by an approved verifier throughout the period of certification to verify that at each 3 yearly evaluation, the facility meets the new, lower emissions intensity threshold in place at that time. If on any 3 yearly verification the facility is not demonstrated to meet the emissions intensity threshold then in place, certification will be removed; OR
- Meet the threshold **at the time of certification, then at half of the bond duration, and at one year before the end of the bond certification.** If on any verification the facility is not demonstrated to meet the emissions intensity threshold then in place, certification will be removed

A linear trajectory should be assumed for time periods between the dates and thresholds provided in ***Table 4***.

Where a number of production facilities are being assessed, this should be done facility by facility, i.e., not averaged across a portfolio of assets.

Example:

Option a. Compliant

A 10-year bond starting in 2030 for hydrogen production may demonstrate that the plant's emissions intensity at the point of issuance meets the average emissions intensity of the plant pathway between 2030 and 2040:

- 2030 threshold = 1.5
- 2040 threshold = 0.6
- (1.5 + 0.6) / 2 = 1.06 t CO_2/t hydrogen
- The facility's emissions intensity in 2030 is already 1t CO_2/t hydrogen. **This is lower than the necessary averaged threshold (1.06 t CO2/t hydrogen) and the facility meets the criterion. No further verification is required for meeting emissions intensity thresholds.**

Option b. Compliant

- A 10-year bond starting in 2035 would have to show compliance in annual reporting for the thresholds of 2035, 2038, and 2041.
- Verification must demonstrate every 3 years that these thresholds are met.

Option c. Compliant

- A 10-year bond starting in 2030 would have to show compliance in annual reporting for the thresholds of 2030, 2035, and 2039.
- Verification must demonstrate that these thresholds are met at every assessment.

To demonstrate compliance with any of the emissions intensity thresholds set in ***Table 4***, issuers are required to carry out a GHG emissions assessment as described in ***Box 2 above***.

Applicants seeking certification of a hydrogen facility (not linked to any financial instrument)

The facility must meet the facility-level pathway threshold at the time of certification.[39]

[39] As this is a point-in-time certification, there is no need to continuously meet the pathway thereafter.

4.2 Adaptation and Resilience criteria for facilities producing hydrogen

4.2.1 The adaptation and resilience checklist

This section describes the Adaptation & Resilience (A&R) Component of the eligibility Criteria for hydrogen production facilities. To demonstrate compliance, all facilities must satisfy the requirements of the checklists detailed below in ***Table 5***.

The checklists are tools to verify that the applicant has implemented sufficient processes and plans in the design, planning and decommissioning phases of a facility/facilities to ensure that the operation and construction of the facility minimises environmental harm and the facility is appropriately adaptive and resilient to climate change and supports the adaptation and resilience of other stakeholders in the surrounding system, if applicable.

All elements of the checklist must be addressed, and appropriate evidence provided that these requirements are being met or are not applicable in respect of the specific facility linked to certification. It is expected that the applicant's evidence will encompass a range of assessment and impact reports and associated data, including but not limited to those reports required to meet national and local licensing and approval processes. This might include Development Consent Orders, planning regulations adhered to, Environmental Impact Assessments, Vulnerability Assessments and associated Adaptation Plans.

It is the applicant's responsibility to provide the relevant information to the verifier. Verifiers must include this information in the scope of verification.

For each question in the scorecard:

- A 'yes' indicates sufficient proof given.
- A 'no' indicates insufficient proof.
- In case of a 'n/a,' please justify why the question is not applicable.

Table 5: Adaptation and Resilience Criteria for Hydrogen Production Facilities

No.	Adaptation and Resilience checklist for Hydrogen Production Facilities	Proof Given	Overall Assessment
		For verifier to complete	
1.	**Section 1:** Clear boundaries and critical interdependencies between the production facility and the system it operates within are identified.		
1.1	Boundaries of the infrastructure are defined using: 1. a listing of all assets and activities associated with the use of the bond proceeds, 2. a map of their location, and 3. identification of the expected operational life of the activity, asset or project.		
1.2	Critical interdependencies between the infrastructure and the system within which it operates are identified. Identification of these interdependencies should consider the potential for adverse impacts arising from, but not limited to: 1. The effects of supply disruption or interruption on dependent electricity users or populations; 2. Exacerbation of wildfires; 3. Relationships of the asset/activity to surrounding water bodies and water courses; 4. Relationships of the asset/project to residential neighbourhoods surrounding the plant; 5. Damage or reduction in value of neighbouring property due to boundary structures at risk of falling during storm events; 6. Reduction in value of neighbourhood property due to pollution caused by the chemical facilities, due to extreme weather events (e.g., release of toxic chemicals due to failure in safety systems in case of extreme weather events);		

