Hinicio

RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

Final report

June 18th, 2024

Prepared for:

Ministry of Economic Affairs and Climate Policy of the Netherlands

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"RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive"

Executive Summary

Report prepared by Hinicio for the Ministry of Economic Affairs and Climate Policy of the Netherlands

June 18th, 2024

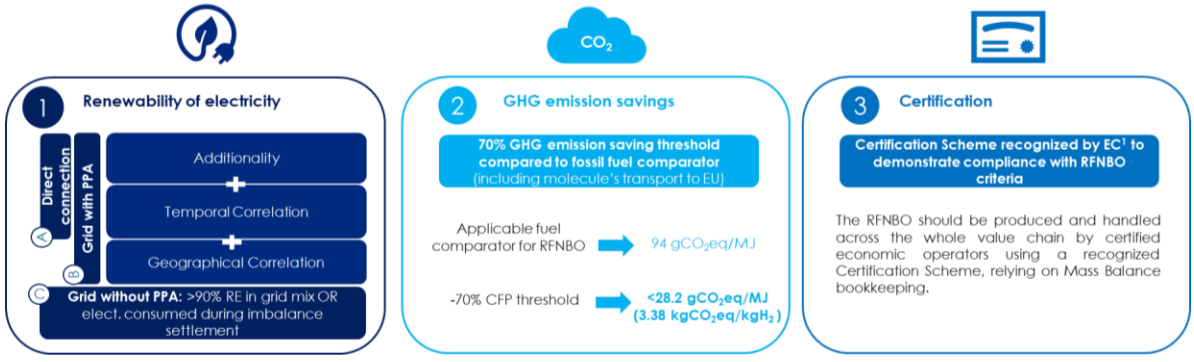
Chile and Uruguay are emerging as key players in renewable hydrogen production and derivates, with numerous Power-to-X projects underway. The government of the Netherlands is establishing international collaboration with a wide range of countries, including countries in Latin America, which have a significant potential to become exporters of hydrogen carriers. Latin America is set to become a hydrogen powerhouse, given its large availability of resources. Dutch stakeholders and ports, such as the Port of Rotterdam, have partnered with both countries to develop hydrogen export corridors.

The H2Global mechanism, with its innovative funding instrument, aims to boost the global hydrogen economy to meet EU climate targets. Projects announced in Chile and Uruguay for exporting to the EU market may potentially participate in the upcoming H2Global's funding window in 2024, supported by the Dutch and the German Governments. Those projects applying to the H2Global's funding window will require compliance with both the Renewable Energy Directive II & III, as well as with Additional Sustainability Requirements (ASR) announced by the H2Global.

Under this context and the collaboration framework that the Netherlands have with Uruguay, the Ministry of Economic Affairs and Climate Policy of the Netherlands requested Hinicio to assess the local conditions for regulatory Renewable Fuels of Non Biological Origin (RFNBO) compliance in Chile and Uruguay, considering also ASR, specifically water and social criteria.

Regulatory and Certification Assessment for RFNBOs in the EU market

The study analyzed the key requirements to consider when developing a project in Chile and Uruguay seeking to export RFNBO's compliant molecules to the Netherlands:



There are three electricity sourcing options allowed, each with specific conditions. Direct connection to a renewable energy generation plant need to comply with additionality and temporal correlation. In the case

of grid connection based with PPA, additionality, temporal and geographical correlation are required. Lastly, grid connection without PPA is also allowed with restrictions based on the renewability of the electricity mix in the bidding zone.

To meet the criterion of geographic correlation and others, the European definition of Bidding Zone needs to be translated into the local context. This translation is based on the Bidding Zone of the European Commission and a technical analysis of the respective country's electricity market and grid.

Uruguayan electricity mix has been more than 90% renewable in four of the last five years with hydro as main electricity supply source, followed by wind and biomass. The country has met the established threshold in those four years. Thus, Power-to-X plants connected to national grid (SIN) can be considered compliant with renewability criterion. In 2022 the grid's carbon intensity was ~17 gCO_2e/MJ, which allows skipping additionality criterion for the following 5 years (until 2027 in this case, relevant for PPA pathway).

Uruguay can be considered as one single bidding zone since its electricity system is integrated and prices are not geographically differentiated, but an official statement in this matter is still required. The country has a National Certification System for Renewable Energy (SCER); GO's (CER's) can be issued with the generated renewable energy and cancelled for RFNBO production purposes. The monthly emitted CER's already present an hourly detail, which facilitates the upcoming requirements of hourly demonstration from 1.1.2030 onwards.

In Chile 56% of the electricity generated in 2022 within the National Electricity System (SEN) was renewable, corresponding to an 11% increase from the previous year. Even if the National Electricity System (SEN) would be considered as one unique bidding zone, it does not comply with the 90% renewability generation requirement. Emissions intensity of the SEN does not allow skipping the additionality criterion (PPA cases). Chile uses the I-Rec Standard to demonstrate renewable origin of electricity. This certificate needs to be bought and cancelled to comply with RFNBO criteria in case of grid connection. I-Rec is still emitted on a monthly basis with monthly data, not on an hourly basis as requested from 2030 onwards. Nevertheless, it is possible to request this information from the transmission operator/energy generator or verify it through smart metering.

The SEN system could be considered a single bidding zone since employs one single pricing methodology, although it shows different marginal prices. The grid suffers congestions due to limited transmission capacities leading to curtailment, low nodal marginal prices (nodal decoupling) and re-dispatch. Therefore, it is recommended to monitor the congested zones and the official statement is also required.

RED compliant RFNBOs need to meet a 70% greenhouse gas emission (GHG) reduction versus fossil fuel comparator (94 gCO_2eq/MJ). Some of the emissions that need to be considered in the GHG calculation are from supply inputs, processing, transport and distribution, combusting the fuel in its end use.

Any source of CO_2 can be used for RFNBO production; but some specific sources can contribute to the carbon footprint (CFP) reduction, depending on their origin according to the regulation. Some sources use have time limitations. One of the sources is the combustion of biofuels, bioliquid or biomass (biogenic CO_2). This type of CO_2 source can be used without any time limit which allows maintaining CFP reduction over time, ensuring RFNBO to be RED II compliant. Both Chile and Uruguay have eligible CO_2 sources, which enables the production of RFNBO compliant hydrogen derivatives.

In Uruguay during 2022 more than 11 Mt/year of CO_2 inevitable emissions are associated to the industrial operation in the country. Cellulose plants are the main source of biogenic CO_2 emissions with more than 9.3 million tons per year of operation, corresponding to nearly the entire available quantity within the country. In Chile, biogenic sources of CO_2 are concentrated in the Biobío region, with more than 7 million tons registered in 2022. These emissions are mainly from the cellulose industry.

At the end of this analyses is concluded that the current main concern of project developers in LAC economies is the translation and validation of Bidding Zone concept and for this key actions are required:

Clear definition of validation of non-EU country specific definition of Bidding Zone; Engage with national Governments to drive the required discussions and deliver all relevant information; Engage with other national Governments of LAC Region to act in an aligned way, facilitating dialogues with importing jurisdictions and promoting regional characteristics and requirements.

Finally, certification must be used to demonstrate compliance with requirements, through a certification system recognized by the European Commission, and employing a Mass Balance emissions tracking model with a Well-to-Wheel approach across the entire supply chain.

Overview of RSB's Additional Sustainability Requirements for H2Global

The report gives an overview on H2Global, a competition-based mechanism that aims to address the existing price gap between low/zero-carbon solutions and conventional products, promoting the ramp-up of clean technologies such as hydrogen. H2Global launched two funding windows in 2023 to support and accelerate Power-to-X projects, financed by the German Federal Ministry for Economic Affairs and Climate Action (BMWK). A new funding window will be launched during 2024 between Germany and the Netherlands.

To ensure sustainability aspects beyond those associated with RED II and III, H2Global bidders must meet Additional Sustainability Requirements (ASR), which outline sustainability criteria for hydrogen derivatives' projects within the H2Global framework. Those are divided into environmental and social criteria and are in line with sustainability Principles & Criteria established by the Roundtable on Sustainable Biomaterials (RSB), which supported H2Global by refining sustainability criteria additional to the RED II and III criteria.

To ensure that project activities comply with those environmental and social standards throughout the project's lifecycle, an Environmental and Social Management Plan (ESMP) must be developed. This is a "living" document that integrates results from the environmental and social impact assessments (ESIA) and mitigation and monitoring plans into a management tool for the project's construction, operation, and decommissioning phases. The ESMP helps ensuring compliance with H2Global guidelines to achieve sustainability goals through continuous monitoring of the project's performance. The study outlines H2Global's Social Requirements, particularly RSB's Principle 5th Rural and Social development aiming to support the social and economic development of local and rural communities. This criterion focuses on labor standards, health and safety, community engagement, and gender equality.

Additional Sustainability Requirements

Environmental Requirements

1. Environmental Impact Assessment (EIA)
2. Environmental & Social Management Plan (ESMP)
3. Water
4. Desalination
5. Conservation
6. No release of toxic substances
7. Waste and pollutant management

Social Requirements

8. Social Impact Assessment (SIA)
9. No forced resettlement/illegal land grabbing
10. Compliance with ILO standards
11. Living wage
12. Access to health services/health insurance
13. Local value creation/competence gains: stakeholder & local SME participation
14. Gender: active involvement of women in project; no gender-based violence/harassment

Based on the United Nations' Human Development Index (HDI), Uruguay and Chile are not considered Regions of poverty. Both countries are members of the International Labour Organization (ILO), which facilitates demonstrating that labour standards comply with the ILO Standards requested by H2Global's. Project developers can provide evidence with Code of Conducts and Contracts, antidiscrimination policies, and interviews with employees to verify labour conditions. Both countries have an institutional and regulatory framework, initiatives, and incentives that promote local value creation, competence gains, gender equity, and living wages, in line with H2Global's Social Requirements.

The study shows that improvement of the socioeconomic status of local stakeholders and encouraging participation of women are supported in both countries, for example, by the H2U Program in Uruguay and

by the Green Hydrogen National Strategy and Green Hydrogen Action Plan 2023-2030 in Chile, initiatives which include measures to support local value creation and gender equality within the development of the green hydrogen market in those countries. These alignments can facilitate project developers ensuring compliance with H2Global's Social Requirements.

The report also examines H2Global's Environmental Requirements, with particular focus on sustainable use of water and RSB's Principle 9th Water. Water management must ensure that its extraction and consumption do not impair the quality or availability of water resources at the project sites. This also includes water impact assessments, water management plans, and regular monitoring to ensure sustainable water use and protection of local water resources. H2Global promotes the use of water-saving technologies and practices to optimize water use efficiency and ensure that hydrogen production does not negatively impact local water supply.

Uruguay presents a significant rainfall system and water availability, relying on both surface and groundwater. The study reports that, according to the WRI Aqueduct Water Risk Atlas, Uruguay is expected to be a low water stressed Region in most of the territory for year 2030, exhibiting suitable conditions for ensuring compliance with H2Global's Additional Sustainability Requirement for Water. Nevertheless, local context for specific project sites must be particularly analyzed, since the impacts on water will depend on specific geographical conditions, local hydrological statistics, the water source chosen such as Aquifers or surface water, among others.

Based on the WRI Aqueduct Water Risk Atlas, Chile is expected to be a high to extremely high water-stressed region in most of the territory by year 2030, therefore compliance with H2Global's requirements for sustainable water use may require further efforts. Considering Chile's extensive coastline, it is expected that seawater will be employed for renewable hydrogen production. Nevertheless, despite the progressive increase in the installation of seawater desalination plants in Chile, it is observed that there is no specific regulation concerning their extraction, processing, treatment, distribution, as well as their use by industrial activities, or for human consumption. Currently, existent regulation is for obtaining maritime concessions or authorizations and they depend on the type of use of water.

Countries like Uruguay and Chile have an opportunity to become exporters of renewable hydrogen and derivatives. Considering this and the assessment carried out on H2Global's ASR, it is recommended for those countries to consider internationally validated environmental and social standards. As a first step to facilitate demonstrating compliance with ASR, the elaboration of guidelines that compare the alignment and gaps between existing national regulations and the requirements outlined by H2Global's ASR in detail is recommended. This might be developed by interested groups such as hydrogen associations or by the public sector. Despite Chile and Uruguay show having high social and labour standards, ensuring compliance with all ASR may require extra efforts, compromising activities beyond the national mandatory requirements, such as development of training programs and initiatives to support gender equality. Although the countries and specific project sites may currently not present water stress levels and therefore compliance with H2Global's Environmental Requirement may be less challenging, projections for future years in different scenarios should be considered. Selecting project sites with guaranteed available water in the long-term water may facilitate water supply.

Final Report

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CONTENT

FINAL REPORT

CONTEXT AND OBJECTIVES

Ramping up the hydrogen market is **key for achieving Global Climate Reduction Goals**

In the wake of the acceleration of the Energy Transition over the last 10 years, **the hydrogen-energy sector is at a turning point in its development at global level. The majority of countries with import and production purposes,** are enhancing their infrastructure and establishing regulatory frameworks to facilitate the large-scale production, transportation, storage, and utilization of renewable hydrogen.

In the recent years, **Latin America has been emerging as a significant player in the hydrogen industry,** owing to its abundant natural resources and therefore competitive renewable hydrogen production. These resources include vast wind and solar power capacities, a largely renewable-based electricity grid, and significant amounts of CO_2 and biomass, essential for the cost-effective production of renewable hydrogen and derivatives.

These aspects have boosted the renewable hydrogen market in the region, and **in countries as Uruguay and Chile, several Power-to-X projects have already been announced.** Many of these projects aim to export to target Regions such as the European Union, thus understanding their regulatory framework will be essential.

Towards a European Green Deal

The European Commission has implemented ambitious targets **for achieving carbon neutrality by year 2050**, increasing the use of RFNBOs –including renewable hydrogen carriers- by 42% in the industry sector and at least 1% in the transport sector by year 2030. Specific standards have been outlined in the **REDII&III and associated regulations such as ReFuelEU Aviation, FuelEUMaritime,** among others.

For reaching those targets, it will be essential for the EU to **collaborate with potential exporting Regions –such as Latin America- and expanding international partnerships,** as it foresees a shortage in meeting its own long-term domestic demand.

Therefore, this study aims to provide a deep **understanding of the EU regulation and certification schemes,** crucial for producers seeking to export RFNBOs made from H_2 and CO_2 (i.e. excluding ammonia) to the Region.

Despite regulatory framework must be analyzed for each project in particular, this work will focus on **providing recommendations for Chilean and Uruguayan stakeholders aiming to export these products to the Netherlands,** considering the agreements in place and collaboration that the parties have announced in the recent years.

> **“900 million euros for the market ramp-up of green H_2”**

THE H2GLOBAL FOUNDATION

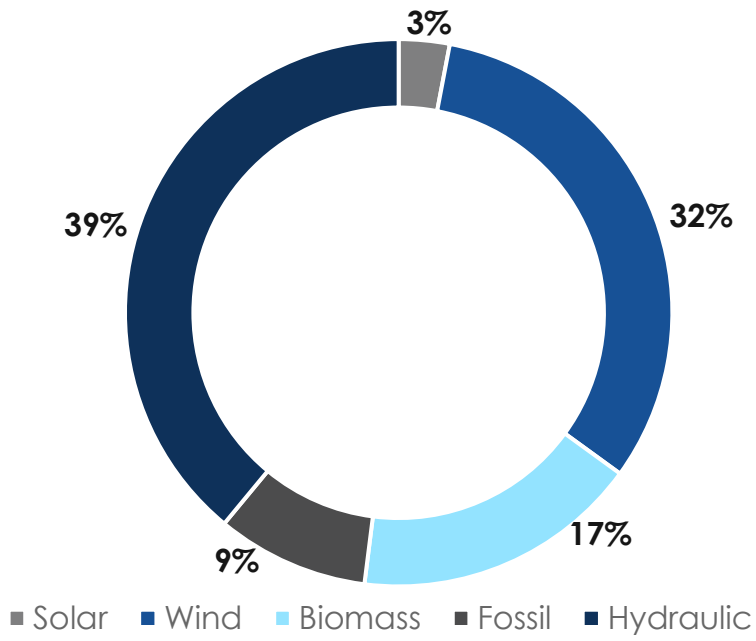
H2Global is a **funding instrument to promote an effective ramp-up of the global Power-to-X market** on an industrial scale. Aiming to accelerate the emergence of markets for clean hydrogen and other zero and low emission technologies, **Hintco acts as an intermediary for both the supply and the demand side (analogue to the Contracts for Difference approach).**
To ensure that projects supported by H2Global ensure environmental and climate protection, the H2Global instrument, supported by RSB, has developed **Additional Sustainability Requirements** that Power-to-X projects must meet. Understanding these requirements will be **crucial for export orientated projects of e-fuels in Latin America** to be recognized with the **highest standards of Sustainability.**

RSB Hintco H2Global Stiftung

Source: H2Global Foundation

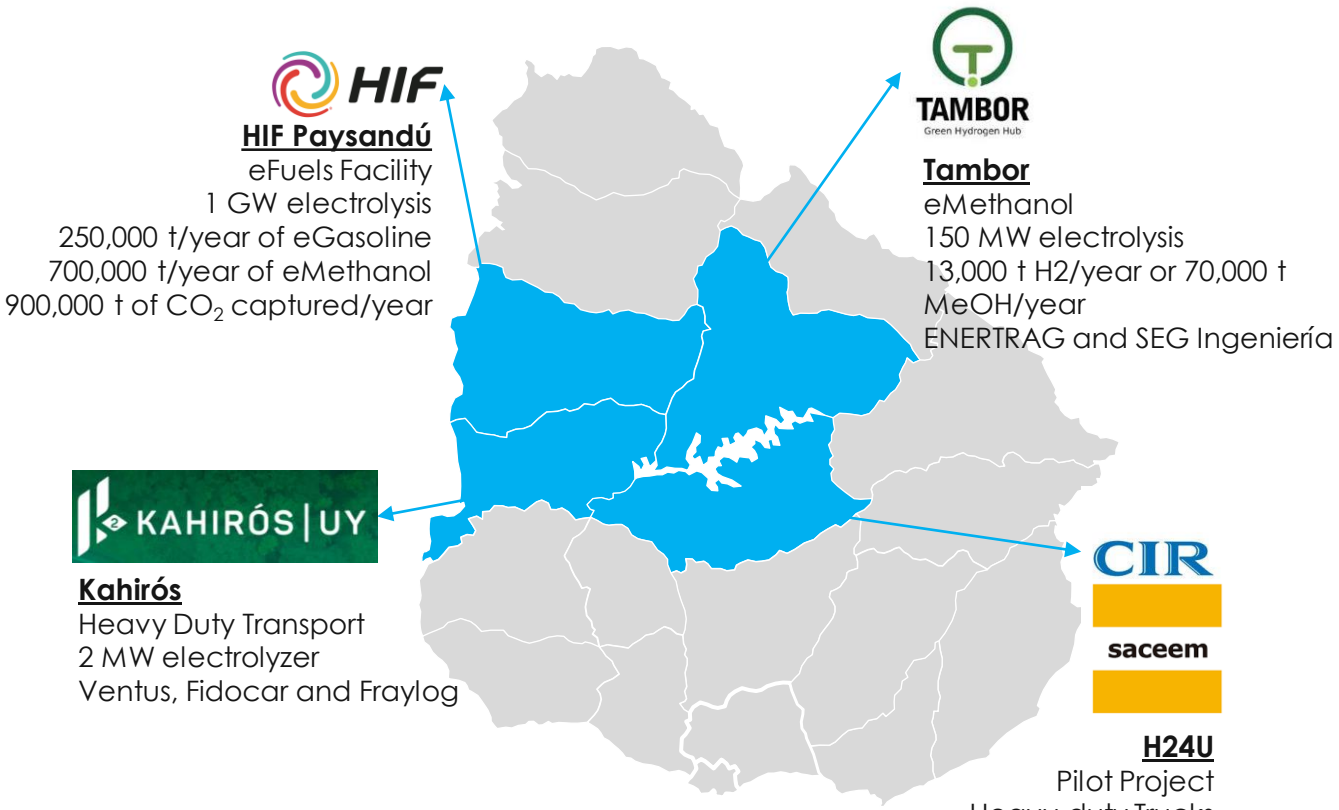
With its highly renewable energy matrix, Uruguay holds significant potential for the development of Power-to-X projects

Electricity generation in Uruguay (2022)



A strong power sector, with 91% RE share, ~5 GW of installed capacity and +300 GW of RE Potential

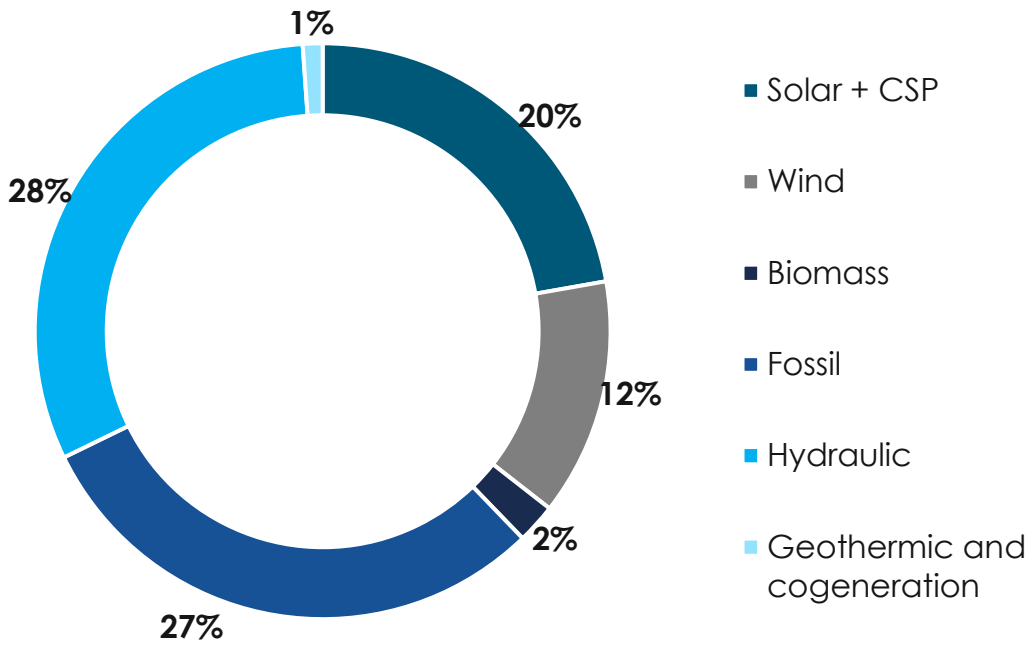
Renewable hydrogen projects announced in Uruguay



Source: Uruguay's National Energy Balance (2022); HIF Uruguay; Comunicación de proyecto Belasay S.A (2021); H2LAC

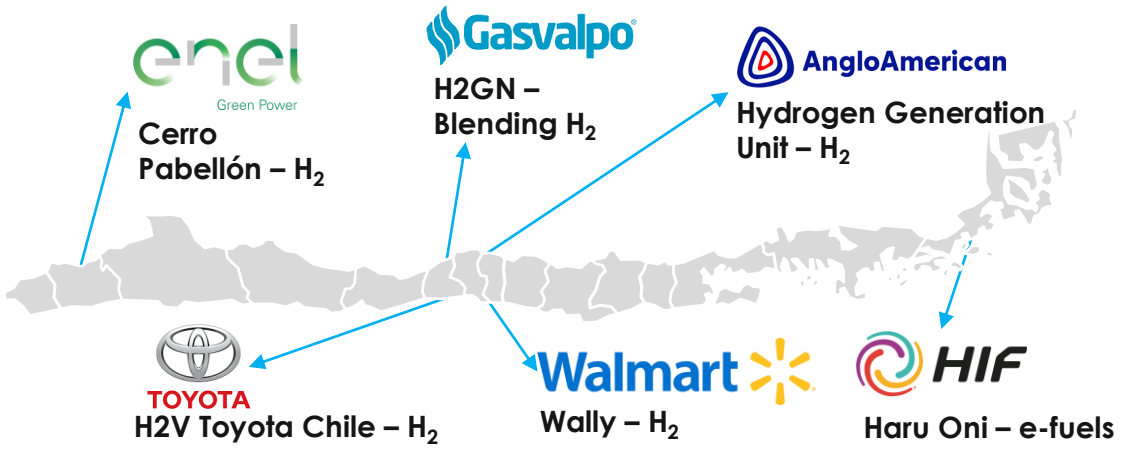
Chile is a long country with abundant renewable resources for the production of renewable hydrogen and its derivates

Electricity generation in Chile (2022)



Until 2022, the electric generation of the SEN was more than 55% renewable. In 2023 it was 64%.