No.	Adaptation and Resilience checklist for Hydrogen Production Facilities	Proof Given	Overall Assessment
		For verifier to complete	
	7. Reduction in biodiversity or High Conservation Valu[e40] habitat; 8. Relationships of the asset/project to nearby flood zones; 9. Fire and other practices that affect air quality; 10. Appropriation of land or economic assets from nearby vulnerable groups[41];		
2.	**Section 2:** An assessment has been undertaken to identify the key physical climate hazards to which the production facility will be exposed and vulnerable to over its operating life		
2.1	Key physical climate risks and indicators of these risks are identified based on: a) a range of climate hazards, and b) information about risks in the current local context, including reference to any previously identified relevant hazard zones, e.g., flood zones. In order to be confident that assets and activities are robust and flexible in the face of climate change uncertainties, it is essential that the climate risks being assessed and addressed cover those that are of greatest relevance to the production of hydrogen. • Is there a good understanding of the risks facing the facility today? In five years? In ten years? • Are risks defined and detailed? • Are risk areas for hazardous materials[42] identified? • Was a hazard assessment conducted to identify toxic, flammable, volatile and reactive chemicals[43] [44]? • Was a Risk management plan (RMP) conducted for the chemicals in the list of regulated substances[45]? • Is there an accident management plan in place? • Time horizon is set according to the severity of the risks. Higher risk locations: shorter time (every 5 years). Lower risk locations: Longer time (every 10 years). See Section 5.3 of the Background Paper for tools and reference guidelines to assess degree of risks. • Where accurate assessments of climate variability for specific locations are not possible, use worst-case scenarios. Optional guidance for carrying out risk assessments is offered in ***Section 5.3*** of the Background Document. The potential impacts that must be considered in the risk assessment include the ones described in the following sections (2.2-2.9)[46]:		
2.2	**Temperature rise and heat waves** 1. Potential increase in temperature may result in expansion and stress of plant, pipework and fittings. 2. There could be an increase in dust emissions from the site. 3. There could be an increase in odour from the site. 4. Increase in fugitive or diffuse emissions from the site. 5. Increase in pollution		

[40] High Conservation Value (HCV) habitat criteria in accordance with www.hcvnetwork.org

[41] According to IFC Performance Standards

[42] Hazardous materials include Explosive, flammable, combustible, corrosive, oxidising, toxic, infectious, or radioactive materials (Federal Emergency Management Agency)

[43] UCLID (International Uniform Chemical Information Database) software is a recommended source of data on intrinsic and hazard properties of chemical substances

[44] www.openaccessgovernment.org/climate-toxicology-human-health/68647

[45] EPA - Risk Management Plan Rule (www.epa.gov/rmp/risk-management-program-rmp-rule-overview)

[46] Chemical Industries Association, 2021. Safeguarding chemical businesses in a changing climate. How to prepare a Climate Change Adaptation Plan

No.	Adaptation and Resilience checklist for Hydrogen Production Facilities	Proof Given	Overall Assessment
		For verifier to complete	
	6. Increase in water consumed for cooling purposes. 7. Increase in energy consumption due to added pumping of cooling water around site. 8. Limited cooling, which implies that throughputs could need to be reduced or processes shut down 9. Volatile chemicals can exceed their temperature range during transportation		
2.3	**Extreme cold weather** 1. Failure of trace heating systems a) Freezing of cooling water, resulting in blockages - particularly on long pipelines and storage in exposed areas. b) Process failures 2. Pipework ruptures, affecting: 3. Boiler condensate, process water, cooling water, effluent systems, this in turn may lead to process interruption. 4. Failure of pH control due to caustic systems solidifying (such as effluent treatment) 5. Catalytic processes can be affected, reducing performance 6. Freezing of coolant lines, equipment, and chemical reaction vessel resulting in rising reaction temperature and pressure 7. Frozen onsite roadways may restrict access for staff and emergency vehicles. 8. Lack of water for fire suppression 9. Damage to site infrastructure from snow-loading over extended periods.		
2.4	**Daily extreme rainfall** 1. Flooding could lead to increased site surface water and flash flooding 2. The site may experience reduced access or egress due to site flooding. 3. Stored substances can react with water or be contaminated 4. Uncontrolled chemical reactions, for example due to shut down of refrigeration systems as a consequence of power outages and lack of backup facilities 5. Emergency relief systems, which work at atmospheric discharge pressure can be affected due to the static head of water. 6. Process equipment running hot materials can be affected by thermal stress		
2.5	**Season rainfall increase** 1. Overland flow or groundwater flooding. 2. Flooding and associated impacts, as previously identified.		
2.6	**Sea level rise** If located near the coast a site could experience increased: 1. Risk of flooding and associated impacts, as previously identified 2. Corrosion due to increase in saltwater spray 3. Reduction of useful life of assets due to frequent exposure to salty water		
2.7	**Drier seasons** 1. Potential increased use or reliance on mains water for dust suppression and cleaning. 2. Potential for increase in dust emissions from the site.		
2.8	**Decreased river flow** 1. Reduced dilution available in receiving watercourse for discharge of effluent, resulting in increased pollution		
2.9	**Wildfires** 1. Severe damage on buildings, process equipment and industrial infrastructure 2. Release of toxic pollutants 3. Volatile organic solvents with low flash points can exacerbate the fire risk 4. Explosions		