Operational projects in Chile



- Chile is a long country with abundant solar resources in the north and wind resources in the south for renewable energy generation for the production of renewable hydrogen and its derivates.
- To date, 64 projects have been announced, of which 6 are in operation (which are shown in the figure above) and 58 are under development. Of the projects under development, ~45% are for hydrogen production, ~39% are for ammonia production and ~7% are for e-fuels.

Sources: Generadoras de Chile; H2 Chile

The objective of the study is to delve into the RED II & III regulations for RFNBOs and the Additional Sustainability Requirements of H2Global, with a focus on their applicability in Chile and Uruguay

General objective

To analyze the RED II and III requirements and associated Delegated Regulations, ensuring compliance for H_2 derivatives that could qualify as RFNBO and CO_2 sources, as well as other relevant sustainability aspects aligned with H2Global's Additional Sustainability Requirements. Special attention will be given to their applicability in Chile and Uruguay. The aim is to facilitate effective knowledge transfer for Latin American Power-to-X project developers, providing them with a deep understanding of the relevant aspects for developing RFNBO compliant product that will be exported to the European Region, particularly to Netherlands, including recommendations on addressing these requirements from a national perspective.

Specific objectives

1. To provide a comprehensive understanding of the EU's regulatory framework and compliance market for RFNBOs, as well as minimum requirements that projects and products must meet when developing a project in Chile and Uruguay seeking to export to the Netherlands.
2. To analyze the applicability of the European regulation on CO_2 sources and eligibility to be RFNBO compliant.
3. To identify and analyze applicable certification systems recognized under the EU for compliance with RFNBO, including the necessary steps for monitoring, verification, and certification processes in Chile and Uruguay.
4. To understand the basics of H2Global's Additional Sustainability Requirements developed by RSB for H2Global, with a specific focus on the criteria of water sustainability and social and rural development, and the strategies necessary to achieve these best practices in Chile and Uruguay, while contrasting them with existing initiatives in these countries to identify areas for improvement.

ACRONYMS

Acronyms (1/2)

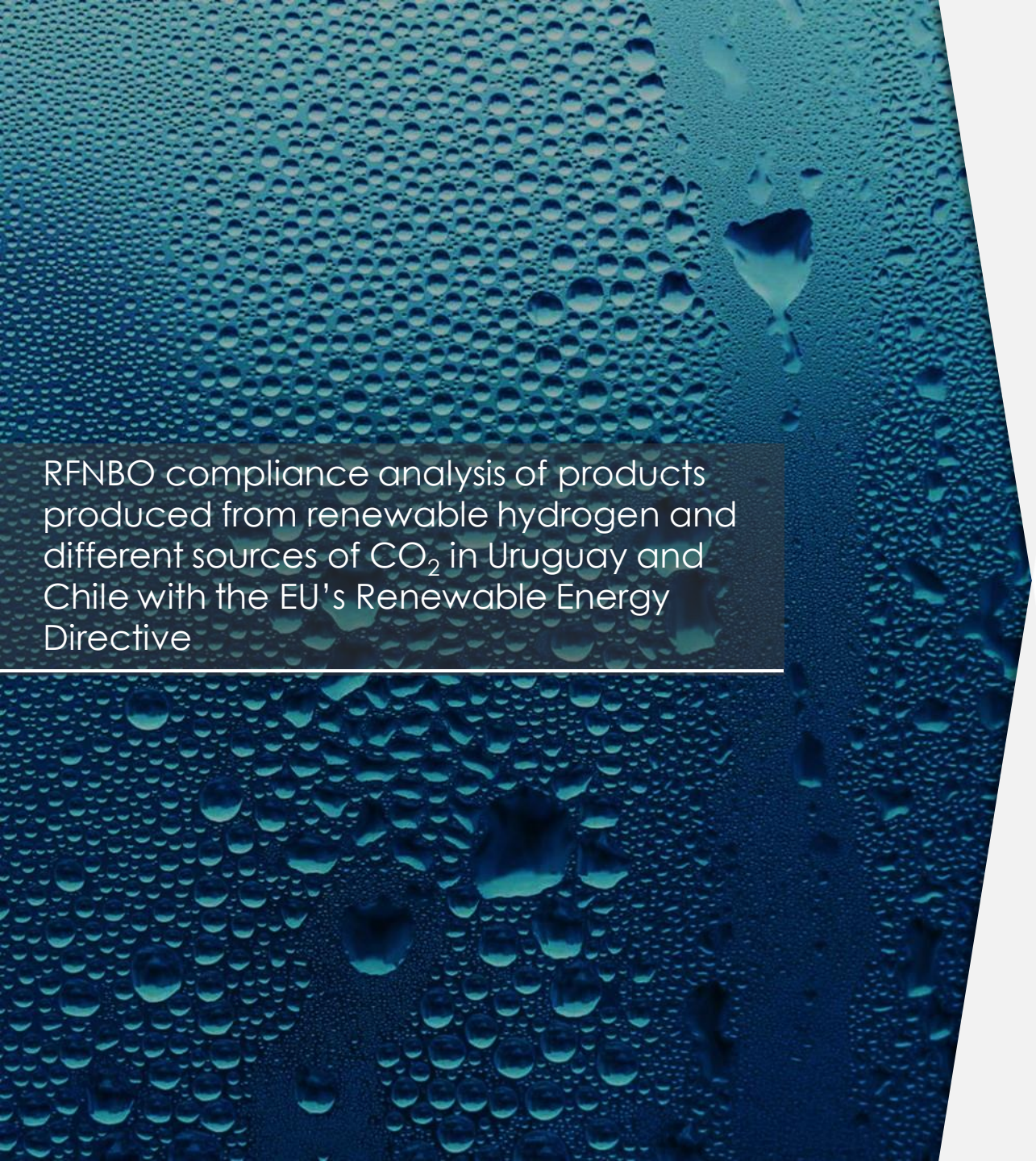
- ACADES: Chilean Association for Water Treatment and Desalination
- ACER: European Agency for the Cooperation of Energy Regulators
- ADME: Uruguayan Electrical Market Administration
- ASR: Additional Sustainability Requirements
- AZE: Alliance for Zero Extinction
- BET: Bureau for Energy Economy and Technical Planning Germany
- CER: Renewable Energy Certificate
- CF or CFP: Carbon Footprint
- CH4: Methane
- CIR: Uruguayan Metallurgical Enterprise
- CNE: Chilean National Electric Coordinator
- CO2: Carbon dioxide
- CONAF: National Forestry Corporation Chile
- CORSIA: Sustainable Aviation Fuel Certification
- CR2: Centre for Climate Science and Resilience University of Chile
- CSR: Corporate Social Responsibility
- DA: Delegated Act
- DAA: Water Use Right Chile
- DEAT: United States Department of Environmental Affairs
- DGA: General Water Directorate Chile
- DIN/VDE: German Technical Norms
- DINACEA: National Directorate of Quality and Environmental Evaluation Uruguay
- DINAGUA: National Directorate of Water Uruguay
- EC: European Commission
- EIA: Environmental Impact Assessment
- EMN: Multi-national Enterprises
- EPA: United States Environmental Protection Agency
- ESIA: Environmental and Social Impact Assessment
- ESM: Environmental Social Management
- ESMAP: Energy Sector Management Assistance Program
- ESMP: Environmental Social Management Plan
- ESMS: Environmental Social Management System
- EU: European Union
- FPIC: Free, Prior, and Informed Consent
- GHG: Greenhouse Gases
- GIZ: German Society for International Cooperation
- GO: Guarantee of Origin
- GW: Gigawatt
- H2: Hydrogen
- H2LAC: Hydrogen Association Latin-America and Caribbean
- H2U: Uruguayan Hydrogen Promotion Program
- H2V: Green Hydrogen
- HDI: Human Development Index
- HPA: Hydrogen Purchase Agreement
- HSA: Hydrogen Service Agreement
- HVDC: High Voltage Direct Current
- IBA: Important Bird Area
- IBAT: Integrated Biodiversity Assessment Tool
- ICMM: International Council on Mining and Metals
- IEC: International Electrotechnical Commission
- IEEE: Institute of Electrical and Electronic Engineers
- IFC: International Finance Corporation
- IGTSS: General Inspection for Labor and Social Security Uruguay
- ILO: International Labor Organization
- I-REC: International Renewable Energy Certificates
- IRENA: International Renewable Energy Agency
- ISO: International Organization for Standardization
- IUCN: International Union for the Conservation of Nature
- LGPA: Uruguayan General Law on the Protection of the Environment

Acronyms (2/2)

- MAE: Mejillones Ammonia Energy, Chilean Green Ammonia producer
- MIEM: Ministry for Industry, Energy and Mining Uruguay
- MINVU: Ministry of Housing and Urbanism Chile
- MP10: Category of Particle Matter in Chile
- MS: Member States
- MVOTMA: Ministry of Housing, Land Use Planning and Environment Uruguay
- MW: Megawatt
- N2O: Nitrous oxide
- NACE: Statistical Classification of Economic Activities in Europe
- NH3: Ammonia
- OCC: Climate Change Observatory
- OECD: Organization for Economic Cooperation and Development
- PIT-CNT: Inter Union Association and National Workers Convention Uruguay
- PPA: Power Purchasing Agreement
- PRC: Communal Regulator Plan
- PREMVAL: Metropolitan Regulator Pan Valparaiso
- PRIBCA: Intercommunal Regulator Plan Borde Costero de Antofagasta
- PRMC: Metropolitan Regulator Pan Concepcion
- RAMSAR: Wetland Convention
- RCF: Renewable Carbon Fuels
- RE: Renewable Energy
- REDII: European Renewable Energy Directive 2
- REDIII: European Renewable Energy Directive 3
- RES: Renewable Energy Sources
- RFNBO: Renewable Fuels of Non-biological Origin
- RSB: Roundtable on Sustainable Biomaterials
- RTFO: Renewable Transport Fuel Obligation (United Kingdom)
- SAF: Sustainable Aviation Fuel
- SCER: National Certification System for Renewable Energy Uruguay
- SDG: Sustainable Development Goals
- SEA: Aysén Electrical System
- SEC: Chilean Superintendency of Electricity and Fuels
- SEIA: Environmental Impact Assessment Service
- SEM: Magallanes Electrical System
- SEN: National Electrical System - Chile
- SIA: Social Impact Assessment
- SII: Internal Revenue Service Chile
- SME: Small and Medium Enterprises
- SNAP: National System of Protected Areas Uruguay
- UE: European Union
- UN: United Nations
- UNDRIP: United Nations Declaration on the Rights of Indigenous Peoples
- UNESCO: United Nations Educational, Scientific and Cultural Organization
- URSEA: Uruguayan Regulatory Unit on Energy and Water Services
- UTE: Uruguayan National Administration of Power Plants and Electric Transmissions
- WRI: World Resource Institute

WORK PACKAGE 1

Regulatory and Certification Assessment for RFNBOs in the EU market



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP1

1.1 Overview of RED II & III and DA regulations for RFNBO

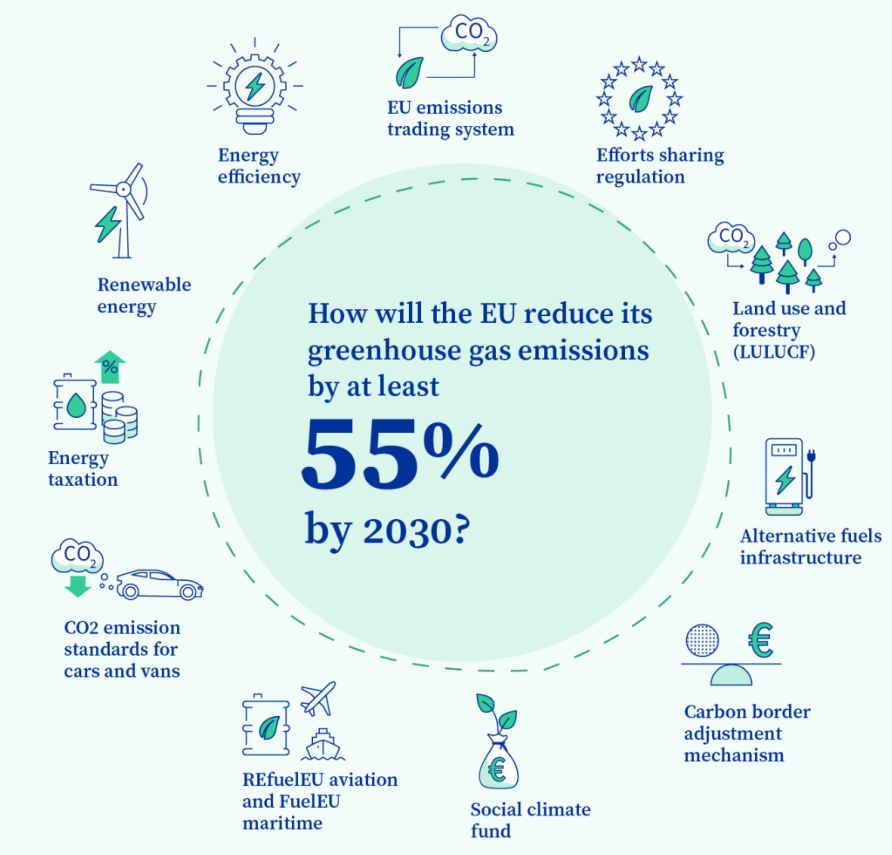
1.2 CO2 requirements under RED II & III and DA for RFNBO

1.3 Certification systems assessment for RFNBO product

1.4 Recommendations for compliance with RFNBO requirements in Chile and Uruguay

EU launched "Fit for 55“, aiming to reduce its GHG emissions by 55% by 2030 compared to 1990 levels and to be net-zero by 2050

How will the EU translate its climate goals into legislation?



Source: European Commission, January 2023

- In July 2021, the European Commission adopted a package of legislative proposals aimed at **revising and updating existing EU legislation** while introducing new laws.
- Key solutions for decarbonization in this context include renewable energy, clean fuels and H2, used as industrial feedstock, and for mobility applications such as heavy-industry transport, maritime transport, and aviation.
- **Six cross-cutting legislative proposals** are relevant to H_2 and its derivatives:

1. Emission Trading Scheme: **ETS**[1]
2. Imports: Carbon Border Adjustment Mechanism: **CBAM**[2]

Carbon Pricing

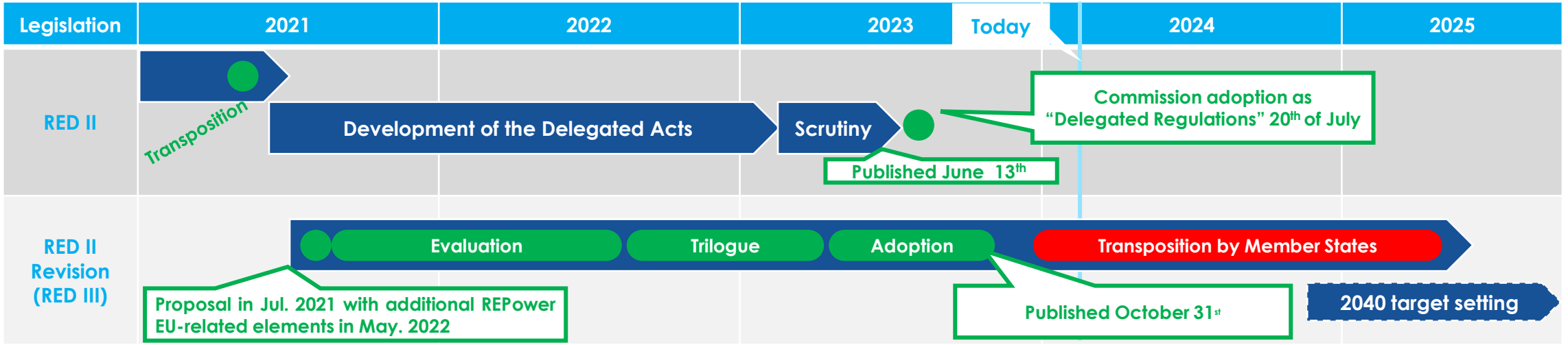
3. Maritime Fuels: **FuelEU Maritime**[2]
4. Aviation Fuels: **ReFuelEU Aviation**[2]
5. Renewable Fuels for Transport: Renewable Fuels of Non-Biological Origin - RFNBO (**RED II & III**)[2]
6. Renewable Raw Material for Industry: RFNBO (**RED III**)[2]

Clean fuels/ renewable energies

[1]Law Amendment
[2] New Law Proposal

The Renewable Energy Directive (RED II & RED III) shall drive the uptake of renewable energy (RE) in the EU economy, including H_2

- Introduced in 2009, the **Renewable Energy Directive (RED) is the main regulation driving the uptake for renewable energies in Europe.** Its revision was one of the key elements of the 'fit for 55' package published in July 2021, in which it was included:
  - Definition of the different eligible renewable fuels to reach the targets in transport and industry including the **Renewable Fuels of Non-Biological Origin (RFNBOs[1])** encompassing renewable hydrogen and derivatives, according to Articles 25 – 30.
  - Definition of the **detailed requirements for RFNBO production (through Delegated Regulations (DR)).**
  - **Creation** of **demand for RFNBOs** through binding and indicative targets:
    - For RFNBO hydrogen **in industry[2].**
    - For RFNBO fuels (hydrogen & derivatives) **supplied to the transport sector**.
    - For RFNBO (hydrogen & derivatives) **supplied to the heating & cooling sector (indicative non binding target)**.
  - Definition of specific **sub-targets and multiplicators that prioritize RFNBO consumption** (hydrogen & derivatives) **stimulating their market value and uptake**.
- The new version of the Directive (RED III) was adopted in October 2023, setting increased overall and sector-specific targets.
- As a Directive, this regulation will have to be transposed in the MS[3] national jurisdictions (by adopting and/or strengthening these targets) within 18 months after adoption.



[1] **RFNBO:** Liquid or gaseous fuels, the energy content of which is derived from renewable sources other than biomass (Source: Directive (EU) 2023/2413, Art. 2.(36)).
[2] **Industry:** undertakings and products that fall under sections B, C, and F and under section J, division (63) of the statistical classification of economic activities (NACE REV.2), as set out in Regulation (EC) No 1893/2006 of the European Parliament and of the Council).
[3] **MS** = Member States

Sources; DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

Renewable Energy Directive RED II revision (RED III)

Introduces targets on share of renewable energy in Industry

European Commission Proposal

Increased targets:

- Global objective of **40% share of energy from renewable** sources in gross final consumption of energy in 2030
- RED II 2030 target on RES in transport replaced by **target on emission savings (13%) equivalent to an increase from 14% to ≈28% RES** (energy content)
- Establishment of minimum target of **2.6% for RFNBO (energy content) use in the transport sector by 2030, supporting use of green ammonia as a shipping fuel.**

Specific targets for Industry and Heating & Cooling sectors:

- Addressing **renewable energy use in industrial sectors**, such as iron and steel, aluminum, chemicals, fertilizer (including ammonia) and cement, and construction
- Member states to ensure that, **by 2030, 50% of the H_2 used by industry is compliant with RED II criteria**
- Indicative (non-binding) target to **increase renewable energy use in heating and cooling sectors by 1.1%** per year from 2030

European Parliament and Council positions

Targets *(2030)*	Commission proposition	Council proposition	Parliament proposition
RE Share	40 %	40 %	45 %
Emissions savings in Transport	13 %	13 %	16 %
RFNBO subtarget	2.6 % (RED III) 5 % (RePowerEU)	5.2 %	2.6 % (2028) 5.7 % incl. 1.2% for maritime (2030)
RFNBO in industry	50%	35 % (2030) 50 % (2035)	50 % (2030) 75 % (2035)

RED II & III and Delegated Regulations set RNFBO, Biofuel and Recycled carbon fuels (RCF) targets for Transport, Industry and Heating and Cooling sectors

Directives	Main requirements	Fulfilment options
REDII	Binding targets on **renewable fuels in Transport – 14% by 2030 - with intermediary targets set by the EU MS**	This target can be reached by low-carbon fuels, such as **RNFBO's and recycled carbon fuels (RCF[3]) as well as biofuels[1]** and **advanced biofuels[2]**.
RED II Delegated Acts	**Definition of requirements to be considered a renewable fuels of non-biological origin (RFNBO)**	Hydrogen coming from electrolytic hydrogen must fulfil specific criteria (emissions reduction, power sourcing) to be considered an **RNFBO**.
RED III	Binding targets on **GHG emission reduction for Transport – 14.5% by 2030** **OR** **Renewable Energy Share for Transport – 29% by 2030**	This target can be reached by low-carbon fuels, such as **biofuels**, **advanced biofuels**, **RNFBOs, and by RCF.** Member States can choose between one of the two targets
	Binding targets on **share of renewable fuels (RFNBO) and advanced biofuels in Transport – 5.5% by 2030 (including 1% of RFNBO)**	The target can be reached by **advanced biofuels** and **RFNBO's**, while 1% needs to be reached by using RNFBO-compliant hydrogen as a fuel (H2, NH3, MeOH, and e-fuels) or by using RFNBO hydrogen for desulphurization of fuels in refineries.
	Binding targets on **RFNBOs in Industry – 42% by 2030, 60% by 2035 / and Indicative targets of** RE **in Heating & Cooling.**	Replacement of fossil-based hydrogen by **RFNBO** hydrogen and derivatives in Industry; and **renewable energy (incl. RFNBO) & RCF** in Heating & Cooling.

[1] **Biofuel:** Liquid fuel for transport produced from biomass (Source: Directive (EU) 2018/2001, Art. 2.(33))
[2] **Advanced Biofuels:** Biofuels that are produced from the feedstock listed in Part A of Annex IX (Source: Directive (EU) 2018/2001, Art. 2.(34)), generally waste bio-feedstocks.
[3] **RCF (Recycled Carbon Fuels):** Liquid and gaseous fuels that are produced from liquid or solid waste streams of non- renewable origin which are not suitable for material recovery in accordance with Article 4 of Directive 2008/98/EC, or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations (Source: Directive (EU) 2018/2001, Art. 2.(35)).

Hinicio

Sources; DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

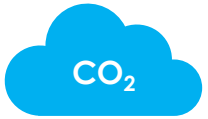
Requirements for renewability, CFP[1] calculation & certification have been detailed in Delegated & Implementing Regulations

To be **RED compliant, an RFNBO** needs to:

- Fulfill the criteria for renewability and GHG emissions reduction compared to fossil fuel-based alternatives
- Be certified under a Voluntary Scheme recognized by the European Commission relying on Mass Balance

1 Renewability of electricity

- **Direct connection** (A)
- **Under PPA** (B)
  - Additionality
  - \+ Temporal Correlation
  - \+ Geographical Correlation
- (C) **Outside PPA:** >90% RE in grid mix OR elect. consumed during imbalance settlement



2 GHG emission savings

70% GHG emission saving threshold compared to fossil fuel comparator

Applicable fuel comparator for RFNBO → 94 gCO2eq/MJ

-70% CFP threshold → **<28.2 gCO2eq/MJ (3.38 kgCO2eq/kgH2)**

3 Certification

Certification Scheme recognized by EC[2] to demonstrate compliance with RFNBO criteria

The RFNBO should be produced and handled across the value chain by certified economic operators using a recognized Certification Scheme, relying on Mass Balance bookkeeping.

[1] CFP = Carbon Footprint
[2] EC = European Commission

Sources; DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

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To be **RED compliant, an RFNBO** needs to:

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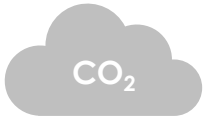
- Be certified under a Voluntary Scheme recognized by the European Commission relying on Mass Balance



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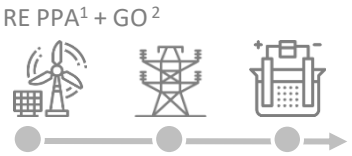
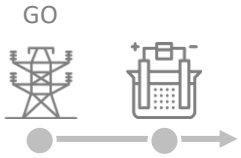
Different electricity sourcing options allowed, each with specific conditions to claim a molecule as RFNBO

Pathways	Scenario	Electricity supply for H_2 production	Hydrogen type	Percentage of renewable hydrogen	Additional renewability conditions / elements to be considered
A	**Direct connection**			**100%**	• Additionality • Temporal correlation • 70% GHG emissions saving
B	**Grid based with a Power Purchase Agreement (PPA)**			**100%** Up to the **power consumption of electrolyzer production that is covered** by the PPA.	• Additionality • Temporal and Geographical correlation • 70% GHG emissions saving
C	**Grid-based without PPA but with > 90%* Renewable Energy (RE) in the consumption mix**			**100%** To the extent that the **electrolyzer ratio of full load hours does not exceed the share of RE** in the bidding zone gross consumption mix **as per 1 year before production**	(*) RES share of over 90% demonstrated in at least one year within the previous five years in the bidding zone • 70% GHG emissions saving.
	Grid based without PPA with less than 90% RE grid mix			**X%** **X% of RE** in bidding zone **production mix 2 years prior** to production.	• 70% GHG emissions saving.

 Renewable energy (RE) production asset (excl. biomass)

 Grid

 H_2 production asset / electrolyzer

 Renewable Fuel of Non-Biological Origin (RFNBO)

 Mix of RFNBO H_2 and conventional H_2

[1] PPA: Power Purchase Agreement (PPA not required in case that RE asset is owned by the fuel producer).
[2] GO: Guarantees of Origin (renewable energy certification), hourly data required from 1.1. 2030 onwards.

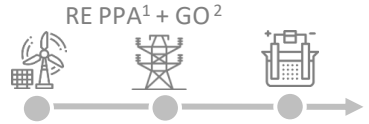
Sources: DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).
(*) Article 2, point (65), of Regulation (EU) 2019/943 of the European Parliament and of the Council (2019).

Electricity sourcing pathways A and B need to comply with 3 key criteria

A **Direct connection**

Renewable electricity sourced from an offgrid-plant directly connected to the electrolyzer (and not connected to the grid, or with a smart metering showing that power was not drawn from the grid), with a production that is at least equivalent to the amount of electricity claimed as fully renewable.

B **Grid based with a Power Purchase Agreement (PPA)**



Renewable electricity sourced through one or several Power Purchase Agreements (PPAs) which are not owned by the H2 production facility owner, for an amount of electricity at least equal to the amount of electricity that is claimed renewable[1]

ADDITIONALITY

1. The RES installation came into operation or was repowered **maximum 36 months before the electrolyzer.**

AND

2. **Pathway B:** Installation generating the electricity has **not received capex nor opex support** (unless fully repaid) **(applies from 01.01.2028)[2].**
   - **Exception:** Support for land and grid connection.

AND

3. **Pathway B:** Repowered RES plants are considered additional when **repowering investments > 30%** of the original investment.

- **Exception from additionality Pathway B:** in bidding zones where the emission intensity of electricity **is below 18 gCO2eq/MJ**, additionality is not required (i.e. a grid with high hydro share). Once threshold is reached: considered fulfilled for the subsequent five calendar years.

TEMPORAL CORRELATION

1. The electricity from the PPAs is **consumed** by the electrolyzer **within the same hour[3] (applies from 01.01.2030).**

OR

2. The electricity from the PPAs is **stored behind-the-meter within the same hour.**

OR

3. The electricity from the PPAs is consumed when the **clearing price of electricity** resulting from single day-ahead market coupling in the bidding zone **is ≤ 20 €/MWh or ≤ 0,36 x price of an EU CO2 allowance.**

GEOGRAPHICAL CORRELATION

Pathway A:
Geographical correlation is not **required for RE direct connection (pathway A).**

Pathway B: The RES installation and the electrolyzer (EZ) are in the **same bidding zone.**

OR

2. The RES installation and the EZ are in **interconnected bidding zones** and the **day-ahead price on the RES installation side is equal or higher** than the price on the EZ side.

OR

3. The RES installation is in an **offshore bidding zone interconnected** with the bidding zone of the electrolyzer.

[1] If the respective electricity grid **system has Guarantees of Origin** (GOs) **in place**, GOs must be **bought and cancelled** for RFNBO production purpose covering the total consumption amount.
[2] **Grand-fathering**: projects that start operation before **01.01.2028** will benefit from the transitional rules **until 01.01.2038.**
[3] **Before 01.01.2030:** Monthly matching (calendar month); No grand-fathering; MS may already apply **hourly matching from 01.07.2027** following a notification by the EC.

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Sources; COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

Grid-based plants without PPA: RFNBO compliance depends on demonstrated renewability share of the grid

Electricity mix from the grid without PPA

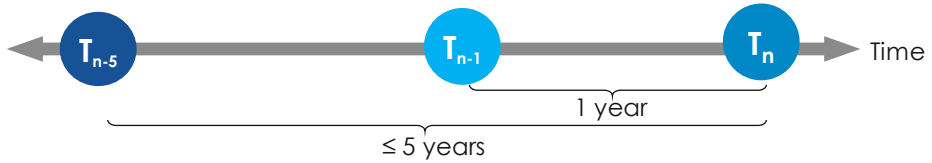
Grid-based without PPA but with > 90% Renewable Energy (RE) in the consumption mix

OR

Grid based without PPA with less than 90% RE in the grid mix

Grid-based outside of a PPA with > 90% Renewable Energy (RE)[2] in the consumption mix. For hydrogen produced to be considered 100% renewable, the electricity sourced from the grid must meet the following criteria:

1. Grid consumption takes place within a **bidding zone that has achieved a RES share of over 90% for at least one year within the last five years preceding production**, and the production does not exceed a maximum number of hours set in relation to the proportion of renewable electricity in the bidding zone[2].
   - Once the **90% threshold** is reached, it will be **considered fulfilled for 5 years** (in which 100% of production can be considered RFNBO compliant).



T_n= Year of hydrogen production
T_{n-1} = Year in which the RE share must be evaluated to ensure that the electrolyzer's load factor in year Tn does not exceed this percentage value.
T_{n-5} = Defined timeline in which the RE share shall be at least in 1 year >90% to consider 100% of the H2 production (Tn) as RFNBO.

Grid-based outside of a PPA with < 90% of grid renewability[2]. Electricity consumed during imbalanced settlement or share of hydrogen that will be considered renewable is equivalent to the renewability of the bidding zone production mix 2 years preceding production.

1. To be considered 100% renewable, the electricity used to produce H2 must be consumed during an imbalance settlement during which power-generating facilities using RES **were downward redispatched and the electricity consumed is reducing the need for redispatching by a corresponding amount.**

OR

2. With less than 90% of grid renewability, the challenge will be to achieve the 70% reduction in greenhouse gas (GHG) emissions, since the Carbon Footprint (CFP) is calculated as the average of the total production amount (see next slides).

T_n= Year of hydrogen production
T_{n-2} = Year in which the RE share must be evaluated to determine the percentage of the produced H2 as RFNBO.

[1]If grid **system has in place Guarantees of Origins** (GOs) emitted with the power, GOs must be **bought and cancelled** for RFNBO production purposes for the total energy consumed.
[2] It includes the share of all energy defined as renewable by regulation, **including energy from biomass sources and energy imports, and excluding energy exports.**

Hinicio

Sources; DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

High level assessment of the local power market structures and their compliance with RED II & III

To meet the criterion of geographic correlation, the European definition of Bidding Zone needs to be translated into the local context

Bidding Zone Concept

- To meet the geographic correlation, the electricity injection and withdrawal points need to be within the same/equivalent bidding zone (or an equivalent concept for third countries).
- ***Bidding zone (BZ):*** "largest geographical area within which market participants are able to exchange energy **without capacity allocation** (capability of the interconnected system to accommodate energy transfer between bidding zones) [1]
- In Europe, the term "**copper plate**" is used to refer to a bidding zone, meaning **electricity can be transmitted without any restriction across a determined area.**

Q&A statement for implementation of BD concept

- The Annex "Implementation of bidding zone concept" from the Q&A released by the European Commission states that, **for the implementation of BZ, the following approach should be applied**:
  - "Certifiers should assess whether at the location of the electrolyser, market regulations applied are similar to the rules set out for bidding zones in Regulation (EU) 2019/943. In this context "similar" means that there are rules requiring establishing hourly prices for electricity in a geographical area. If such rules are in place, the geographical area for which the prices are established should be considered as a bidding zone.
  - If the electricity network of the country is integrated and there are no geographically differentiated electricity prices, the whole country may be considered as one bidding zone"

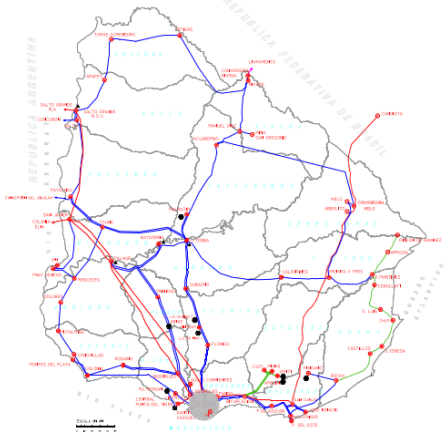
To determine the REDII and REDIII compliant equivalent concept of the European Bidding Zone definition, a technical analysis of the respective country's electricity market and grid is required.

Sources:
[1]Article 2, point (65), of Regulation (EU) 2019/943 of the European Parliament and of the Council (2019); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023);
[2] Q&A implementation of hydrogen delegated acts (14/03/2024), European Comission (This report summarises the outcome of those meetings and does not create any enforceable right or expectation … it should be regarded as a 'living tool' open for improvement and its content may be subject to modifications without notice"-

Chilean and Uruguayan transmission systems exhibit radial characteristics and have major differences with the EU's system

Bidding zone compliance

Uruguayan transmission System (SIN)



The Uruguayan transmission system currently has **radial characteristics**, but efforts are underway to strengthen and enhance its resilience.

Based on ADME's (Electric Market Administration) information, there is **only one spot price sanctioned hourly** for the entire market.

In general, **the grid capacity exceeds peak demand,** avoiding **congestions of the transmission lines**.

Chilean transmission system (SEN)[1]

The **Chilean** transmission system has **radial characteristics** due to its great length. It links consumption and generation poles by transmission lines which have few interconnection points.

Day-ahead hourly prices are determined by the demand of each node (substation) and generation units are dispatched centrally by the National Electric Coordinator (CNE).

The **grid suffers congestions** due to a lack of enough transmission capacities, specifically in the North where multiple RE plants need to feed-in high electricity amounts which exceed available capacity, leading to curtailment and prices zero.

European interconnected system (ENTSO - E)

The European transmission system is **meshed**, with consumption and generation points evenly distributed throughout.

The pricing methodology within Europe is generally defined by Member States.

This characteristic increases the number of transmission possibilities and helps **prevent congestion**.

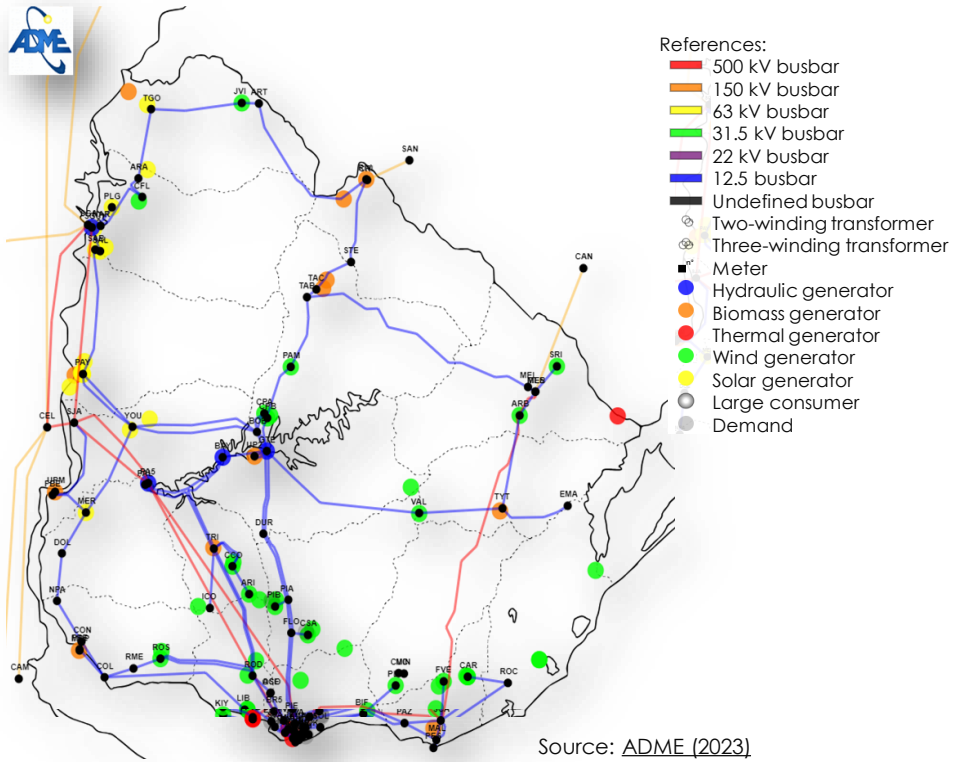
[1] The Regions of Magallanes (one of Chile's HUBS where several Power-to-X-projects are being developed) and Aysén, in Southern Chile, are not part of the Interconnected Electricity System SEN; they are isolated systems.

Sources: Uruguay Power System Flexibility Assessment (IRENA, 2018); National Electric Coordinator (CNE).

Uruguay can be considered a single bidding zone since, despite nodal spot prices, it shows no congestion and a single hourly price

Uruguayan Electrical Power Market

- One public entity, the **UTE (National Administration of Power Plants and Electric Transmissions)**, is **in charge of the transmission and distribution** of the electricity in Uruguay, where any public or private entity can participate. Therefore, the Uruguayan electrical power market operates as a **centralized market**.
- The **ADME** (Electric Market Administration) is **in charge of the administration** of the wholesale electrical market under two main principles:
  1. Allow the execution of contracts freely agreed between the parties.
  2. Dispatch the required demand, considering the optimization of the National Interconnected System, based on the recognition of energy and power prices according to the criteria and values established in the Law 16.832 of the country.
- The **purchase and sale of electricity** in the short-term, concentrated in the Spot Market, is **hourly with nodal spot prices** reflecting the short-term marginal cost.
- According to the information regarding sanctioned spot prices available at ADME's platform, there is **only one spot price sanctioned hourly** for the entire market (same nodal spot prices for all nodes).



Source: ADME (2023)

- *When analyzing the technical restrictions of the system, it is observed that Uruguay has a single hourly spot price for the entire system, which at the same time demonstrates that Uruguay's transmission system shows no signs of electrical congestion and that there is not re-dispatch of the generation capacity.*
- ***For the purposes of this analysis and considering the market's characteristics based on the Q&A information presented by the European Comission, it is concluded that the entire system is very likely to be treated as one single bidding zone since "the country is integrated and there are no geographically differentiated electricity prices".***

Sources: Title III – *Spot Market: Reglamento del mercado mayorista de energía eléctrica* published in 2002 (Official Information Center); Law N° 16,832 (Official Information Center).

The SEN system could be considered a single bidding zone; however, further analysis is recommended due to re-dispatch of capacity

Chilean Electrical Power Market

- **Day-ahead hourly prices are determined by the demand of each node (substation)** and generation units are dispatched centrally by the National Electric Coordinator (CNE). Therefore, the Chilean electrical power market operates as a **centralized market** under the category "Marginal nodal price or generator nodal price".
- **Merit Order system:** Generating units are **ordered according the marginal cost of production ($/MWh).** Generating units are dispatched from the most economical to the last one required to meet the demand in each of the nodes (substations) of the transmission system. If there are technical constraints that make it impossible to dispatch according to the merit order of the system, a nodal redispatch of the generation units exists ("**digital twin of the electrical system**").
- A 500 kV HVDC transmission line is planned from Antofagasta to the Metropolitan region, which will expand the network's capacity + reduce congestion (start of construction 2025-2026).
- Both the **Magallanes and Aysén systems** are medium centralized markets operated by Edelmag and Edelaysen de Saesa, respectively. This companies are responsible for generation, distribution and transmission. Pricing is done at average cost and has similar values for all nodes of the systems; therefore, it can be concluded that no energy redispatches occur. However, both also have major expansion projects underway to support the scale of projects expected in the region. Thus, it is concluded that the current state of the network is not definitive, and a **detailed analysis of the future or projected grid is required to gather conclusive information on the bidding zones in this area.**

- *Chile's electricity market operates on a nodal **day-ahead hourly prices**, categorized as "Marginal nodal price". **Since the SEN system employs a single pricing methodology centralized by the CNE, it can be considered a single bidding zone according to the European Commission's Q&A** ("the geographical area for which the prices are established should be considered a bidding zone.")*
- *However, technical restrictions reveal re-dispatch of generation capacity and curtailment in many congested nodes, so **further analysis is recommended on this topic. An official statement on this matter, and its approvement by the European Commission, is still required to assume the bidding zone.***

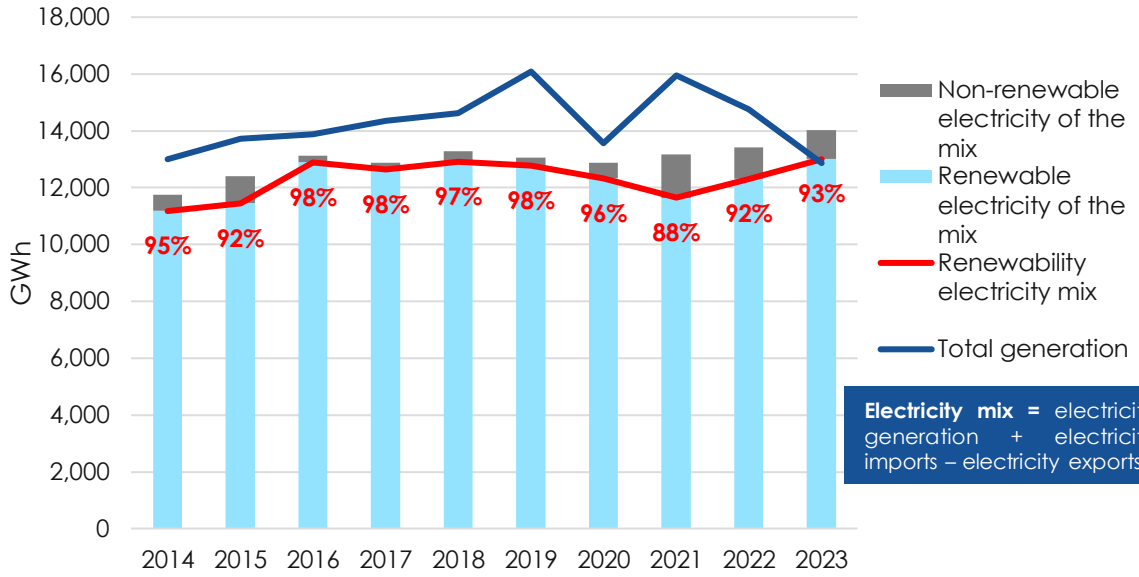
Sources: Generadoras de Chile; Conexión Energía (2023)

H_2 projects connected to the Uruguayan grid under Pathway C[1] could consider 100% of their consumed electricity as renewable

Grid renewability compliance

- In the case of Uruguay, the electricity consumption of 2022 was more than 13,000 GWh, with 92% from renewable sources.
- The **primary renewable energy source is hydroelectric generation**, followed by wind and then biomass[2]. The difference between the RE generation and the electricity demand is complemented with thermoelectric energy generation and import of electricity from neighbor countries, Brazil and Argentina (MIEM, 2024).
- Considering the renewability of the system, if the total SIN is considered as a bidding zone, Uruguay **has a grid with 90% or more of RE generation in at least one of the 5 past years.** In fact, more than three of the last five years meet >90% renewable generation.
- **Under this scenario, all projects located in Uruguay connected to the national interconnected grid (SIN) can be considered as complying with the renewability criteria, thus ensuring that 100% of their H_2 production is RFNBO compliant, while at the same time facilitating the product to be RED II compliant as it potentially allows a 70% reduction in emissions. This is possible as long as the number of full load hours of the electrolyzer does not exceed the proportion of renewable electricity in the grid from the previous year (e.g. In 2024 an electrolyzer connected to the Uruguay grid can only operate 0.92*8,760=8,059 hours).**
- **Uruguay has a National Certification System for Renewable Energy (SCER).** This Guarantees of Origin (GOs) emitted with the power must be bought and cancelled for RFNBO production purpose on the full power consumption scope.

Electricity mix in the Uruguayan grid, 2014-2023



Electricity mix = electricity generation + electricity imports – electricity exports

Note: The year **2021** is identified with **low hydraulic generation** and an **increase in exports**. Like Argentina and Brazil, Uruguay suffered the impact of a drought since 2020, resorting to **greater use of fossil** generation to cover national and export demand. This explains the reduced renewability of the electricity mix for the given year.

Uruguay's grid has a slight variation in the RE share over the years. As previously explained, even though RE targets are fulfilled for a period of five years once achieved, the EZ load factor cannot exceed a maximum number of hours relative to the proportion of RE in the bidding zone.

Thus, if the RE share of the grid varies, there will also be an impact on the overall production. In these cases, PPAs can be used to improve EZ utilization rates. However, seeking access to PPAs of varying amounts from year to year may be challenging.