No.	Adaptation and Resilience checklist for Hydrogen Production Facilities	Proof Given	Overall Assessment
		For verifier to complete	
	5. Pipelines for transporting oil and gas, fuel storage facilities, external floating roof tanks for combustible liquids can spread the fire 6. Supply chain disruption		
3.	**Section 3:** The measures that have or will be taken to address those risks, mitigate them to a level such that the production plant is suitable to climate change conditions over its operational life have been identified and planned if not yet undertaken.		
3.1	The following are examples of risk management activities[47] that bond issuers might consider, or that might be adopted as part of regulations (e.g., codes and standards). This list is not exhaustive and bond issuers should fully assess the mitigation measures that are relevant to the climate risks and impacts identified in the risk assessment. Measures depend on the specific and local conditions of an asset.		
3.2	1. **Temperature rise and heat waves**Identify temperature limits that could impact your processes and workers 2. Regular inspection and preventative maintenance of plant and equipment 3. Regular site cleaning and use of dust suppression systems 4. Appropriate odour abatement is in place and maintained effectively 5. Appropriate odour management plan is in place 6. Make sure an appropriate fugitive or diffuse emissions plan is in place. 7. Water can be cleaned and recirculated for reuse on site 8. Alternative cooling systems. 9. Assess how efficient the current cooling system is, and to propose upgrades or modifications where necessary.		
3.3	**Extreme cold weather** 1. Identify temperature limits that could impact your processes and workers 2. Regularly inspect and maintain insulation, particularly on pipework and equipment in exposed areas of the site. 3. Consider added insulation on pipework containing water review operating procedures to make sure pipework is not left full of static water when not in use identify any potential dead-legs where static water may be held up 4. Reviewing the capability of caustic systems to remain liquid at expected colder temperatures. 5. Regularly inspect and maintain roadways during winter and remove any standing water 6. Make sure grit is available to treat road surfaces 7. Review the design of structures to withstand increased loadings.		
3.4	**Daily extreme rainfall** 1. Suitable measures are in place for the management of expected surface water and flood waters a. Drainage systems are inspected and maintained b. External areas where wastes are handled or stored are provided with contained drainage c. The site drainage system and effluent treatment plant has sufficient storage or treatment capacity 2. Make sure there are suitable alternative transport routes to and from the site.		
3.5	**Season rainfall increase** 1. Make sure suitable measures are in place for the management of anticipated overland flow or groundwater flooding.		

[47] Chemical Industries Association, 2021. Safeguarding chemical businesses in a changing climate. How to prepare a Climate Change Adaptation Plan