[1]Grid without PPA

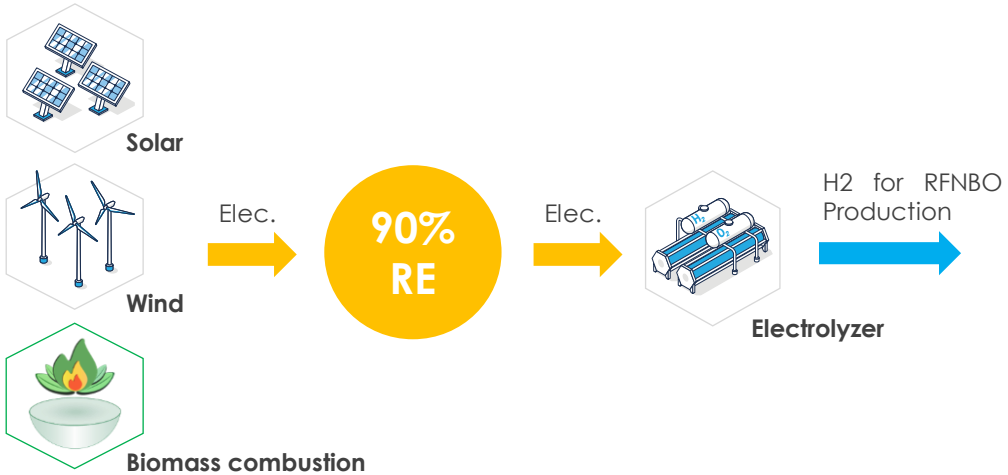
[2] 'biomass' means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin (Source: Directive (EU) 2018/2001, Art. 2.(24)).

Source: DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); Uruguay's National Energy Balance, MIEM (2024)

When proving that the grid has >90% renewability for RFNBO production, electricity from biomass combustion can be included

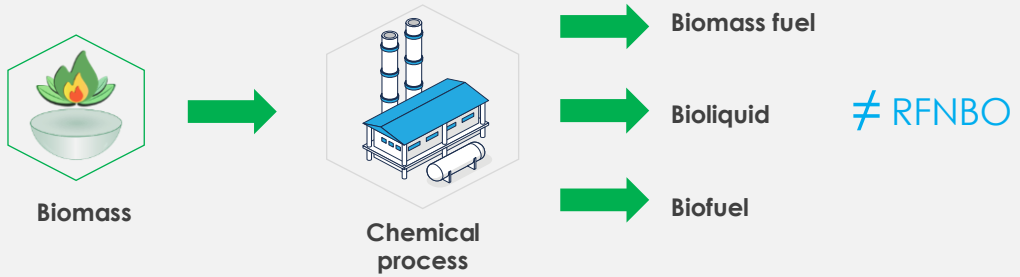
- The use of biomass in the production of RFNBOs is not allowed in most cases, however, a relevant exception is found when electricity from the combustion of biomass is part of the renewable energy share of the national grid.
- In this case, **if an electrolysis plant is connected to the grid without the PPA (Pathway C), the 90% of renewable energy that is required may include electricity from biomass combustion**

Pathway C – Possible renewable energy sources:



- In this context, biomass is defined according to the RED II as the biodegradable fraction of products, waste and residues from biological origin, including bio-based industrial residues.
- Under this definition, common bio-waste from the Uruguayan industrial landscape such as **black liquor from pulp and paper plants, can be accepted as a biomass source for the renewable energy mix of the grid.**

- While the inclusion of biomass-based electricity in the renewable energy mix from the national grid is allowed for RFNBO production in the specific pathway just described, this aspect must not be confused with the contribution to renewable energy targets from biomass fuels, bioliquids and biofuels
- The RED II regulation defines biomass fuels, bioliquids and biofuels as fuels produced from biomass, which depending on the source must go through different chemical conversions and comply with sustainability requirements.



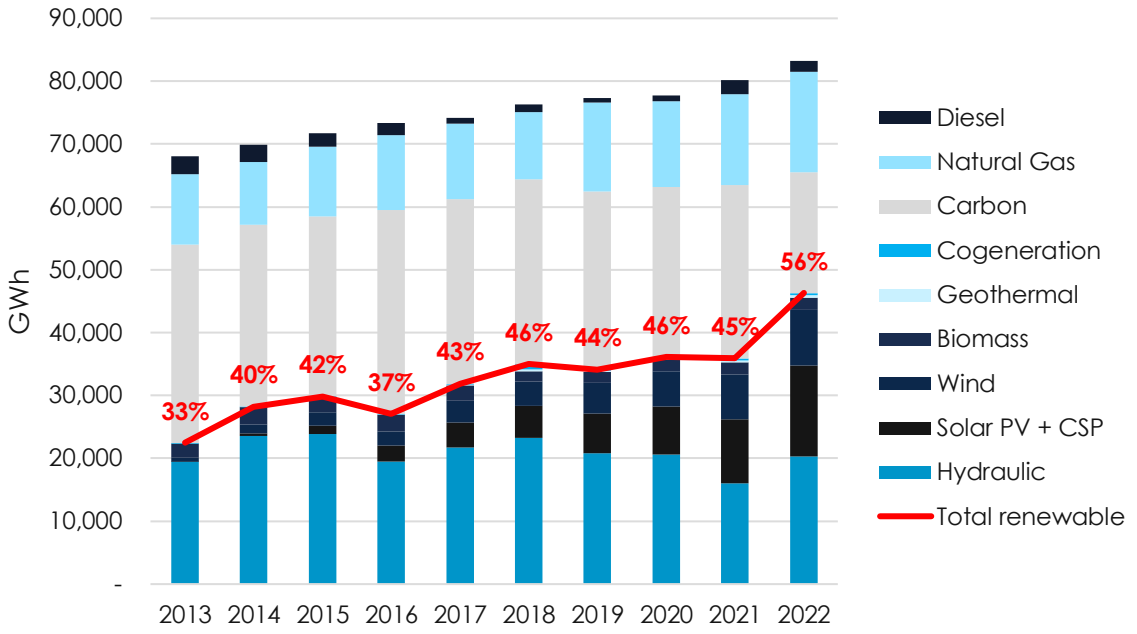
- While industrial waste, such as black liquor, can be used for the production of biofuels, this process must comply with the biofuels production regulation instead, and it can no longer be considered part of an RFNBO value chain.
- Additional sustainability criteria that must be considered for the use of biomass in biofuels production can be found in Article 29. of the RED II regulation. These sustainability requirements mainly affect biomass coming from agricultural and forestry sectors, whereas bio-based waste does not present major environmental requisites.

Chilean grid does not comply with a 90 % RE share, so Pathways A[1] and B[2] are recommended for projects in the country

Grid renewability compliance

- In the Chilean national electricity system (SEN), **56% of the electricity generated in 2022** was renewable, corresponding to an 11% increase from the previous year. The remaining 44% primarily consisted in thermoelectric generation.
- Considering the renewability of the system, if the SEN would be considered as one unique bidding zone, it **does not comply with the requirement of having 90% renewable generation. For this reason, considering electricity sourcing options A and B (direct connection and grid connected with PPA** which should cover the total amount of energy consumed and meet the criteria of additionality and correlations) **is recommended.**
- However, this should be studied on a node-by-node basis**. If one of this nodes exceeds the 90% renewability, the project could access to pathway C only connecting to the grid in that specific zone.**
- It is worth noting that in 2025-2026, the HVDC transmission line project "Kimal-Lo Aguirre" will enter construction phase, connecting the Antofagasta with the Metropolitan region. This will expand the network's capacity and reduce congestion in the national grid, potentially improving the country's ability to meet this RED II criterion.
- **Chile uses the I-Rec Standard to demonstrate renewable origin of electricity**. In the case of grid connection this certificate needs to be bought and cancelled to comply with RFNBO criteria.

Electricity mix[3] in national grid (SEN), 2013 - 2022



When considering the SEN, it is far from reaching the necessary renewable share.

However, some regions have high penetration of RES and cold achieve +90% RE generation in the coming years. Renewable Energy Sources (RES) share in Chile keeps growing fast, with huge solar and wind onshore capacities and high plant factors.

[1]Direct Connection
[2] Grid with PPA
3 Chile does not import electricity. Chile (SEN) has been exporting energy to Argentina since 2022, with the exported amount representing less than 0.2% of the total energy generated in that year.

Sources: Generadoras de Chile; Conexión Energía (2023)

Uruguay's high RE grid share potentially allows plant operators using pathways B* to **skip the additionality** criterion

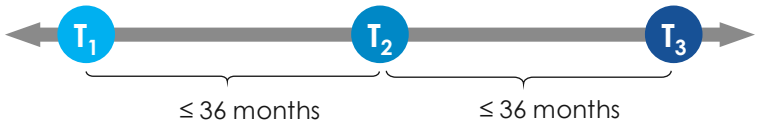
Additionality

- The renewable energy installation must have been operational or upgraded no more than 36 months prior to the electrolyzer's commissioning.
- Any additional production capacity must be added within 36 months of the initial installation becoming operational to be considered part of the same plant. Capacity additions made after 36 months from the commissioning of the electrolyzer must be treated as a new plant, requiring all necessary implications and permits.

T_1: Minimum period for commissioning of an RE plant

T_2: Commissioning of the electrolysis plant

T_3: Maximum deadline to add RE capacity



Uruguay

In 2021, the emissions intensity of the Uruguay grid was ~28 gCO2e/MJ[2](with a renewability of 88% of the electricity mix). In 2022 due to an increased of the renewable share in the grid, the **emissions intensity decreased to ~17 gCO2e/MJ[3].**

Since the emissions factor is bellow **the 18 gCO2e/MJ limit**, the emissions intensity of 2022 would allow to skip the additionality criteria for the subsequent five calendar years for the projects under **Pathway B** (since it is a small difference, it cannot be guaranteed that this will continue to be fulfilled in future years).

In the case of 2021 it is possible to notice that a 4% difference in the renewability of the grid (compared to 2022), would mean not being able to access this exception because the emissions intensity is 55% higher than the limit.

Therefore, to sustain this condition over time, it's necessary to have at least a significant share of renewable energy in the grid.

Chile

In 2023, the **emissions intensity of SEN was ~66 gCO2e/MJ[1]**, marking a 21% reduction compared to 2022 and a 37% reduction compared to 2021. However, the emissions factor **exceeds the 18 gCO2e/MJ limit**, that if met it would have allowed skipping the additionality criteria for the subsequent five calendar years.

Finally, to reach the emissions factor limit, an increase in the renewable share of the energy matrix is needed.

*Grid with PPA

Sources:
[1] National Electric Coordinator
[2] National Energy Balance, 2021
[3] National Energy Balance, 2022
COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

Temporal correlation[1]: GOs proving hourly correlation (Path B) is ideal, while both A and B paths need smart metering

Temporal correlation

- Electricity must be consumed by the electrolyzer and/or storaged **within the same hour of generation from 01.01.2030 (before: monthly).**
- Additionally, the fuel producer shall provide **reliable information demonstrating that all requirements are complied for each hour**, including amount of electricity used for production and amount of RE generated by installations.

2024	2025	2026	2027	2028	2029	2030	2031
Monthly correlation						*Hourly correlation*	

Critical point: Given the need to demonstrate information on energy consumption and RE production, two important aspects must be considered:

1. The **electricity consumer** must implement a **Smart Metering system** (as defined in Article 2(23) of Directive (EU) 2019/944). This system is capable of measuring electricity flows fed to the grid or consumed from it on an hourly basis in the RE production process. These **devices must adhere to EU standards** concerning security, communication, and privacy.
2. The **RE generator** must transmit the **energy information to the purchaser with the appropriate temporal granularity**. Therefore, the generator must also achieve this measurement (through **GO's,** or information from the **transmission operator and/or respective generator**, or through **smart metering** implementation).

Uruguay

1. Until the end of February, **more than 80% of the Uruguayan households have their smart metering system** installed. This demonstrates the existence and implementation of smart metering systems in Uruguay, which could be used for a grid-connected project.
2. **Given that the grid has over 90% RE, it is a favorable option to opt for Pathway C and thus temporal correlation is not required.** However, if this renewability is not met and/or Pathway B is implemented, it **should be demonstrated hourly correlation (through hourly based GO's, or requesting** information from the transmission operator and/or respective generator, or verifying it through smart metering)
3. According to the national certification system guidelines, the allocation of **a CER is made considering the consumption within the calendar month with** GOs on an hourly basis. In this way, Uruguay may also comply with the hourly correlation. In case direct connection with the plant, the use of smart metering systems with hourly injection details should be required.

Chile

1. While **smart metering systems are available in the Chilean market,** their widespread use is **limited** because the network is not sufficiently smart, according to the Superintendency of Electricity and Fuels (SEC).
2. Chile implements the I-REC certification system. Although it **currently lacks hourly correlation**, in 2022 The I-REC Standard facilitated a **24/7 matching pilot** with Google in Chile, showcasing efforts towards achieving this. Such correlation could potentially be available by 2030 for the country.
3. In order to comply with hourly correlation while the hourly granularity of I-REC is being developed, **information can be requested** from the Electricity Transmission System Operation (SEN) and/or respective generator, or smart metering can be implemented. The National Electric Coordinator has a National Registry of Renewable Energy (RENOVA), which currently provides monthly information, which has the potential to evolve to allow for the demonstration of hourly correlation.

[1]Criterion applicable to Parthways A (direct connection) and B (Grid with PPA).

Geographical correlation[1] may not be a challenge in Uruguay and Chile

Geographical correlation[1]

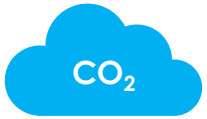
	Pathway A (Direct connection)	Pathway B (Grid with PPA in same bidding zone)	Pathway B (Grid with PPA in different bidding zone)
	The renewable generation plant is connected by a direct line to the production plant.	The renewable generation plant and the electrolyzer are in the **same bidding zone**	The renewable generation plant and the electrolyzer are in a **different bidding zone** and the generation price of an **hourly block is lower or equal in the electrolyzer bidding zone** than in the renewable generation plant.
Uruguay	No critical point are identified for the connection of a dedicated renewable generation plant.	As Uruguay may be considered a single bidding zone, no critical points are identified concerning geographical correlation.	
Chile	The main critical point to consider for a dedicated plant in Chile is that the areas with high potential for renewable generation are located at the extremes of the country. Therefore, for a dedicated grid to be used, the plant should be situated nearby, or it may imply a grid with significant extension (and therefore significant costs).	If the SEN system is considered a single bidding zone, no critical points are identified concerning geographical correlation. The same applies if the Aysén and Magallanes systems are considered independent bidding zones and consumption is carried out within these same bidding zones.	The southern zones (Aysén and Magallanes systems) have hourly spot energy prices lower than the central zone. This suggests that the electrolyzer cannot be located in the central zone (SEN system, that could be considered as one bidding zone) and produce with energy from the southern zones (which also have the highest renewable potential). The evolution of the systems in the south should be monitored over time according to their expansion projects to see the effects on the energy prices, and whether or not they can be considered a bidding zone.

[1]Criterion applicable to Parthways A (direct connection) and B (Grid with PPA).

Requirements for renewability, CFP[1] calculation, & certification have been detailed in Delegated & Implementing Regulations

To be **RED compliant, a RFNBO** needs to:

- Fulfill the criteria for renewability and GHG emissions reduction compared to fossil.
- **Be certified under a Voluntary Scheme recognized by the European Commission relying on Mass Balance**



1 Renewability of electricity

- **Direct connection** (A)
- **Under PPA** (B)
  - Additionality
  - \+
  - Temporal Correlation
  - \+
  - Geographical Correlation
- (C) **Outside PPA:** >90% RE in grid mix OR elect. consumed during imbalance settlement

2 GHG emission savings

70% GHG emission saving threshold compared to fossil fuel comparator

Applicable fuel comparator for RFNBO → 94 gCO2eq/MJ

-70% CFP threshold → **<28.2 gCO2eq/MJ (3.38 kgCO2eq/kgH2)**

3 Certification

Certification Scheme recognized by EC[2] to demonstrate compliance with RFNBO criteria

The RFNBO should be produced and handled across the value chain by certified economic operators with a recognized Certification Scheme, relying on Mass balance bookkeeping.

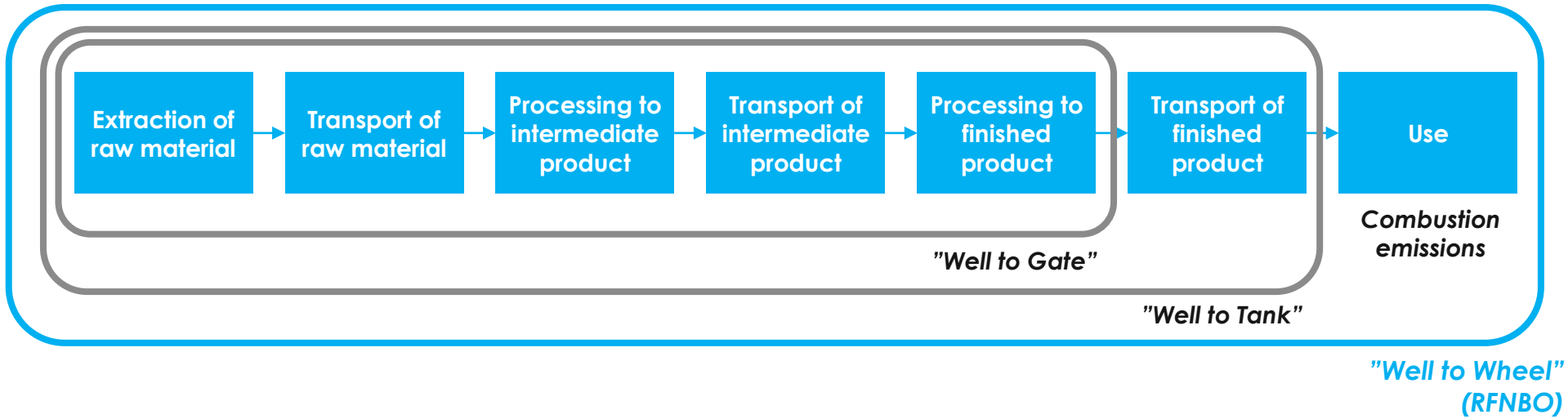
[1] CFP = Carbon Footprint
[2] EC = European Commission

Sources; DIRECTIVE (EU) 2018/2001 of the European Parliament and of the Council (2018); DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1184 (2023).

The CFP calculation scope must cover the entire supply chain, including the transportation, under a "Well-to-Wheel" approach

- **"Well to X" footprint of a fuel** = sum of GHG emissions (and removals) over the specified lifecycle scope (until X point), per unit of energy, in gCO2e/MJ.
- Emissions are expressed in CO_2 equivalent (CO_{2eq}) to take into account emissions of all GHG gases.
- The European regulation for RFNBOs require the use of a **Well-to-Wheel scope**, which considers not only the production and processing of the product but also its transportation to the target market. This is crucial for RFNBOs due to the **decoupling of production and consumption value chains**, often involving long-distance transportation, which can **significantly impact the CFP of the final product.**
- **Emissions from the construction of assets are not considered** (conveyed above by reference to "Well" rather than to "Cradle").

Commonly used scope designations



As the Carbon Footprint scope is Well-to-Wheel, the **downstream activities will have an impact on the consortium products environmental attributes** and, therefore, in its RED II & III compliance.

Sources; DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1185 (2023).

RFNBOs need to meet a 70% GHG emissions savings threshold compared to references fuels to be RED compliant

The equation to calculate the Emissions Savings (ES) from the use of an alternative fuel can be expressed as follows:

$$ES_{AF}\,[\%] = \frac{CF_{RF} - CF_{AF}}{CF_{RF}}$$

ES = emissions savings
CF = carbon footprint
AF = alternative fuel
RF = reference fuel

Carbon footprint (CF) = sum of GHG emissions and removals calculated over whole fuel lifecycle, expressed in (gCO2eq/MJ)

Reference fuel

The value for reference fuel or 'fossil fuel comparator' is set under the Delegated Act as:

For **RFNBOs & RCFs** used in **transport**: **94 gCO_2eq/MJ**

Other values for alternative fuels are set under RED2 as follows:

- Fuels (bioliquids & biomass) used to produce electricity: 183 gCO_2eq/MJ
- Biomass fuels used for heating/cooling: 124 gCO_2eq/MJ
- Bioliquids used for heating/cooling: 80 gCO_2eq/MJ

Alternative fuel

The quantification of the carbon footprint of an alternative fuel follows a "consequential approach". Emissions should be considered as CO_{2eq}:

$$CF_{AF}\left[\frac{gCO_2eq}{MJ}\right] = E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

CF	=	Carbon footprint	**etd**	=	Emissions from transport and distribution
E	=	Total emissions	**eu**	=	Emissions from end-use[1]
ei	=	Emissions from the supply of inputs	**eccs**	=	Emissions savings from carbon capture and storage
ep	=	Emissions from processing			

At least 70% emissions savings from use of alternative fuel → $CF_{AF} \leq 30\%\ CF_{RF}$ = 28.2 gCO_2eq/MJ = 3.38 $kgCO_2eq/kgH_2$

[1] Emissions from combustion of the fuel refer to the total combustion emissions of the fuel in use (considered as equivalent CO_2 emissions).

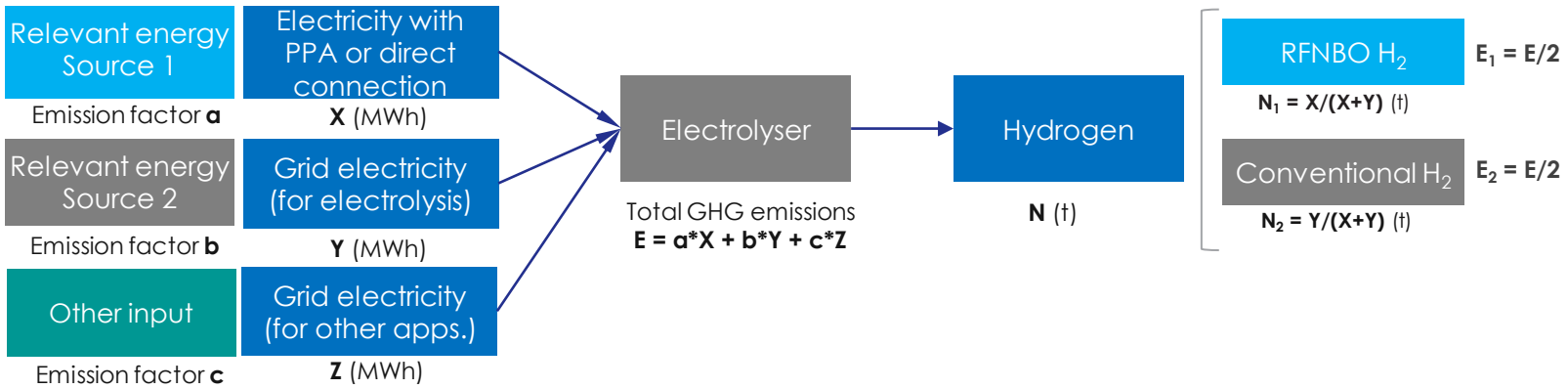
Sources; DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1185 (2023).

To produce RFNBOs only the relevant energy inputs must be renewable, but the CFP must cover the entire production

In RFNBO production, **an energy input is considered relevant when it contributes to the energy content of the product,** other energy inputs (e.g. the required for auxiliary equipment) are only considered to determine the product's CFP. **Only relevant energy inputs must be renewable as per RED II,** other power consumption can be renewable or not, but the impact of non-renewable power on the **RFNBO CFP should be closely monitored**.

- **Share of renewable fuel =** relevant renewable energy input / total relevant energy input
- Relevant energy inputs are defined in different ways whether we are touching upon electricity or material inputs:
  - For electricity, it is defined as the energy enhancing the fuel Lower Heating Value (LHV).
  - For material inputs, it is the defined as the material entering the molecular structure of the fuel.
  - In the case of the production of **renewable electrolytic ammonia**, core energy comes from **the electricity used to produce hydrogen** (other derivatives need to be analysed case by case). In consequence, only this electricity needs to comply with renewability criteria, but the rest should be also considered in the CFP.
- **Coproduced fuels of different origin all have the same CFP:** GHG emissions intensity may be calculated as an average for the entire production of fuels occurring during a period of at most one calendar month. Except when
  - RFNBO/RCF only partially replace conventional input
  - RFNBO/RCF is co-processed with biomass

Example: **Electrolytic hydrogen**



- Product **not 100% renewable** because electricity is not always sourced from fully renewable sources.
- The **share of renewable hydrogen is proportional** to the share of consumed electricity that is using a PPA
- Both hydrogen products have the same CFP

Sources; DIRECTIVE (EU) 2023/2413 of the European Parliament and of the Council (2023); COMMISSION DELEGATED REGULATION (EU) 2023/1185 (2023).

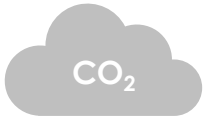
Requirements for renewability, GHG emissions calculation, & certification have been detailed in Delegated & Implementing Acts

To be **RED compliant, a RFNBO** needs to:

- Fulfill the criteria for renewability and GHG emissions reduction compared to fossil.
- **Be certified under a Voluntary Scheme recognized by the European Commission relying on Mass Balance**

1 Renewability of electricity

- A — Direct connection
- B — Under PPA
  - Additionality
  - Temporal Correlation
  - Geographical Correlation
- C — **Outside PPA:** >90% RE in grid mix OR elect. consumed during imbalance settlement



2 GHG emission savings

70% GHG emissions savings threshold compared to references fuels

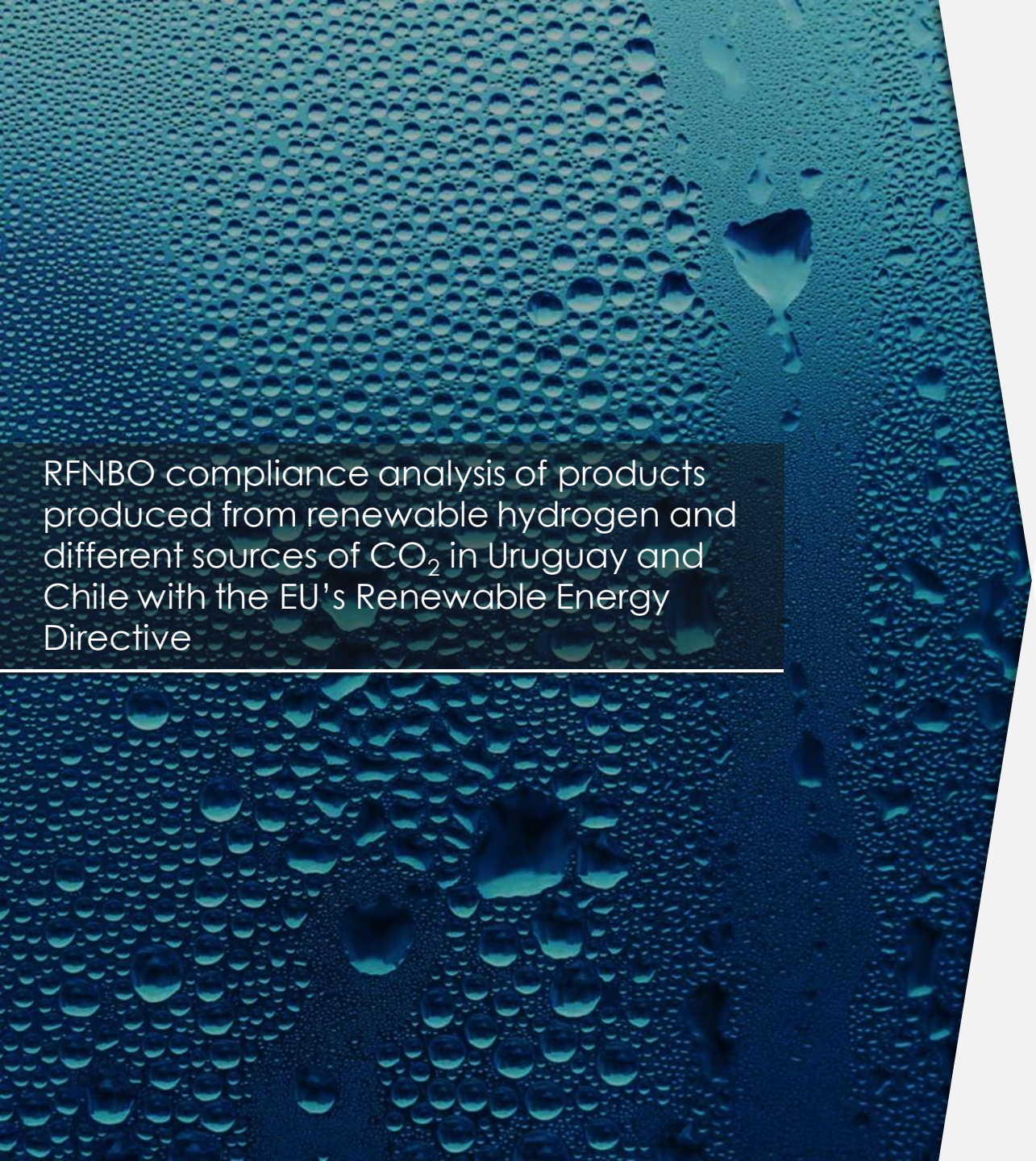
Applicable fuel comparator for RFNBO → 94 gCO2eq/MJ

CFP threshold → **<28.2 gCO2eq/MJ (3.38 kgCO2eq/kgH2)**

3 Certification

Recognized VS under Mass Balance

The RFNBO should be produced and handled across the value chain by certified economic operators under a recognized Voluntary Scheme, relying on Mass balance model.



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP1

1.1 Overview of RED II & III and DA regulations for RFNBO

1.2 CO2 requirements under RED II & III and DA for RFNBO

1.3 Certification systems assessment for RFNBO product

1.4 Recommendations for compliance with RFNBO requirements in Chile and Uruguay

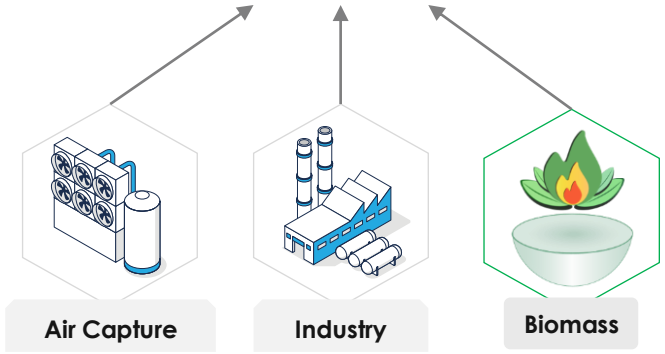
Renewable hydrogen produced by electrolysis can be used as **feedstock for ammonia, methanol and e-fuels production**

1 Power-to-NH_3

2 Power-to-Methanol

3 Power-to-Liquids

Carbon is required to produce methanol and e-fuels. A source of CO_2 is necessary.



The CO_2 source contributes to the input emissions in the production of synthetic fuels, impacting its 70% emissions reduction

- According to the methodology established in the EU regulation[1], the GHG emissions from the production and use of RFNBO shall be calculated using the following expression:

$$E = e_i + e_p + e_{td} + e_u - e_{ccs} \quad [gCO_2eq/MJ]$$

- Where:

e_i	=	Emissions from supply inputs
e_p	=	Emissions from processing
e_{td}	=	Emissions from transport and distribution
e_u	=	Emissions from combusting the fuel in its end-use
e_{ccs}	=	Emissions savings from carbon capture and geological storage

- **At the end point of the value chain, total emissions must be less than the limit set by the 70% emission reduction: 28.2 gCO_2eq/MJ**

- **The source of CO_2 contributes to emissions from the supply inputs (e_i)** from the production process of the synthetic fuel.
- These emissions break down as follows:

$$e_i = e_{i-elastic} + e_{i-rigid} - e_{ex-use}$$

- Where:
  - $e_{i\text{-elastic}}$ = emissions from elastic inputs (from supplies that can be increased to meet extra demand)
  - $e_{i\text{-rigid}}$ = emissions from rigid inputs (from supplies that can not be expanded to meet extra demand)
  - **$e_{ex\text{-use}}$ = CO_2 emissions used in the process that would otherwise be emitted to the environment.**
- Eligibility of the CO_2 source for **emission reductions through the $e_{ex\text{-use}}$ factor depends on the fulfillment of specific conditions** (see next slide).

[1]More details about the emissions counting methodology for RFNBO fuels can be found in the *Commission Delegated Regulation (EU) 2023/1185*

Any source of CO_2 can be used for RFNBO production; but some specific sources can contribute to the CFP reduction, depending on their origin

- The use of avoided emissions will achieve the required 70% emission reduction; CO_2 shall come from a "currently ongoing activity" that would have been released CO_2 to the atmosphere instead OR that is already releasing CO_2 to the atmosphere, rather than burning sources to generate CO_2 emissions for RFNBO production purpose. The following CO_2 sources are eligible to be considered as avoided emissions:[1]

1	CO_2 capture from an activity listed under Annex I of the EU Directive 2003/87/EC ("industrial emissions" falling under EU ETS generated by production processes like steel, cement, power production)	CO_2 eligibility from this sources/activities for CFP reduction valid until 2036 (CO_2 from power plants) / 2041 otherwise
2	CO_2 captured from the air (DAC)	Only CO_2 source with no regulatory for its use. Still relatively expensive and low efficient.
3	Captured CO_2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and GHG saving criteria[2] and the CO_2 capture did not receive credits for emission savings from CO_2 capture and replacement, set out in Annex V and VI of Directive (EU) 2018/2001	Biogenic CO_2 can be used without any time limit. Using this type of CO_2 source allows maintaining CFP reduction over time, ensuring RFNBO to be RED II compliant.
4	Captured CO_2 stems from the combustion of RED II compliant RFNBOs or RCFs	CO_2 emitted through use of an RFNBO (future), following circular approach; challenging as it would be captured in another place than RFNBO production.
5	Captured CO_2 stems from a geological source of CO_2 with previously naurally released CO_2 (e.g. geysirs, naturally carbonated water)	
X	Captured CO_2 originating from a deliberately combusted fuel for specific purpose of producing CO_2 and its capture	Emissions from a combustion process carried out with the only intention of CO_2 capture are not considered an avoided emission eligible to be deducted from CFP.

[1]More details about the emissions counting methodology for RFNBO fuels can be found in the *Commission Delegated Regulation (EU) 2023/1185*
[2]The sustainability and greenhouse gas saving criteria can be found in Annex 1 – Biomass sustainability requirements

Emissions from four groups of activities are eligible for reducing the carbon footprint of the RFNBO

CO_2 capture from an activity listed under Annex I of the EU Directive 2003/87/EC

Energy activities

- Combustion installations with a rated thermal input exceeding 20 MW
- Mineral oil refineries
- Coke ovens

Production and processing of ferrous metals

- Metal ore roasting or sintering installations
- Installations to produce pig iron or steel (with a capacity exceeding 2.5 tones per hour)

Mineral industry

- **Installations to produce cement clinker in rotary kilns (with a capacity exceeding 500 tones per day)**
- **Installations to produce lime in rotary kilns (with a capacity exceeding 50 tons per day)**
- Installations to produce other furnaces (with a capacity exceeding 50 tons per day)
- Installations of manufacture of glass (with a capacity exceeding 20 tones per day)
- Installations for the manufacture of ceramic by firing (with a capacity exceeding 75 tons per day)

Other activities

- Industrial plants to produce:
  - Pulp
  - Paper and board (with a capacity exceeding 20 tons per day)

These activities remain valid only until 2041, except for CO_2 emissions from power generation processes, which are valid until 2036.

For further details on activities eligible for RFNBO's carbon footprint reduction through CO2 capture, Annex I of the EU Directive 2003/87/EC provides comprehensive information.

All CO_2 emissions associated with CO_2 capture process must be taken into account in the carbon footprint calculation

The methodology outlined by RED II specifies that **emissions linked to the consumption of electricity, heat, or other materials during the CO_2 capture process should be included as inputs to the process:**

$$E = e_i + e_p + e_{td} + e_u - e_{ccs} \quad [gCO_2eq/MJ]$$

$$e_i = e_{i-elastic} + e_{i-rigid} - e_{ex-use}$$

Input emissions associated with the capture process

Emissions removed in case of an eligible source

- In the case of using a heat source for the CO_2 capture process, the regulation (EU Directive 2003/87/EC) provides emission values associated with the combustion of different materials, including biofuels.
- The detailed emission factors are CO_2, CH_4 and N_2O. For conversion to CO_2 equivalent emissions, the Global Warming Potential for a period of 100 years (GWP_{100}) should be used.
- Additionally, in the same document, the upstream emissions factors associated to each potential fuel are detailed.

The following table shows part of the default emissions factors for stationary combustion [g/MJ fuel on a net calorific value][1]:

Fuel	CO_2	CH_4	N_2O
Solid fossil fuels			
Anthracite	98,3	0,001	0,0015
Coking coal	94,6	0,001	0,0015
Other bituminous coal	94,6	0,001	0,0015
Sub-bituminous coal	96,1	0,001	0,0015
Lignite	101	0,001	0,0015
Patent fuel	97,5	0,001	0,0015
Coke oven coke	107	0,001	0,0015
Gas coke	107	0,001	0,0001
Coal tar	80,7	0,001	0,0015
Brown coal briquettes	97,5	0,001	0,0015
Manufactured gases			
Gas works gas	44,4	0,001	0,0001
Coke oven gas	44,4	0,001	0,0001
Blast furnace gas	260	0,001	0,0001
Other recovered gases	182	0,001	0,0001

Source: *Commission Delegated Regulation (EU) 2023/1185*

[1]Full table can be found in the *Commission Delegated Regulation (EU) 2023/1185*

Case Study: For an RFNBO production process, the input factor represents the critical contribution to the product's emissions

For a better understanding of the emissions associated with the RFNBO production process, a particular case of e-methanol production in Uruguay was evaluated, as an illustrative example.

- When counting the emissions of a specific fuel through the RED II methodology, the contribution of most factors should not change significantly when produced in Uruguay, with the exception of the input emissions, that will vary depending on the process' feedstocks.
- Using the production, transport and use of e-methanol as an illustrative example, the following emission results may be found in a carbon footprint calculation:

Emissions distribution for an e-methanol export value chain from Montevideo to Port of Rotterdam (the assumptions used in the calculations are presented in Annex 2):

	$E = e_i$	**Emissions from the supply of inputs**
Emissions from processing	$+ e_p$	**~ 0.02 gCO_2eq/MJ**
Emissions from transport and distribution	$+ e_{td}$	**~ 8.2 gCO_2eq/MJ**
Emissions from end-use[1]	$+ e_u$	**~ 68.9 gCO_2eq/MJ**
Emissions savings from carbon capture and geological storage	$- e_{ccs}$	**N/A**

- As previously mentioned, the emissions from the supply of inputs comprise upstream emissions from the feedstocks and fuels that enter the process coupled with the possible discount of emissions due to the capture of eligible CO_2 sources.
- Following the e-methanol example, the emissions from the supply of inputs can lead to two different outcomes depending on the eligibility of the CO_2 source:

$$e_{i-elastic} + e_{i-rigid} - e_{ex-use}$$

Fixed input emissions associated with the capture process	Possible discount from the capture of an eligible CO_2 source
~ 0.8 gCO_2eq/MJ	**~ 68.9 gCO_2eq/MJ**

- Considering the Uruguayan landscape, the use of biomass as an eligible CO_2 source presents as an attractive alternative to opt for the emissions discount of the product.
- Specifically, **the use of sugarcane bagasse as a biomass-based CO_2 source, which is widely available in the Uruguayan territory, can be admitted for this purpose.**

[1]Considering methanol combustion

Case Study: Emissions associated with maritime transport account about ~10% to the e-methanol molecules carbon footprint

It is important to note that if this illustrative project were located elsewhere in the world, maintaining all its inputs and technologies, the only emissions that would vary are those related to maritime transport.

$$E = e_i + e_p + e_{td} + e_u - e_{ccs} \quad [gCO_2eq/MJ]$$

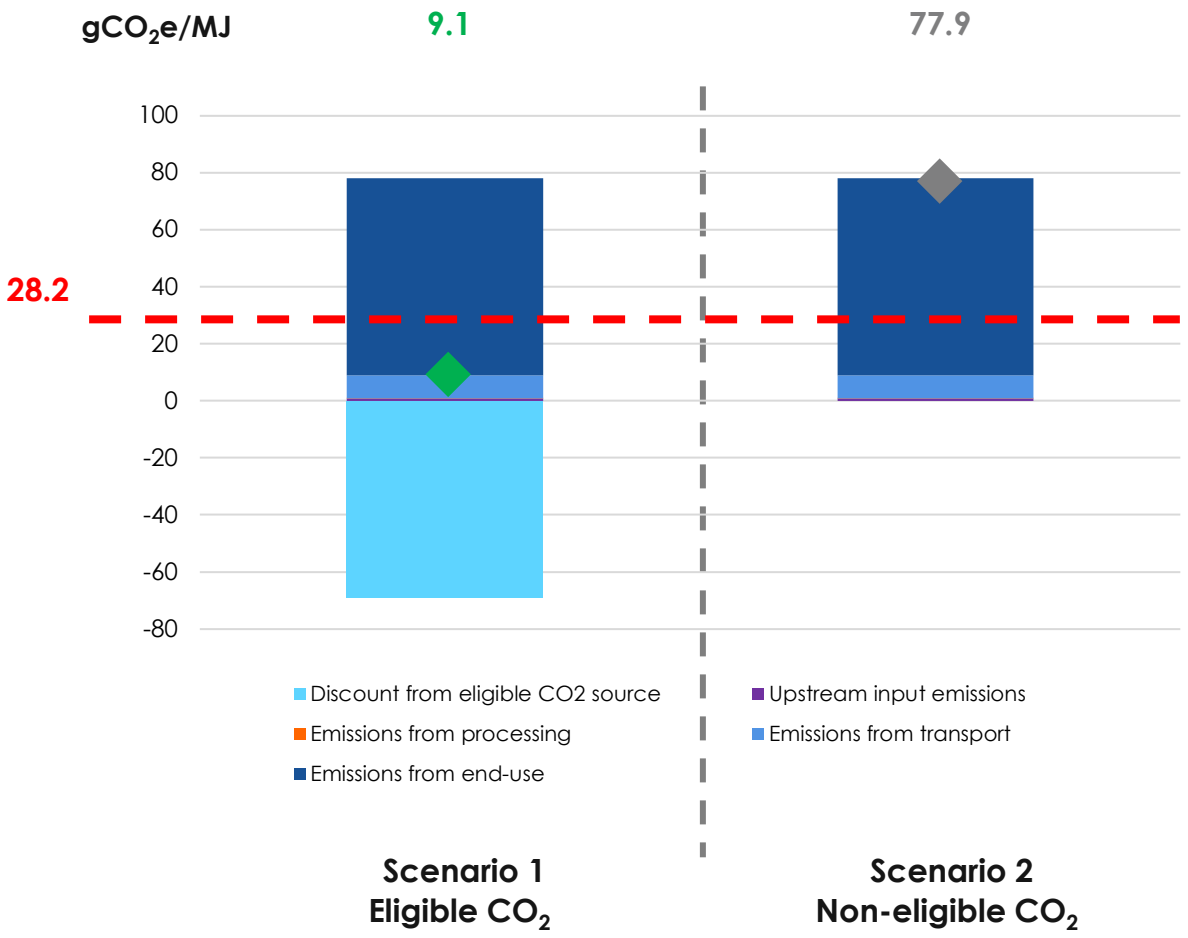
e_{td} → Emissions from transport and distribution

Country	Average Distance to Port of Rotterdam (km)	Fuel Oil emissions
		gCO_2eq/MJ
Uruguay	11,513	~8.2
Morocco	2,560	~1.8
Australia	21,885	~15.6

Assumptions:
- Fuel consumption → 87.9 kg-fuel oil/nautical mile
- Emissions factor → 3.11 $kgCO_2$/kg-fuel
- Vessel capacity → 35,500 t

- According to Hinicio estimates, even when considering a route from Montevideo to Rotterdam, emissions from transport fuels can account up to 10% of the total emissions when considering the whole CFP. Even with the long distances between exporting and importing countries, 70% GHG reduction could be achieved for RFNBO production in Uruguay.
- Emissions associated with road transportation are negligible when compared with maritime transportation emissions. According to Hinicio estimates, the transportation of e-methanol over 400 kilometers in diesel trucks results in emissions of less than 0.8 gCO_2eq/MJ, which represents approximately 1% of the total emissions.

Case Study: Using a CO_2 source that can be considered as an avoided emission is decisive in achieving the required emissions savings



	Scenario 1 Eligible CO_2	Scenario 2 Non-eligible CO_2
Compliance	✓	X
GHG savings	90%	17%

Key takeaways

- The emissions from the e-methanol production illustrative example, set in the case study, are presented in the graphs to the right, representing the two possible scenarios of emissions from the supply of inputs.
- In the first scenario, the emissions discount provided by the use of an eligible CO_2 source is added to the calculation, resulting in a net total below the required level to comply with the 70% emissions savings.
- On the other hand, when the discount is not added, due to the incorporation of a conventional CO_2 source, the total emissions exceed the limit and therefore the product cannot not be labeled as RFNBO.
- While the regulation does not forbid the use of any particular CO_2 sources for the production of RFNBOs, it is clear from the results of the case study that **it is highly unlikely to comply with the emissions savings requirements if the CO_2 source is not considered an avoided emission.**
- It is also important to notice that most of the emissions from the analyzed value chain come from the combustion of the fuel, representing ~88% of total emissions (without considering the discount).
- In terms of the emissions from the fuel's transport it can be observed that, even considering a route from Montevideo to Rotterdam, the emissions account for ~10% of total emissions (in scenario 2).