No.	Adaptation and Resilience checklist for Hydrogen Production Facilities	Proof Given	Overall Assessment
		For verifier to complete	
	2. Prepare flood plan including: a. Risk assessment of process equipment and services at greatest risk from flooding b. Provision of emergency pumps to remove floodwater and identification of lowest risk location for discharge of floodwaters c. Protection of control and electrical systems d. Identification and protection of flat bottom tanks at risk of floating in floodwater 3. Ensure backup power, capable of functioning during extreme weather events and guarantee the stability and safety of the stored chemicals.		
3.6	**Sea level rise** 1. Prepare flood plan including: a. Risk assessment of process equipment and services at greatest risk from flooding b. Provision of emergency pumps to remove floodwater and identification of lowest risk location for discharge of floodwaters c. Protection of control and electrical systems d. Identification and protection of flat bottom tanks at risk of floating in floodwater 2. Prevent corrosion. Measures could include making sure that plant or equipment prone to corrosion are: a. Protected, such as by being painted with resistant coating b. Regularly inspected and maintained		
3.7	**Drier seasons** 1. Measures are in place to review and minimise water use and to maximise collection and use of rainfall a. Mains water capacity is adequate, taking into account reduced availability of rainwater for activities such as dust suppression and cleaning 2. Potential for increase in dust emissions from the site.		
3.8	**Decreased river flow** 1. Review the environmental risk assessment for discharge to water from on-site effluent treatment 2. Check existing environmental risk assessment to make sure low river flow used in assessment remains valid - if not, discuss with Environment Agency (local site inspector and water quality team) and carry out an updated environmental risk assessment		
3.9	**Wildfires** 1. Implement active fire prevention measures such as fire detector, gas detector, design of sprinkler systems, use of line detectors, design of deluge systems, design of gaseous extinguishing systems[29] 2. Implement passive fire protection measures, like permanent inertization of warehouses, support for pipe racks, fireproofing cabling, use of fire resistance cable coating, protection of tank farms 3. Storage protection measures such as distancing to avoid fires from spreading within an industrial complex 4. Wildland and vegetation management		
4.	**Section 4:** The facilities do no harm to the climate resilience of the defined system they operate within, as indicated by the boundaries of and critical interdependencies with that system as identified in item 1 in this checklist.		

No.	Adaptation and Resilience checklist for Hydrogen Production Facilities	Proof Given	Overall Assessment
		For verifier to complete	
4.1	The facilities themselves do not pose significant risk of harm to the system they are located within or others' natural, social, or financial assets according to the principle of best available evidence during the investment period, taking into account the boundaries and critical interdependencies as defined in item 1 in this checklist. 1. The effects of supply disruption or interruption on dependent electricity users or populations; 2. Exacerbation of wildfires; 3. Relationships of the asset/activity to surrounding water bodies and water courses; 4. Relationships of the asset/project to residential neighbourhoods surrounding the plant; 5. Damage or reduction in value of neighbouring property due to boundary structures at risk of falling during storm events; 6. Reduction in value of neighbourhood property due to pollution caused by the chemical facilities, due to extreme weather events (e.g., release of toxic chemicals due to failure in safety systems in case of extreme weather events); 7. Reduction in biodiversity or High Conservation Value[48] habitat; 8. Relationships of the asset/project to nearby flood zones; 9. Fire and other practices that affect air quality; 10. Appropriation of land or economic assets from nearby vulnerable groups[49].		
5.	**Section 5:** There will be ongoing monitoring and evaluation of the relevance of the risks and resilience measures and related adjustments to those measures will be taken as needed.		
5.1	Indicators for risks identified under item 2 in this checklist are provided. • Risk thresholds/trigger levels, for which new adaptation actions are set[50], are monitored		
5.2	Indicators for risk mitigation measures identified under item 3 in this checklist are provided. • Determine whether planned outputs and outcomes from adaptation actions have been achieved[51].		
5.3	Issuers have a viable plan to annually monitor and evaluate 1. climate risks thresholds/triggers, 2. climate resilience performance, 3. appropriateness of climate resilience measure(s) and to adjust as necessary to address evolving climate risks.		

[48] High Conservation Value (HCV) habitat criteria in accordance with www.hcvnetwork.org

[49] According to IFC Performance Standards

[50] The adaptation process Coastal Climate Adaptation Decision Support (C-CADS), 2018.

[51] National Climate Change Adaptation Research Facility. NCCARF, 2018.

4.2.2 Other environmental impacts

Overarching requirements

- An environmental Impact Assessment for the facility and its site consistent with local regulations and conducted by an independent third-party expert.
- For hydrogen production using desalination water plants: a brine management plan, developed and approved as within the EIA process, addressing all potential environmental risks and mitigation measures associated with brine disposal and meet the Climate Bonds criteria for desalination plants in the Climate Bonds water sector criteria[52].

In addition, the following specific requirements apply:

a. Pollution prevention
   - For hydrogen produced from fossil resources, emissions must be lower than Best Available Techniques for refining of oil and gas[53].

b. Land use
   - For hydrogen produced from biomass, facilities must meet the requirement 2 in the Climate Bonds bioenergy criteria: Reducing the risk of indirect land use impact[54]

c. Water Consumption
   - A water resource management plan. Specification of when freshwater aquifers will be used, and whether these aquifers are currently used for human consumption. [55]
   - A water-use licence issued by the regional environmental regulator as part of the environmental authorisation process.
   - A local water availability assessment and demonstration that water use for hydrogen production is not impacting water availability for human consumption and agriculture. Hydrogen production assets should not be located in regions with high water stress[56] that do not have seawater desalination as an alternative.