The availability of biogenic CO_2 in Uruguay can contribute to meeting the carbon footprint reduction criteria for RFNBO to achieve RED II compliance

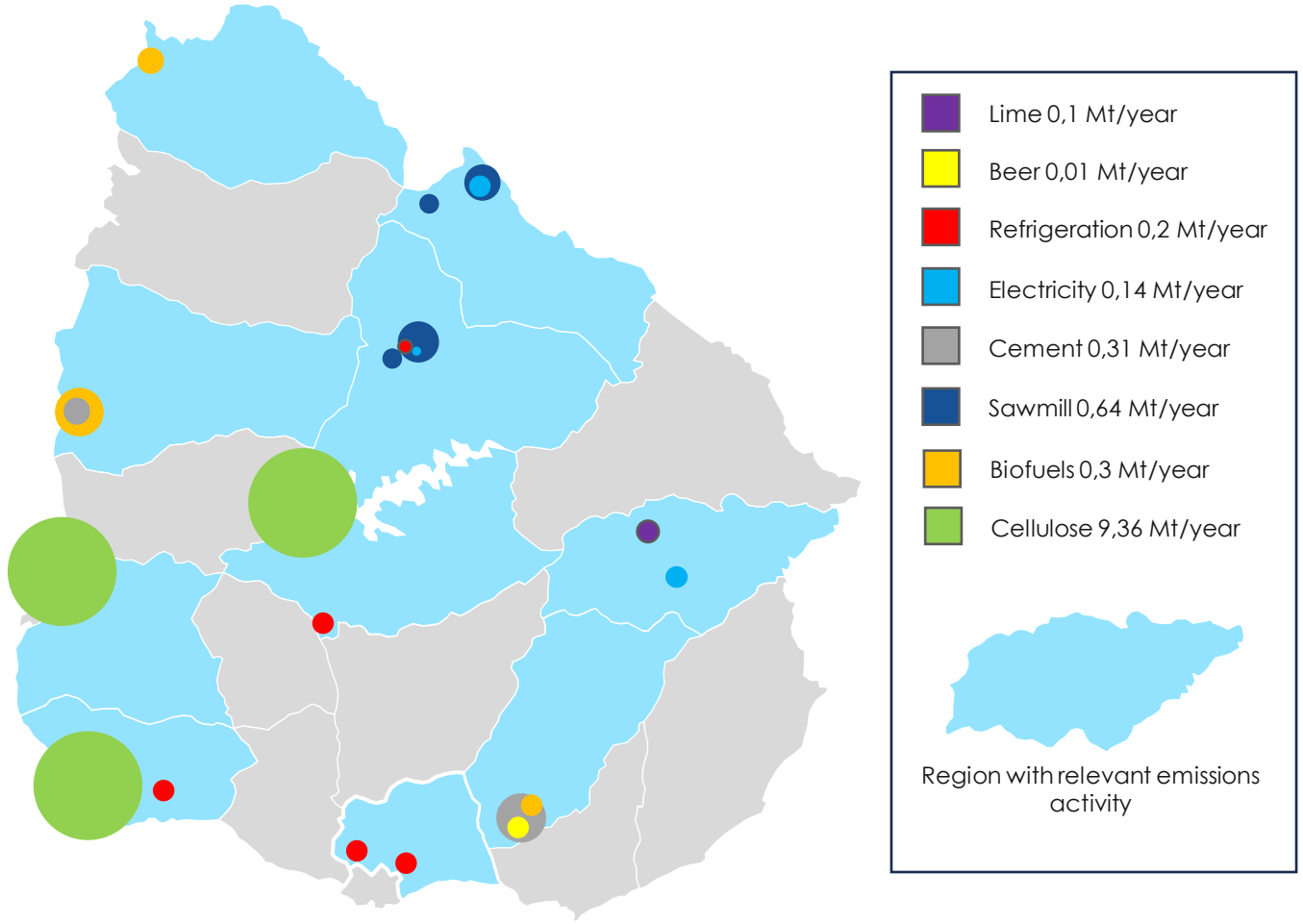
During 2022 more than 11 Mt/year of CO_2 inevitable emissions are associated to the industrial operation in the country.

- Cellulose plants are the main source of biogenic CO_2 emissions with more than 9.3 million tons per year of operation, corresponding to nearly the entire available quantity within the country.
- Main sources of biogenic CO_2 are located in the southwest region of Uruguay.

The availability of biogenic CO_2 for RFNBO production could contribute to meet the emissions criteria outlined in RED II. Besides, Uruguay possesses other favorable conditions for emissions reduction, including:

- As Uruguay is a small country, the transportation of biogenic CO_2 to production plants and/or RFNBO to ports shouldn't represent a significant amount of emissions in the RFNBO carbon footprint, as presented in the Case Study. This impact should be evaluated case by case according to the specifications of each project.
- Sources of biogenic CO_2 are near water sources, which could facilitate the commissioning of an RFNBO production plant.

Biogenic and non-biogenic inevitable emissions in Uruguay



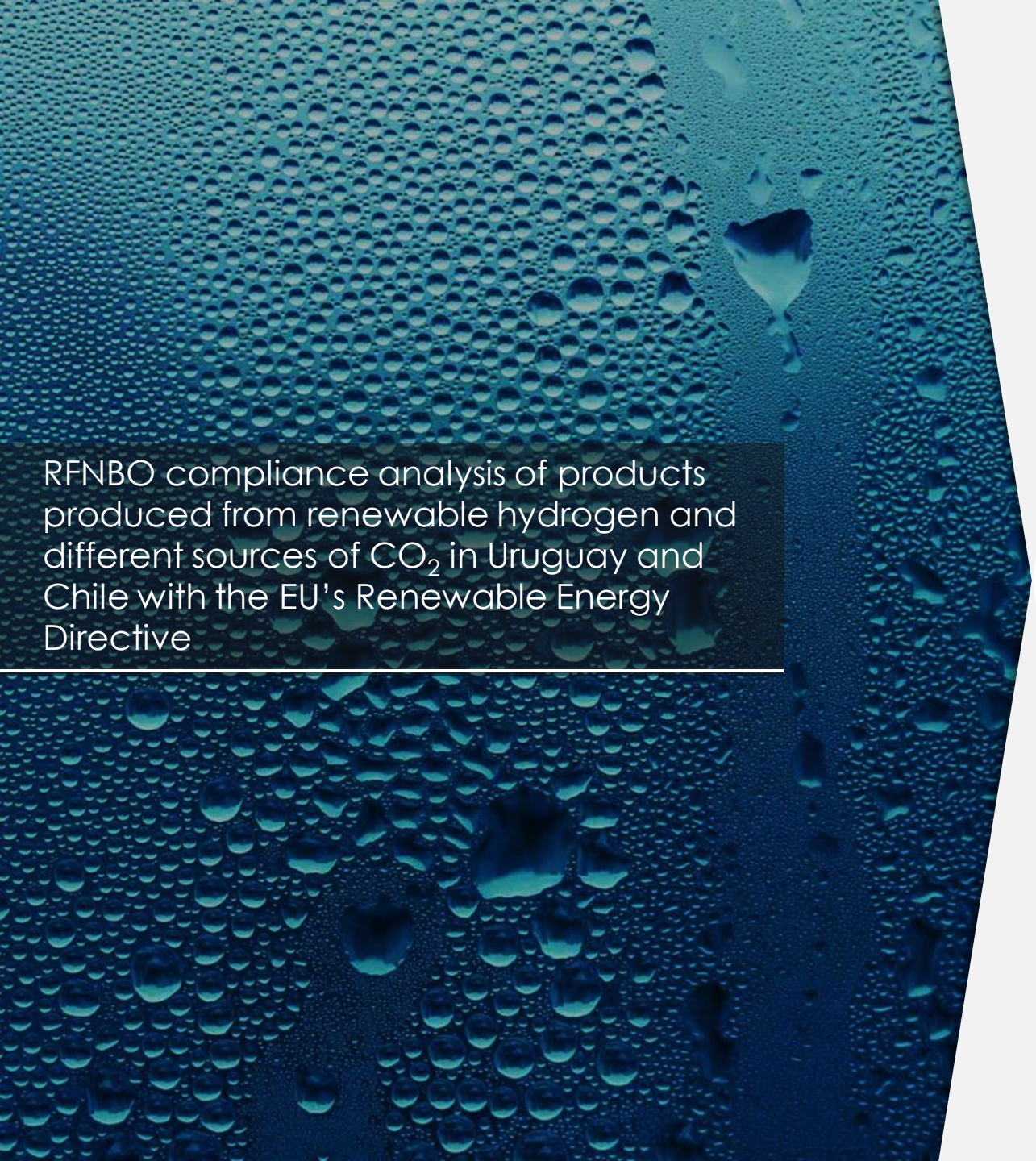
Sources: Análisis de la disponibilidad de CO_2 para la producción de derivados de H_2 verde en Uruguay (GIZ, 2023).

The availability of biogenic CO_2 is exclusive to the central regions of Chile, with a notable concentration in the Biobío region

Availability of biogenic and non-biogenic CO_2 in Chile

- According to the definition of RED II, eligible sources of CO_2 that contribute to reducing emissions are mainly located in Chile's central regions.
- Biogenic sources of CO_2 are concentrated in the Biobío region, with more than 7 million tons registered in 2022. These emissions are mainly from the cellulose industry.
- Besides the biogenic CO_2 there are emissions from another eligible sources available in Chile that can help reduce the product emissions until 2036/2041, associated to industrial activity. These are also concentrated in the regions located in the center of the country.
- Most announced projects and those under development will be located in northern or southern Chile, particularly in regions such as Antofagasta and Magallanes, which are consider major poles for hydrogen development mainly because of the renewable generation potential. Projects can also be developed in the Biobio region, but the potential of the aforementioned regions is higher.
- In this scenario, an option could be to transport the CO_2 captured at the source location to production plants situated in other regions.
- It's crucial to consider that the transportation of biogenic CO_2 from the capture site, in the case of using CO_2 available in the central zone of Chile for production plants located in the extreme zones of the country, entails CO_2 emissions that must be factored into the carbon footprint of the RFNBO.

Sources: Building Value Chains: The market ramp-up of e-Fuels in Chile (INERATEC, 2024); RETC 2022 (Ministry of Environment of Chile).



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP1

1.1 Overview of RED II & III and DA regulations for RFNBO

1.2 CO2 requirements under RED II & III and DA for RFNBO

1.3 Certification systems assessment for RFNBO product

1.4 Recommendations for compliance with RFNBO requirements in Chile and Uruguay

Emerging H_2 markets are looking for H_2 with specific environmental and social attributes: renewable and low carbon H_2

An eligible certification system is one that is **recognized under the specific jurisdiction/market**, whether voluntary or mandatory, to **report and validate the required (social, technical and environmental) attributes** of the respective product :

The molecule
Historically used as industrial feedstock

Cost driven

Fossil Hydrogen

No premium value

Low carbon and/or renewable H_2 to comply with **voluntary market purposes**

Sustainability/CSR driven

Fossil Hydrogen < Low carbon Hydrogen ≈ Renewable Hydrogen

Limited premium value

Example: EU H2 GO certificates

Hydrogen consumers procure less carbon-intensive H2 for **CSR and GHG corporate reporting** purposes and need a solution to make informed decisions with regards to their H_2 procurement,
Hydrogen producers **need a certification system to disclose production-related information to their customers** and obtain premium values.

Renewable H_2 to comply with **mandatory targets**

Compliance driven

Fossil Hydrogen ≈ Low carbon Hydrogen < Renewable Hydrogen

High (potential) premium value

Example: RFNBO certificates

The European Commission has set binding targets and specific criteria for the adoption of renewable hydrogen in specific market segments/applications.

Fuel suppliers and industry producers **need a certification system to show compliance with the EU targets and RFNBO criteria.**

Certification grants targets compliance, access to premium prices and financial and reputational benefits in H_2 markets

Depending on the target market, **certification can offer various benefits** to those who implement it:

Financial

- Access to **tax incentives** (tax exemptions, deductions, bonuses or reductions)
- Reduction in the **number of emission allowances** to be acquired
- Access to **grants** or special financing programs

Compliance

- With obligations to buy, use or sell fuels or energy from **renewable or low-carbon sources**
- With obligations to **reduce GHG emissions**

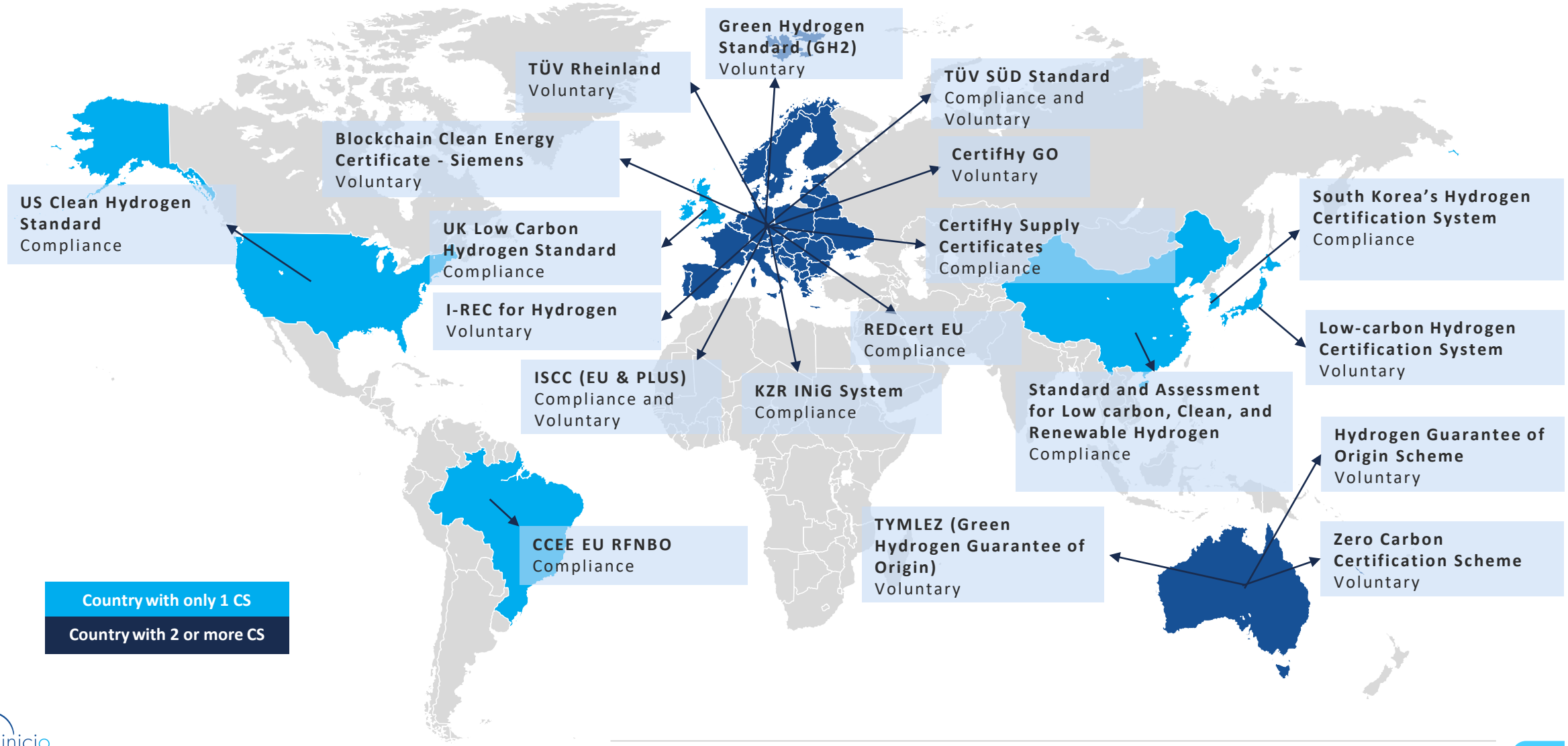
Market access

- Possibility to sell in markets or jurisdictions where it is **not allowed to sell gray hydrogen** or fossil fuels

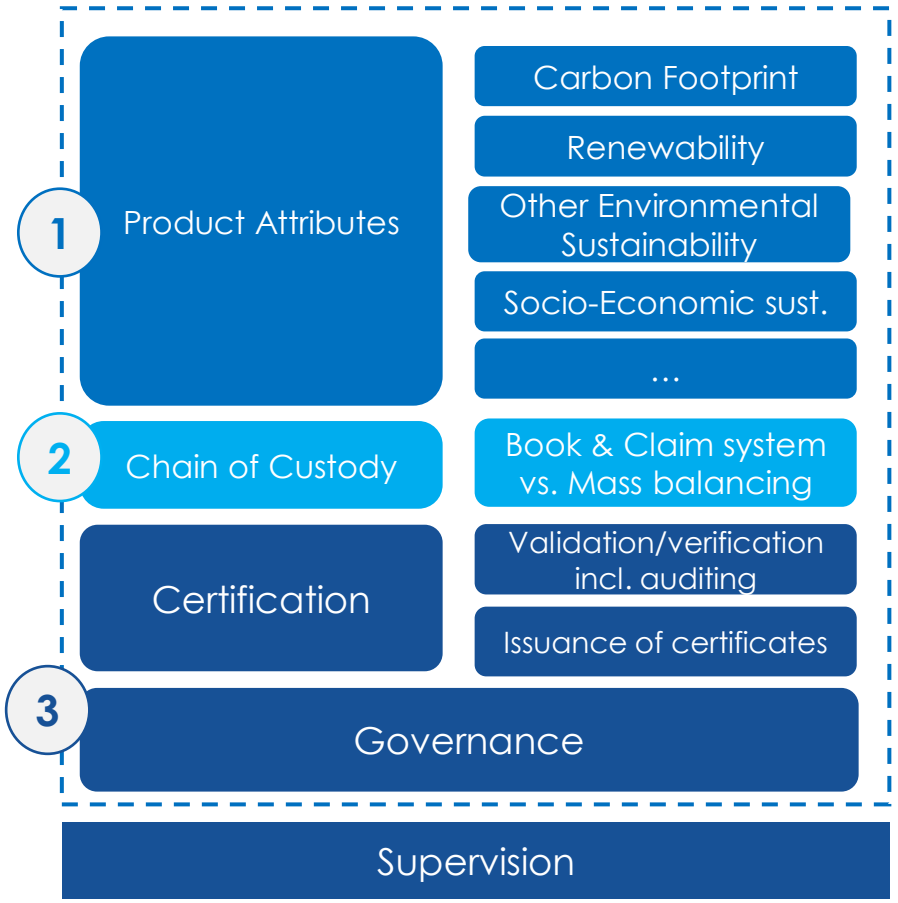
Reputational

- Contribution with **ESG and CSR criteria**
- **Traceability, transparency and trust** for the final consumer

Multiple hydrogen certification systems operational and under development worldwide, for mandatory and voluntary markets



Certification systems are based on specific principles and components



Main components of a hydrogen and derivatives certification system:

1. **Product attributes.**
2. **Chain of Custody.**
3. **Certification, Governance and Supervision.**

Attributes refer to the characteristics that products and production processes must meet to obtain certification

1

Product attributes encompass specific requirements that must be met under a given certification scheme

- Criteria and requirements defined by certification systems world-wide vary considerably
- A globally common defined product attribute is the carbon intensity of the product
- Some schemes include further environmental, social and economical sustainability criteria.

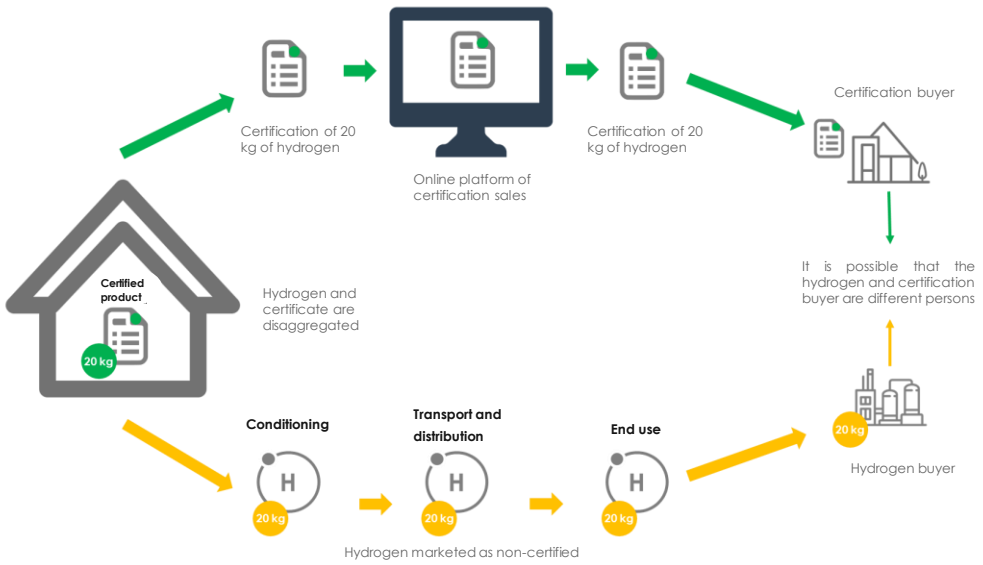
	System	California	China	Europe	EU RED II		Germany	Global	Biofuels: EU voluntary schemes			EU	Further Systems		
	Criteria	LCFS		CertifHy	GO	RFNBO	H2Global	GBEP	RSB	ISCC	REDcert	Taxonomy			
	GHG balance	x	x	x		x	x	x	x	x	x	x			
	Renewable origin		(x)	x	x	x	x		x	x	x				
Input	Additionality					x									
Input	Temp. Correlation					x									
Input	Geogr. Correlation					x									
	CO_2 Sources					tbd	x								
ENVIRONMENTAL SUSTANABILITY	**Biodiversity Conservation**														
ENVIRONMENTAL SUSTANABILITY	Biodiversity					?	x	x	x	x	x				
ENVIRONMENTAL SUSTANABILITY	Natural Habitats, ecosystems					?	x	x	x						
ENVIRONMENTAL SUSTANABILITY	High conservation value areas					?		x	x	x	x				
ENVIRONMENTAL SUSTANABILITY	**Soil conservation**														
ENVIRONMENTAL SUSTANABILITY	Soil protection					x		x	x	x	x				
ENVIRONMENTAL SUSTANABILITY	Residues, wastes							x	x		x				
ENVIRONMENTAL SUSTANABILITY	Waste management						x	x	x	x	x				
ENVIRONMENTAL SUSTANABILITY	**Sustainable Water**														
ENVIRONMENTAL SUSTANABILITY	Water rights							x	x	x	x				
ENVIRONMENTAL SUSTANABILITY	Water quality					x		x	x		x	x			
ENVIRONMENTAL SUSTANABILITY	Water management, conservation							x	x	x	x	x			
ENVIRONMENTAL SUSTANABILITY	Efficient use of water						x	x	x			x			
ENVIRONMENTAL SUSTANABILITY	**Air quality**														
ENVIRONMENTAL SUSTANABILITY	Air pollution					x		x	x	x	x				
SOCIAL/ECONOMIC SUSTAINABILITY	**Community Development**														
SOCIAL/ECONOMIC SUSTAINABILITY	Local Infrastucture and services development							x	x						
SOCIAL/ECONOMIC SUSTAINABILITY	Increase in energy access							x	x						
SOCIAL/ECONOMIC SUSTAINABILITY	Local Economic development and employment						x	x	x	x					
SOCIAL/ECONOMIC SUSTAINABILITY	Local Professional skills training and education								x	x					
SOCIAL/ECONOMIC SUSTAINABILITY	**Social aspects**														
SOCIAL/ECONOMIC SUSTAINABILITY	Social Impact Assessment						x	x	x	x					
SOCIAL/ECONOMIC SUSTAINABILITY	Indigenous peoples' rights								x	x					
SOCIAL/ECONOMIC SUSTAINABILITY	Land right issues							x	x	x	x				
SOCIAL/ECONOMIC SUSTAINABILITY	Gender issues						x								
SOCIAL/ECONOMIC SUSTAINABILITY	**Labor conditions**														
SOCIAL/ECONOMIC SUSTAINABILITY	Working conditions / ILO conventions						x	x	x	x	x				
SOCIAL/ECONOMIC SUSTAINABILITY	Contracts								x	x	x				
SOCIAL/ECONOMIC SUSTAINABILITY	Health and Safety								x	x	x				

Based on: LBST, ILF: Requirements for the production and export of green-sustainable hydrogen; for GIZ/ Energy Partnership Chile-Alemania; December 2021

Certification can follow a Book & Claim or Mass Balance chain of custody model depending on the certification system

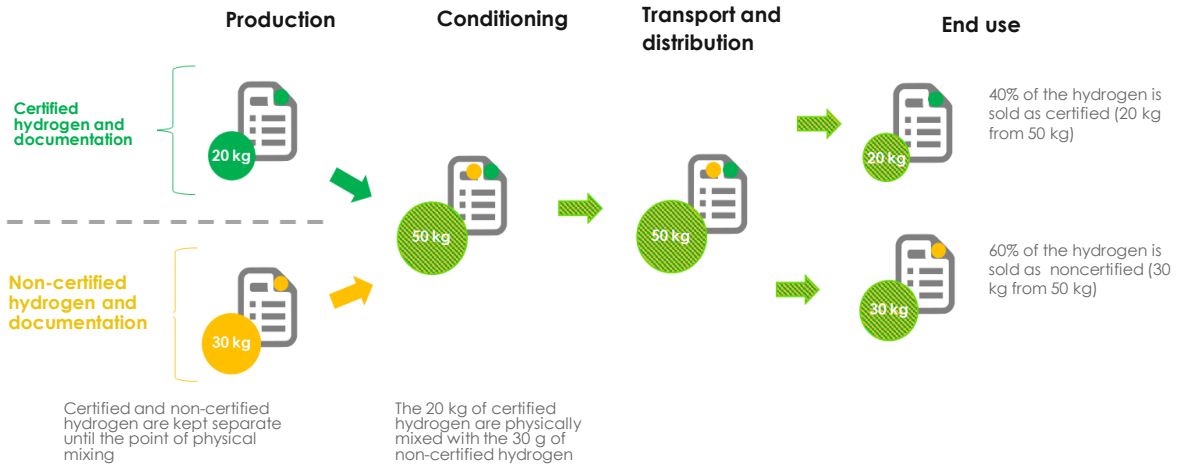
2 **Hydrogen certification systems implement either the Book & Claim or Mass Balance models, depending on the scope and market targeted by each system.**

Book & Claim model



- Allows to trade the certificate (product attributes) from the physical flow of the product separately.
- Certificates can be traded and assigned to any other product unit within a geographic perimeter (country, region, or worldwide), separately from the product.

Mass Balance model



- Product attributes follow the physical flow of the product; however, the model allows mixing of certified and non-certified products within the same supply chain.
- Each step of the chain of custody must be certified (e.g. feedstock, production, injection, and consumption)
- **The outcome needs to be equal to the income: although 20 kg renewable H2 are mixed with 30 kg non-renewable H2, just 20 kg of the end product can be sold as renewable.**

Governance, verification and supervision rules are key elements to ensure robust and reliable certification systems

3

Governance, Verification and Supervision of a certification system are fundamental elements to ensure a reliable demonstration of compliance with regards to respective regulations and/or demonstrate renewable attributes of products for consumer & corporate reporting.

Governance

Governance encompasses the system by which a certification scheme is controlled and operates, and the mechanisms by which it, and its people, are held to account.

Ethics, risk management and administration are elements of governance.

Verification

Verification is the process of ensuring that documentation submitted by regulated parties is reliable. Verification is key in achieving confidence and reliability in reported data for stakeholders, market participants, and the public.

Verification is usually carried out by trained and independent parties.

Supervision

Supervision consists of an investigation of whether existing legal requirements have been followed. This may involve long-term follow-up as well as short-term and random sampling mechanisms.

How and by whom this surveillance is carried out depends on the respective legal framework.

In **mandatory markets** the certification is a "mirror" of the regulation, since requirements are first given by regulation

► Every project will **depend on certification to capture the added value** of the product. It is critical to start by **identifying the target markets** and their respective regulations.

► In Europe there are different carbon reduction targets and rules to be met, depending on the specific regulation.

Regulation (in force or proposed)	**Driver for certification**
RED II (under revision)	Compliance w/ **RES-T obligations** [RES-I obligations concern H_2]
Taxonomy (New)	Compliance w/ **GHG intensity limit** for access to green finance
ReFuelEU Aviation (New)	Compliance w/ **obligations on RES & share of RFNBOs**
FuelEU Maritime (New)	Compliance w/ **fuel mix GHG intensity reduction** obligations
EU ETS extension to Maritime (New)	Reporting of **emissions from use of fuel**
EU ETS – CBAM (New)	Reporting of **production emissions** of imported product

Within the **RFNBO market**, five certification systems are seeking **European Commission's recognition** for compliance

While all systems undergoing **recognition cover RFNBO products**, **not all of them currently have geographical coverage in the LATAM** region, specifically in Chile and Uruguay.

Nevertheless, some have certified other products in LATAM geographies and/or utilize certification bodies that also operate in them.

Certification systems	Current geographic scope	Experience in Chile and Uruguay (certified projects)	Certification bodies/auditors in Chile and Uruguay
ISCC EU (extension of the scope to also RFNBOs and RCF)	Global	The certification system has been involved in certifying biomass/biofuels products in Chile and Uruguay, yet there haven't been any RFNBO projects certified in these countries.	• Control Union Certifications • Certificadora Gallega del Noroeste SL • CGN • TUV SUD • Bureau Veritas • SCS Global Services (Chile) • CUGG (Uruguay) • BV PL (Uruguay) • LSQA S.A. (Uruguay)
REDcert EU (extension of the scope to also RFNBOs and RCF)	Global	No	• Control Union Certifications • TUV SUD • Bureau Veritas • SGS
CertifHy (RFNBO)	Global	No	• TUV SUD • Bureau Veritas
CCEE Hydrogen and Derivatives Certification System (RFNBO)	Brazil	No	-
KZR INiG System (extension of the scope to also RFNBOs and RCF)	Global	No	• SGS • Control Union Certifications • Bureau Veritas • TUV SUD

Within the **RFNBO market**, five certification systems are seeking **European Commission's recognition** for compliance

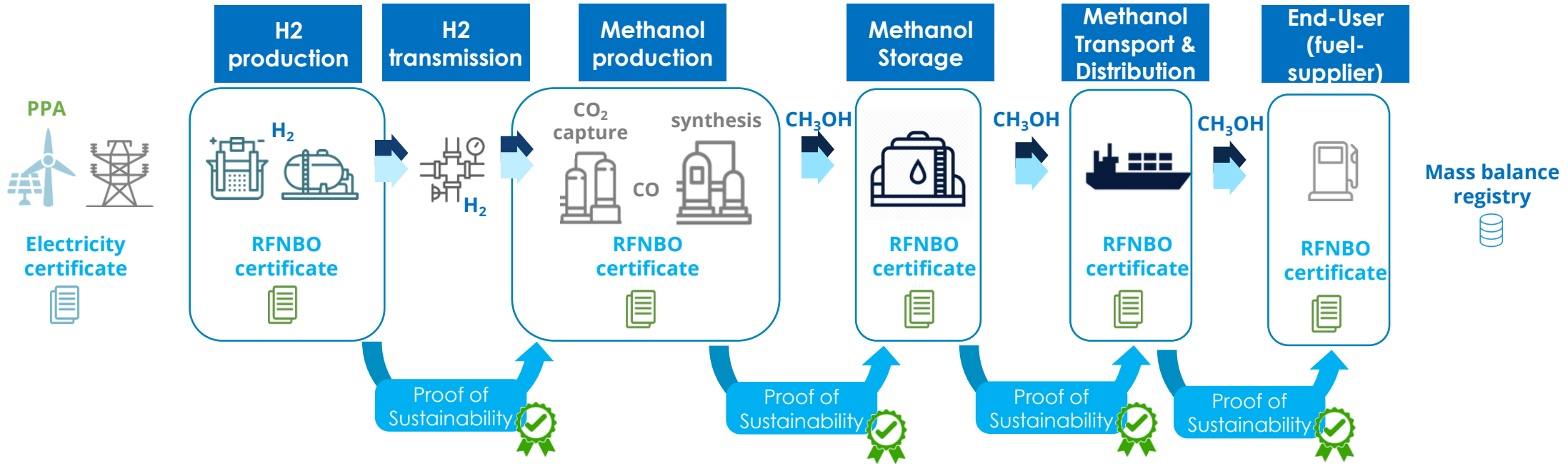
All certification systems undergoing recognition for RFNBO **cover the minimum requirements specified by the RED II regulation** for these products described in previous chapters, aiming to demonstrate compliance.

Attributes	ISCC EU RFNBO	REDcert EU RFNBO	CertifHy RFNBO	CCEE RFNBO	KZR INiG System
Energy source for H2 production	✓	✓	✓	✓	✓
Temporal correlation	✓	✓	✓	✓	✓
Geographical correlation	✓	✓	✓	✓	✓
Additionality	✓	✓	✓	✓	✓
GHG intensity	✓	✓	✓	✓	✓

The Chain of Custody defines the method and extent of tracking along the value chain: Mass Balance is the defined approach

To demonstrate that a product **is a RED-compliant RFNBO** a Mass Balance chain of custody approach must be applied, considering:

- Every **economic operator (EO)**[1] within a Well-to-Wheel scope must undergo a **validation and certification** process (following the process described in next slides including an audit).
- Once all EO have their RFNBO certification (issued by the certification system), the **Proofs of Sustainability** (corresponding to declarations issued by each EO) **transmit information regarding sustainability criteria** and associated emissions at each stage of the supply chain. These are **exchanged among EO's until the final consumer and include the accumulated information up to that stage.**



[1] Companies or organizations that supply a good or service in the market and are required to obtain the system's certifications for these (i.e. H2 producers, ammonia producers, hydrogen and ammonia carriers, distributors)

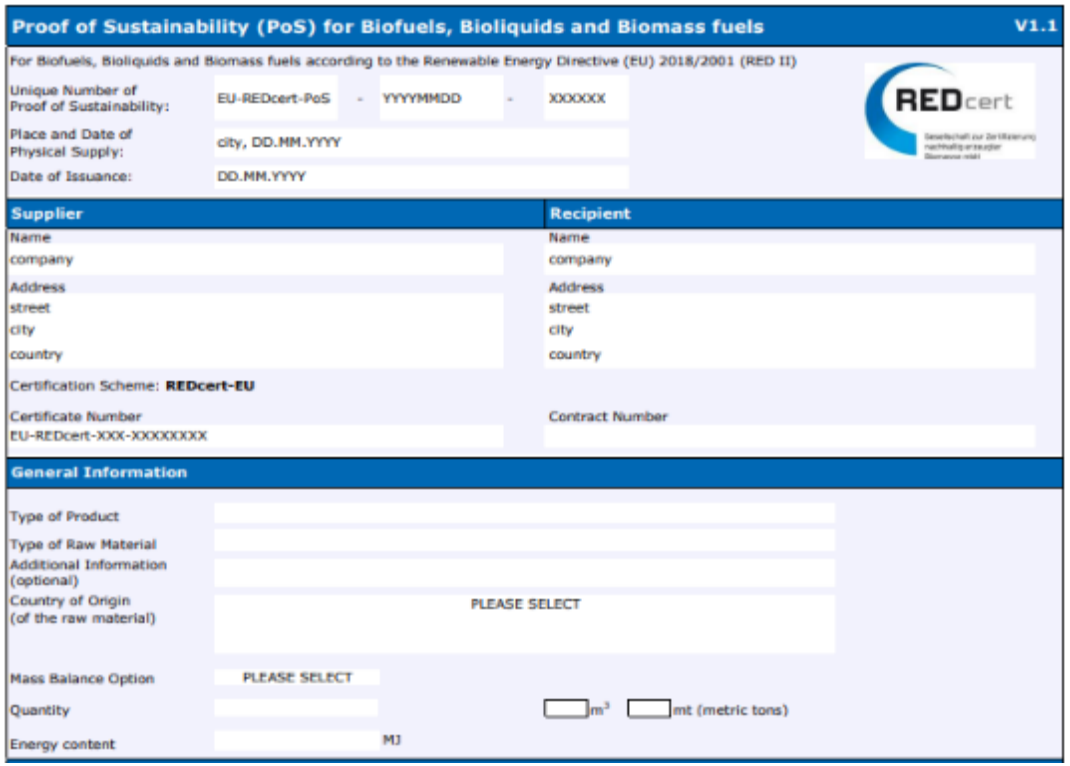
Economic operators must undergo various exercises during the certification process of RFNBO products

- The **audit phase is a yearly exercise** allowing to certify the set-up developed by the producer (The certification exercise is done once a year and should be based on an overall strategy assessment and actual production data & evidences).
- It is split in two main steps:
  - **The Preparation**: initial **audit validation (book exercise)** to make sure that all the requirements for certification are fulfilled based on evidence
  - **The Audit:** validation is based on plan and **verification exercise based on actual production data**.
- In case of major updates in the process, a declaration should be made to the auditor and a new audit should be conducted.
- Control audits can be conducted at any time over the year.

Step	Register	Preparation	Audit	Certification	Proof of Sustainability
Process	Choose the certification scheme, and register the account and plant in its system	Calculate Carbon Intensity and prepare evidence based on certification scheme requirements	The scheme shall indicate a 3rd party conformity assessment to undergo the audit	Once the audit has been approved and the issuing body has been informed, it will issue the certification.	Issuance of PoS statement among economic operators and address it to customers.
Responsible	**H_2 producer**	**Economic operators**	**Certification body (on behalf of designated accredited auditor under respective scheme)**	**Issuing body**	**Economic operators**

A certified economic operator can issue PoS to its customers, which are standard documents associated with the products

- The Proof of Sustainability (illustrated below by a biofuel PoS as already established market based on similar mechanisms, as RFNBO ones that are not yet in place) is a standard document to be issued by the certified economic operator (EO).
- Its content is declared by the EO and should be done respectfully to the process that has been audited and led to the certification.
- This document is linked to the physical product (related to a specific batch or volume produced), and follows it across the value chain as Mass Balance is required to demonstrate RED compliance.



Proof of Sustainability (PoS) for Biofuels, Bioliquids and Biomass fuels V1.1

For Biofuels, Bioliquids and Biomass fuels according to the Renewable Energy Directive (EU) 2018/2001 (RED II)

Unique Number of Proof of Sustainability: EU-REDcert-PoS - YYYYMMDD - XXXXXX

Place and Date of Physical Supply: city, DD.MM.YYYY

Date of Issuance: DD.MM.YYYY

Supplier	Recipient
Name	Name
company	company
Address	Address
street	street
city	city
country	country

Certification Scheme: **REDcert-EU**

Certificate Number	Contract Number
EU-REDcert-XXX-XXXXXXXX	

General Information

Type of Product

Type of Raw Material

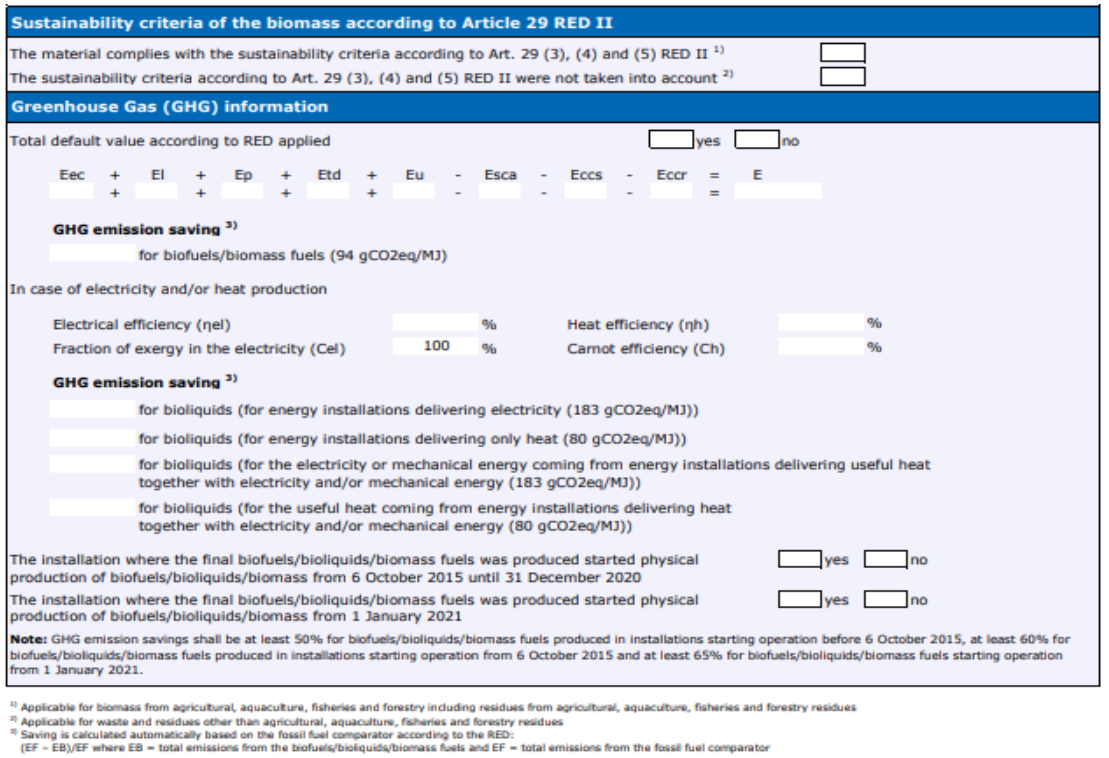
Additional Information (optional)

Country of Origin (of the raw material) PLEASE SELECT

Mass Balance Option PLEASE SELECT

Quantity ☐ m³ ☐ mt (metric tons)

Energy content MJ



Sustainability criteria of the biomass according to Article 29 RED II

The material complies with the sustainability criteria according to Art. 29 (3), (4) and (5) RED II [1] ☐

The sustainability criteria according to Art. 29 (3), (4) and (5) RED II were not taken into account [2] ☐

Greenhouse Gas (GHG) information

Total default value according to RED applied ☐ yes ☐ no

Eec	+	El	+	Ep	+	Etd	+	Eu	-	Esca	-	Eccs	-	Eccr	=	E
	+		+		+		+		-		-		-		=	

GHG emission saving [3]

☐ for biofuels/biomass fuels (94 gCO2eq/MJ)

In case of electricity and/or heat production

Electrical efficiency (ηel)	%	Heat efficiency (ηh)	%
Fraction of exergy in the electricity (Cel)	100 %	Carnot efficiency (Ch)	%

GHG emission saving [3]

☐ for bioliquids (for energy installations delivering electricity (183 gCO2eq/MJ))

☐ for bioliquids (for energy installations delivering only heat (80 gCO2eq/MJ))

☐ for bioliquids (for the electricity or mechanical energy coming from energy installations delivering useful heat together with electricity and/or mechanical energy (183 gCO2eq/MJ))

☐ for bioliquids (for the useful heat coming from energy installations delivering heat together with electricity and/or mechanical energy (80 gCO2eq/MJ))

The installation where the final biofuels/bioliquids/biomass fuels was produced started physical production of biofuels/bioliquids/biomass from 6 October 2015 until 31 December 2020 ☐ yes ☐ no

The installation where the final biofuels/bioliquids/biomass fuels was produced started physical production of biofuels/bioliquids/biomass from 1 January 2021 ☐ yes ☐ no

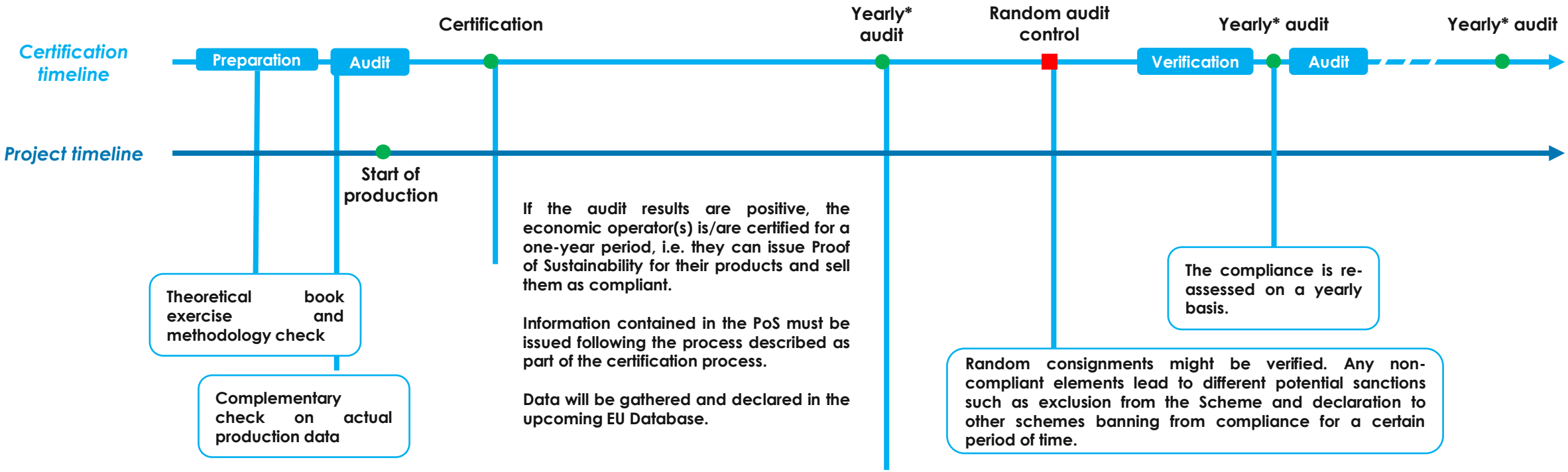
Note: GHG emission savings shall be at least 50% for biofuels/bioliquids/biomass fuels produced in installations starting operation before 6 October 2015, at least 60% for biofuels/bioliquids/biomass fuels produced in installations starting operation from 6 October 2015 and at least 65% for biofuels/bioliquids/biomass fuels starting operation from 1 January 2021.