4.2.3 Disclosure Component

In the interests of transparency and disclosure, issuers of Certified Climate Bonds are required to publicly disclose the following in respect of the assets and use-of-proceeds incorporated in that deal:

- The planning standards, environmental regulations and other regulations that the facility has been required to comply with.
- The environmental impacts assessment and the measures to address potential risks

[52] Climate Bonds Water Criteria. 4.2.2. Desalination projects and assets; and Appendix 1, Section 5. Desalination Plants www.climatebonds.net/files/files/Water%20Criteria%20Document%20Final_100822.pdf

[53] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0738&from=EN

[54] Climate Bonds Bioenergy Criteria www.climatebonds.net/files/files/standards/Bioenergy/Bioenergy%20Criteria%20Document%20Mar%202021.pdf

[55] An aquifer that contains fewer than 10,000 mg/L total dissolved solids. U.S. EPA Underground Injection Control Program (2014).

[56] When the demand for water exceeds the supply or when poor quality limits its use

5 Criteria for entities and Sustainability Linked Bonds (SLBs)

NOTE: ***Certification of entities and SLBs will not be possible until the*** *draft Climate Bonds Standard v4.0 has been finalised. This is because* ***the Standard v4.0 includes new, non-sector specific requirements that entity and SLB certifications will need to comply with in addition to the hydrogen-sector specific-criteria below****. Please see here for more information. It is anticipated that the Standard v4.0 will be finalised by the year end.*

The following sections detail similar, yet distinct, criteria depending on what is being certified:

- A whole entity (in this case, a business segment or part of a company producing hydrogen in the scope of these criteria)– ***Section 5.1***
- An SLB issued by an entity that produces hydrogen in the scope of these criteria- ***Section 5.2***

Section e contains methodological notes applicable to both entities and SLBs.

NOTE: ***Current proposals would*** *allow for the certification of only part of a company or group of companies ('the Assessed Entity'), or an SLB that relates to only part of a company or group of companies. See the draft Climate Bonds Standard v4.0* ***Part D Section 2.2*** *for full details here.*

5.1 Sector specific criteria for eligible non-financial corporates

Two tiers of entity certification are available, described in ***Table 6***

Table 6: SLB Tiered Certifications

e	Entity Certification Requirements
Tier 1	**Climate Mitigation Criteria** 1. At the time of certification, the Assessed Entity's hydrogen production facilities average emissions intensity meets the entity level pathway threshold and their future Performance Targets for those facilities to which the bond coupon is linked continue to align with those declining thresholds through to 2050 (see ***Section 4.1, Table 4***); *and* 2. The Assessed Entity's Transition Plan provides credible evidence that those future Performance Targets to 2050 will be met (see the draft Climate Bonds Standard v4.0 (***Part D Section 3.2***) for detailed requirements in respect of the Transition Plan); *and* 3. The Assessed Entity provides sufficient external transparency and assurance in respect of these Performance Targets and Transition Plans (see the draft Climate Bonds Standard v4.0 (***Part D Sections 6 and 7***) for detailed requirements in respect of disclosure and external assurance); *and* 4. If any of the Assessed Entities current of future hydrogen production facilities use alternative feedstocks or alternative fuels, implement electrification or use CCU or CCS, they must meet the respective cross-cutting criteria in ***Section 6***. More details in ***Section 3***, ***Table 2.*** **Adaptation and Resilience Criteria:**

	At the time of certification, all of the Assessed Entity's facilities meet the adaptation and resilience criteria described in ***Section 4.2*** and that is reassessed and reconfirmed every five years during the term of the bond.
Tier 2	The criteria are the same as for Tier 1, except in respect of point 1: The Assessed Entity's hydrogen production facilities average emissions intensity does not meet the emissions intensity threshold at the time of certification, but the future Performance Targets align with those entity-level emissions thresholds by **2030** and continue to align thereafter through to 2050 (see ***Section 4.1, Table 4***)

5.2 Criteria for Sustainability Linked Bonds (SLBs)

Two tiers of SLB certification are available, described in ***Table 7***:

Table 7: SLB Tiered Certifications

Entity Tier	Entity Certification Requirements
e	**Climate Mitigation Criteria** 1. At the time of certification the Assessed Entity's hydrogen production facilities average emissions intensity meets the entity level pathway threshold and their future Performance Targets to 2050 continue to meet those declining thresholds (see ***Section 4.1, Table 4***); *and* 2. The Assessed Entity's Transition Plan provides credible evidence that those future Performance Targets to 2050 will be met (see the draft Climate Bonds Standard v4.0 (***Part D Section 3.2***) for detailed requirements in respect of the Transition Plan); *and* 3. The Assessed Entity provides sufficient external transparency and assurance in respect of these Performance Targets and Transition Plans (see the draft Climate Bonds Standard v4.0 (***Part D Sections 6 and 7***) for detailed requirements in respect of disclosure and external assurance); *and* If any of the Assessed Entities hydrogen production facilities use alternative feedstocks or alternative fuels, implement electrification or use CCU or CCS, they must meet the respective cross-cutting criteria in ***Section 6***. More details in ***Section 3***, ***Table 2***. 4. For any plant becoming operational post certification date, that plant will meet the criteria described in ***Section 6*** from day 1 of commencing operation. Details of this to be provided in the company's transition plan. **Adaptation and Resilience Criteria:** At the time of certification, all of the company's facilities meet the adaptation and resilience criteria described in ***Section 4.2***, and that is reassessed and reconfirmed every five years during the term of the bond.
Tier 2	The criteria are the same as for Tier 1, except: 1. The Assessed Entity's hydrogen production facilities average emissions intensity does not meet the emissions intensity threshold at the time of certification, but the future Performance Targets align with those entity-level emissions thresholds by **2030** and continue to align thereafter through to 2050 (see ***Section 4.1, Table 4***)

6 Cross-cutting mitigation criteria

6.1 Additional criteria depending on the age of the facility

New facilities commencing operation in 2023 or after are eligible only if they implement CCS or CCU when using fossil gas, which is eligible up to 2035. [57]

6.2 Additional criteria depending on the feedstock used

Facilities must meet the requirements listed in ***Table 2*** depending on the feedstock.

Fossil gas is only eligible when combined with CCS or CCU measures.

6.3 Additional criteria depending on the electricity source

Facilities must meet the requirements listed in ***Table 2*** for different electricity sources.

6.4 Additional criteria when using CCS or CCU

Facilities using CCS or CCU must meet the criteria in ***Table 2***. For entire facilities certifications, it is not necessary to demonstrate a minimum capture rate. These emissions must be included in the total GHG accounting.

[57] For entire facilities certifications, it is not necessary to demonstrate a minimum CCS capture rate, given that CCS related emissions must be included in the total GHG accounting. See Box 3.

Appendix A: TWG and IWG members

TWG Members		
Emré Gencer Principal Research Scientist	MIT Energy Initiative	
Clarissa Bergman Fonte Researcher in Energy planning	Federal University of Rio de Janeiro, Brazil	
Cédric Philibert Senior Energy Consultant.	Independent	
Gabriela Nascimento da Silva Hydrogen consultant	KfW (the development bank of Germany)	
Giuseppe Bianchi Senior Professional in Innovation and Decarbonisation	Independent	
Gniewomir Flis Associate, Senior Advisor Hydrogen	Energy Revolution Ventures	
Graeme Sweeney Chair of the Advisory Council	European Technology Platform of Zero Emission	
Joe Powell Senior consultant.	Independent	
Maria de los Angeles Valenzuela Manager Consultant	HINICIO (Chile)	
Marta Lovisolo Advisor on Renewable Energy Systems	Bellona Europa	
Narayan Kumar Associate Director Electricity and Fuels	The Energy and Resources Institute (TERI)	
Patrick Molloy Manager Breakthrough Technologie	Rocky Mountain Institute (RMI)	
Rachel Fakhry Green Hydrogen Sector Lead	Climate Champions. Race to zero UNFCCC	
Zainab Datti Technical Advisor	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	
Zaffar Hussain Project Lead PtX Africa	Agora Energiewende	
ADDITIONAL EXPERTS CONSULTED:		
Herib Blanco Analyst - Hydrogen Energy (Power to X)	International Renewable Energy Agency (IRENA)	

IWG Members	
CWP Global	Hydrogen Europe
Hydrogen Brazil	Green Hydrogen Coalition
IFA (International Fertilisers Association)	Institutional Investors Group on Climate Change (IIGCC)
Sustainalytics	NSW | Point Advisory an ERM Group Company
Bureau Veritas	Rubicola Consulting
Carbon Trust	IHI Corporation