[1] Applicable for biomass from agricultural, aquaculture, fisheries and forestry including residues from agricultural, aquaculture, fisheries and forestry residues
[2] Applicable for waste and residues other than agricultural, aquaculture, fisheries and forestry residues
[3] Saving is calculated automatically based on the fossil fuel comparator according to the RED:
(EF – EB)/EF where EB = total emissions from the biofuels/bioliquids/biomass fuels and EF = total emissions from the fossil fuel comparator

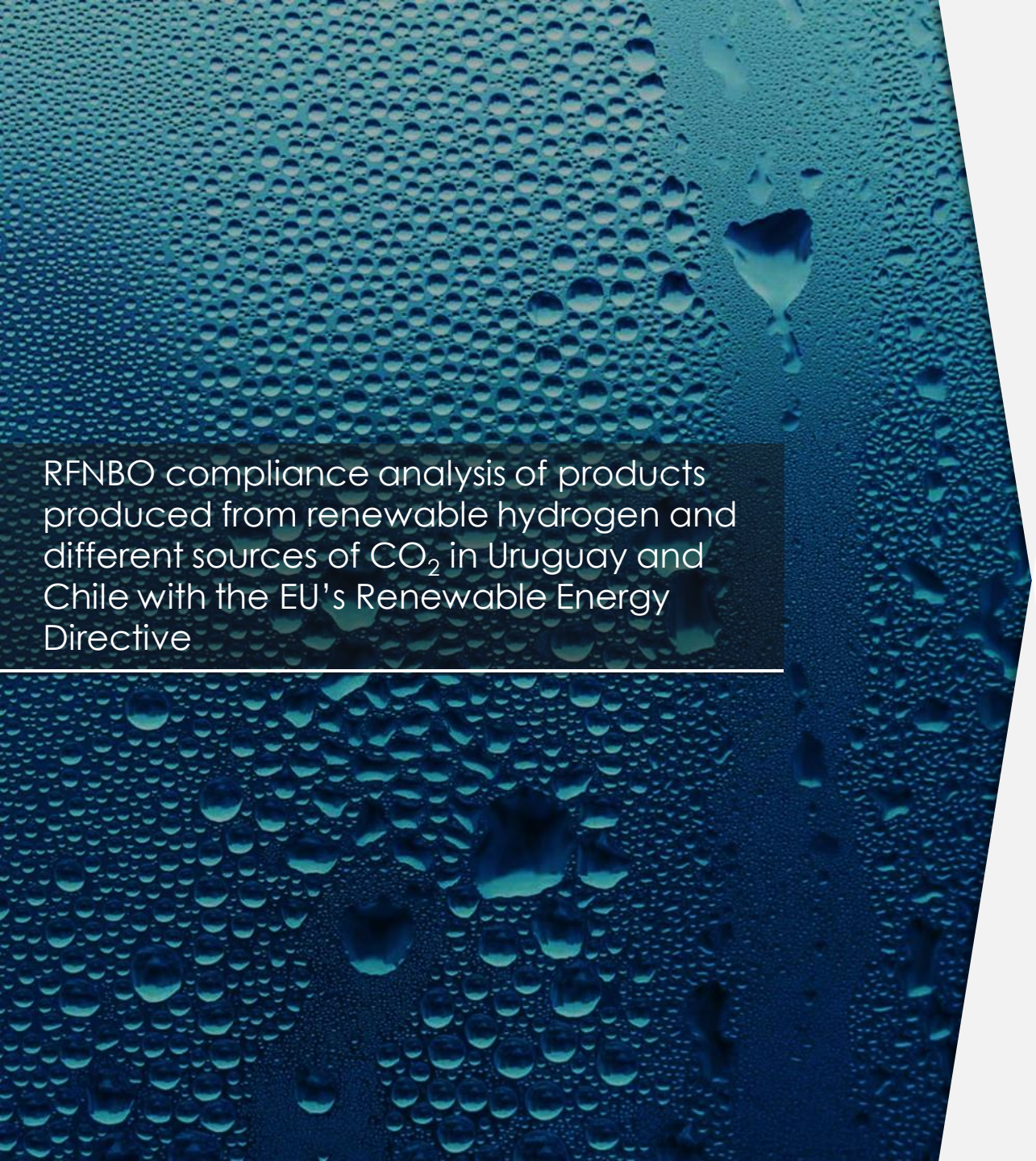
Source: REDcert Proof of Sustainability for Biofuels, Bioliquids and Biomass fuels

Until the certification systems receives the recognition by the EC, pre-certification is good approach to prepare for compliance

- It is necessary to wait for the recognition of the European Commission regarding certification systems so that they can operate in the RFNBO market. Once this happens, producers in Chile or Uruguay can choose and contact the certification system to start the certification process.
- As a recommendation, **pre-certification may be a positive initial approach** to ensure that the design and operation of the respective value chain of the projects comply with RFNBO requirements.
- Below, a summary of the process that the developer must follow to achieve product verification and certification is presented, in parallel with the project timeline:



*Yearly check is the base case but, depending on the initial audit results, the frequency might be modified (e.g. if major grey zones/risks are identified during the audit, a quarterly check can be defined).



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP1

1.1 Overview of RED II & III and DA regulations for RFNBO

1.2 Certification systems assessment for RFNBO product

1.3 CO2 requirements under RED II & III and DA for RFNBO

1.4 Recommendations for compliance with RFNBO requirements in Chile and Uruguay

Conclusions and recommendations on EU's RFNBO regulation and its applicability in Chile and Uruguay

Overview of RED II & III and DA regulations for RFNBO's

- It is crucial for **project developers** to have a complete **understanding of the regulations** of the European RFNBO market, as those **directly influence the project's design and operation along its value and supply chain**. It is also important to be aware of any modifications those regulations may undergo, as well as eventually specific transpositions in the EU Member States.
- The **Renewable Energy Directive (RED)** plays an essential role in fostering the adoption of renewable energies in fuel and industry sectors in Europe. It is the main driver of progressively increasing demand of RFNBOs, along with other relevant regulations like **ReFuelEU aviation and FuelEU maritime which are focused on ramping-up a market of RFNBO compliant sustainable aviation fuels (SAF) as well as low or zero-emission maritime fuels; and the Carbon Boarder Adjustment Mechanism (CBAM)** which aims at prioritizing low-carbon products through the definition of a carbon intensity threshold for certain import goods, including ammonia**.**
- **Due to the legally binding application targets** set in the previously mentioned regulations**, renewable hydrogen and derivatives from non-biological origin** (RFNBO's) **are expected to face a higher willingness to pay** and thus to receive a "premium price" in the market. However, these **targets can also be met through direct electrification** (the preferred option in terms of its energy efficiency)**, (advanced) biofuels** (including biogenic H_2) **and Recycled Carbon Fuels (RCF),** which may offer greater cost competitiveness. Therefore, the application of RFNBOs is further incentivized through minimum sub-targets and multiplicators.
- Moreover, **CO_2 derived from biogenic sources holds considerable value** for the industry, serving as a **critical input for certain RFNBO derivatives** (i.e. methanol) production, since its utilization **allows to discount emissions from the end product's Carbon Footprint (CFP)**.
- RED III establishes that to achieve the target in the transport sector, two alternatives are offered for each MS to decide on: meeting a minimum RFNBO consumption or reducing GHG intensity by a certain percentage through the consumption of RFNBOs. This evidences that RFNBO products that demonstrate substantial GHG savings may gain more traction in countries that adopt the RED target as an alternative to "GHG emission reduction", since the first alternative can be achieved with all types of RED II-compliant RFNBO products, regardless of their CFP. Therefore, this aspect should be monitored during the transposition of the targets in the Member States.

Conclusions and recommendations on EU's RFNBO regulation and its applicability in Chile and Uruguay

Overview of RED II & III and DA regulations for RFNBO's

- There are **three main criteria** dictated by the delegated RFNBO regulations:

  1. The **renewability of the network**, which depending on the electricity supply pathway must meet different requirements:

     - **Direct connection to the renewable plant:** it is essential to comply with additionality (RE plants coming into operation no more than 36 months before the electrolyzer (EZ)) and time correlation (with hourly correlation between production and consumption from 2030 onwards).

     - **Grid connection with a PPA:** the PPA must meet additionality (which can be avoided if the grid has <18gCO_2/MJ), time correlation (The PPA or GO must be able to deliver hourly information) and geographic correlation (EZ must be in the same supply zone as RE plant, or the EZ should be in a bidding zone with an equal or lower day-ahead price). In this scenario, purchase and cancellation of a GO is required, unless the country does not implement a GO systems or the renewable energy asset is owned by the fuel producer. The PPA must be renewable from a source other than biomass.

     - **Grid connection without PPA:** it is important that the grid has a renewability >90% to consider 100% of the electricity consumed as renewable. In this case, this limit must be met at least one year within the previous 5 years, and the number of hours of production must be kept below the proportion of renewable electricity in the bidding zone of the previous year. Under this scenario all renewables present in the grid (including biomass) can be considered to reach the threshold. If this value is not met, the renewable H2 proportion will be determined based on the share of renewable energy in the grid two years prior. In both cases, purchase and cancellation of a GO is required, unless the country does not implement a GO systems

  2. The RFNBO must achieve a minimum **emissions saving of -70%** compared to the fossil fuel comparator. Therefore, the maximum emissions may be **28.2 gCO_{2eq}/MJ or 3.38 kgCO_{2eq}/kgH_2.**

  3. Certification must be used to demonstrate compliance with requirements, through a certification system recognized by the European Commission, and employing a Mass Balance emissions tracking model with a Well-to-Wheel approach across the entire supply chain.

- **Electricity sourcing pathways can be combined** to optimize the project according to multiple factors: reduction of costs, reduction of the carbon footprint of the final product, a higher percentage of RFNBO compliant production, among others. **The best configuration of options** and selection of optimal, RFNBO compliant electricity source **depends on each project typology and location**, and should be determined **based on a technical-economic analysis**.

Conclusions and recommendations on EU's RFNBO regulation and its applicability in Chile and Uruguay

Application of RED II & III in projects

- **Additionally, the selection of the best electricity sourcing options depends on the grid renewability and on the specific electricity market and its operational design and transmission capacity**. In this case, **Chile and Uruguay face different scenarios**.
- When examining the translation of the bidding zone concept to Chile and Uruguay, it is evidenced that **both countries operate with a Nodal Marginal Nodal Price or Nodal Generator Price system**. However, Uruguay operates with a **single hourly spot price for the entire market**, suggesting a lack of re-dispatches of energy throughout the country. In contrast, the SEN system in Chile operates with a single pricing methodology based in marginal costs, showing **significant variation in marginal electricity costs between nodes**, with some zones experiencing prices as low as 0 USD/MWh at certain times, indicating the existence of energy re-dispatches between nodes. According to the Q&A released by the European Commission, Uruguay and Chile (SEN) can be considered as a single bidding zone as the country is integrated and has the same electricity price and as the country operates under a single pricing methodology, respectively. However, further analysis in the case of Chile is recommended because of the technical restrictions reveal re-dispatch of generation capacity and curtailment in many congested nodes. For both countries need an official statement on this matter, and its approvement by the European Commission, is still required to assume the bidding zone.
- Projects located in Uruguay are facing a favorable scenario, as they **can connect directly to the grid without needing a PPA,** given that the grid in Uruguay has demonstrated a renewable energy percentage greater than 90% in recent years. Alternatively, if projects in Uruguay choose to operate under a PPA, they can **potentially meet the three main criteria of correlation and additionality without significant challenges.** This is because, if Uruguay is considered a single bidding zone, projects in the country can always meet the geographical correlation requirement, while temporal correlation can be easily demonstrated, as the national certification system already includes GOs on an hourly basis. Also, in 2022, Uruguay reported an emission factor of ~17 gCO_2e/MJ, which allows a project in Uruguay under a PPA to skip the additionality criteria. However, both scenarios (with and without PPA) must continue to be monitored in relation to the criteria, as the characteristics of the grid may vary over the years.
- In the case of Chile, the country first needs the approval of the European Commission regarding the establishment of bidding zones in the country and to supervise that the **implemented GOs (I-REC) system provide hourly information to ease compliance with time correlation criterion even though this information can be requested to different actors with this purpose**. Currently, projects developed in the country with a PPA **must comply with additionality**. If these projects are connected to the grid, they **cannot consider 100% of their production as renewable**; instead, their renewable production will follow the renewable share of the grid, which must be less than 90%.
- It is recommended that **public Authorities** of both Chile and Uruguay may issue a formal/official **statement on how the European definition of bidding zone could be considered or translated in local context**. Once the European Commission may approve these statements, project developers at the country level will more easily be able to proof RFNBO compliance.

Conclusions and recommendations on EU regulation for RFNBO and its applicability in **Uruguay**

As previously mentioned, there are three different pathways or options of electricity sourcing. The following tables provide an overview about the advantages and disadvantages of each pathway in the specific local context of Chile and Uruguay, as well as their applicability in projects in each country. **It is worth to highlight that a technical-economic analysis of a project is required, however, in order to draw final conclusions on the best sourcing alternative for each country.**

Electricity sourcing pathways Analysis for URUGUAY

Pathways	Pros	Cons
A: Direct Connection	• No geographical correlation criteria required. • "Easy" demonstration of renewable consumption since energy is directly consumed by the electrolyzer. • No PPA nor GO is required.	• Additionality needs to be met. • Smart metering is necessary to accurately demonstrate temporal correlation • High CAPEX is expected for dedicated renewable plants. Given that the country has small distances, the optimal renewable spots will likely be located relatively close to the electrolyzer, so dedicated lines should not be so long reducing CAPEX.
B: Grid with PPA	• Grid < 18 gCO_2e/MJ (2022), therefore additionality can be skipped. • Guaranteed supply of 100% stable renewable energy. • Stable electricity price (linked to PPA) without CAPEX. • Since Uruguay, based on the presented analysis, could be considered a single bidding zone, geographical correlation would always be met. • The national electricity certification presents hourly data.	• It's crucial to monitor the CFP of the grid, as the limit is being narrowly met (17 gCO_2e/MJ). To achieve this, low-carbon sources of renewable energy should be integrated into the grid. Since Uruguay already has a significant share of renewables, it may be necessary to reduce the reliance on biomass as an energy source and increase the proportion of solar or wind energy to more consistently meet this threshold.
C.1: Grid with > 90% renewability without PPA **C.2: Gird without PPA**	Uruguay already achieves over 90% renewability, allowing a project to connect to the grid and consider 100% of its production as RFNBO compliant for 5 years.	• Monitoring need of RE variability remains (i.e. with Uruguay's drought), since the ratio of full load hours of the electrolyzer cannot exceed the share of RE from the previous year, which could impact the profitability of the business case. It is recommended to explore complementing options, such as a renewable PPA, if needed, based on project-specific analyses.

Conclusions and recommendations on EU regulation for RFNBO and its applicability in **Chile**

As previously mentioned, there are three different pathways or options of electricity sourcing. The following tables provide an overview about the advantages and disadvantages of each pathway in the specific local context of Chile and Uruguay, as well as their applicability in projects in each country.
It is worth to highlight that a technical-economic analysis of a project is required, however, in order to draw final conclusions on the best sourcing alternative for each country.

Electricity sourcing pathways Analysis for CHILE		
Pathways	Pros	Cons
A: Direct Connection	• No geographical correlation criteria required. • "Easy" demonstration of renewable consumption since energy is directly consumed by the electrolyzer. • No PPA or GO is required.	• Additionality should be met. • Smart metering is essential to demonstrate temporal correlation accurately. • CAPEX is high for dedicated renewable plants.
B: Grid with PPA	• Guaranteed supply of 100% stable renewable energy. • Stable electricity price (linked to PPA) without CAPEX. • Since the complete SEN system could be considered a single bidding zone, compliance with geographical correlation should not be a challenge for projects in this zone.	• Grid > 18 gCO_2/MJ, this requires compliance with the additionality criterion. • GOs on an hourly basis (I-RECs) is still under development (currently monthly) • For projects located in the southern areas of Chile (Aysén and Magallanes), the geographic correlation may be more challenging, as projects should be located entirely in these bidding zones respectively, as they have lower marginal costs than the northern areas.
C.1: Grid with > 90% renewability without PPA	• Grid does not have >90% renewability, it should be analyzed on a node's basis. A bidding zone definition approved by the European Commission is required for the country, to be able to evaluate whether the defined threshold is met for each region.	
C.2: Gird without PPA		Since the grid presents only 56% of renewability, 44% of the H_2 production will be considered "non-renewable", reducing the business case.

Conclusions and recommendations on EU regulation and certification for RFNBO and its applicability in Chile and Uruguay

CFP calculation methodology and CO_2 sources eligibility

- In both hydrogen and derivative production, only the **main energy sources are considered** in the final energy balance. However, it is important to be aware that **emissions should be accounted for all the emission sources** and processes of the value chain.
- Additionally, it is recommended to **be aware when using a mix of electricity**, as emissions are averaged across the total product, potentially **negatively affecting the RFNBO footprint**
- When exporting a product to the European RFNBO market, **all emissions along the value chain, including those from transportation, must be considered**. The main differences between the CFP of similar projects lie in their locations, determined by their distance from the import destination and the emissions associated with maritime transport. Emissions linked to maritime transportation can be critical when production facilities are situated far from the EU. However, the case study analyzed demonstrates that emissions from fuel transport, even when considering a route from Montevideo to Rotterdam, only contribute to approximately 10% of the total emissions.
- All types of CO_2 can be used for the production of RFNBO, but **biogenic CO_2 allows for emissions reduction, thus allowing to easier fulfill the 70% emissions savings** criterion explained earlier. While the regulation does not forbid the use of non-eligible CO_2 sources, it is clear from the results of the case study presented, that it is highly unlikely to comply with the emissions savings requirements without using an eligible CO_2 source. It is also important to notice that most of the emissions from the analyzed value chain come from the combustion of the fuel, representing ~88% of total emissions (without considering the discount).
- **Chile and Uruguay have availability of biogenic CO_2** for project development, which are very valuable. Additionally, Uruguay benefits from having a smaller land area, resulting in lower emissions associated with land transportation of this CO_2 to the project site. Chile's case is different, mainly due to the country's length and the concentration of biogenic CO_2 emissions in the central region, unlike H_2 and derivative projects, which potentially will be located in the country's poles due to its renewable potential.

Certification systems

- It is recommended to obtain certifications from **certification systems that are already recognized by the European Commission** to operate in the RFNBO market and have a global scope, meaning they cover the country of origin of the product.
- Additionally, it is recommended to implement certification systems that have **already operated in the country or work with certification bodies** (auditors) that are present there. This facilitates the verification process and ensures smoother communication with these bodies (ISCC, REDcert and CertifHy).

The current main concern of project developers in LAC economies is the translation and validation of Bidding Zone concept

Required actions identified for importing jurisdictions:

Key challenge 1: Clear definition of validation of non-EU country specific definition of Bidding Zone

- Clearly established communication channels between public entities of exporting economies and European Commission is required to solve the questionmark behind the local bidding zone definition.
- This includes clear guidelines on what kind of official statement exporting countries need to submit via which channel to solve the definition, and
- Specific solutions on how to treat and to deal with non-defined bidding zones (e.g. Chile).

Required actions identified for project developers (PD) and exporting jurisdictions (EJ):

Key challenge 1: Engage with national Governments to drive the required discussions and deliver all relevant information

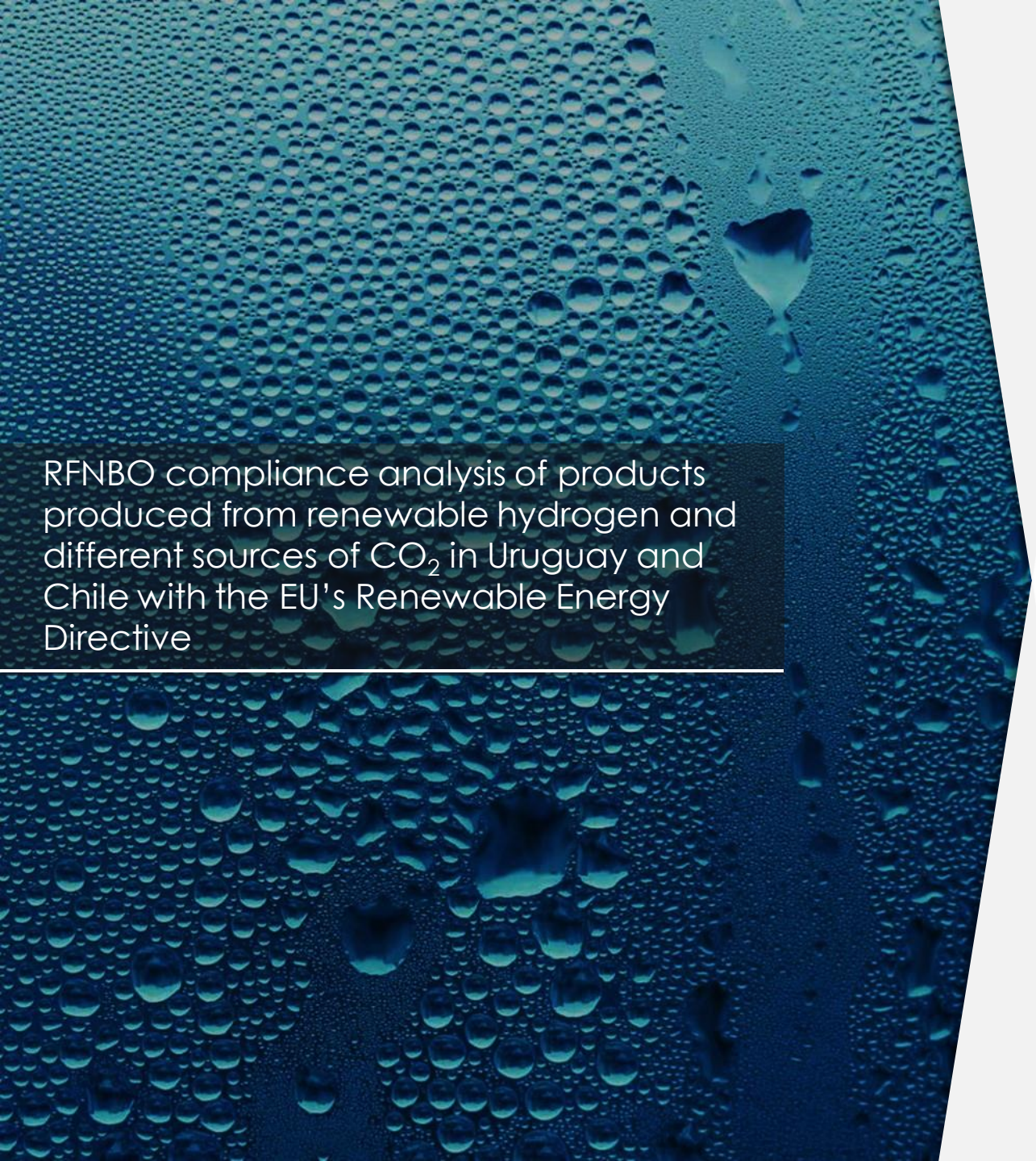
- **PD:** Inform national (local) Government on required data to be provided by energy market actors to be able to fulfil regulatory criteria in EU
- **PD:** Deliver all relevant information to national (local) Governments to optimize their bilateral engagement efforts with importing jurisdictions

Key challenge 2: Engage with other national Governments of LAC Region to act in an aligned way, facilitating dialogues with importing jurisdictions and promoting regional characteristics and requirements

- **EJ:** Group together to define common standpoints
- **EJ:** Drive the concept of shared responsibility, focusing on discussing regionally relevant product and production criteria (ASR – e.g. sustainable water use or absence of land use conflicts) to be covered by certification schemes and to be incorporated in consumer requests

WORK PACKAGE 2

Overview of RSB's Additional Sustainability Requirements for H2Global



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP2

2.1 Overview of RSB Additional Sustainability Requirements for H2Global

2.2 ESMP compliance and execution requirements assessment

2.3 RSB Rural and Social development and Water criteria assessment

2.4 Recommendations for compliance with key ASR for Project Developers in Chile and Uruguay exporting to the Netherlands

H2Global is a support mechanism offering 10-year HPA's to boost the PtX market at industrial scale

- H2Global is a competition-based mechanism that aims to address the existing price gap between low/zero-carbon solutions and conventional products which prevents the large and economically important CO2 emitters in the EU from decarbonizing quickly and consistently, promoting the ramp-up of clean technologies such as hydrogen.

Objectives of H2Global:

- Promote and effectively increase the market for sustainably produced hydrogen, ammonia, methanol and jet fuel in countries out of Europe to provide its availability to the EU.
- Contribute to protect the environment and climate.

Funding

- The first funding window of EUR 900 million (2023) is financed by the German Federal Ministry for Economic Affairs and Climate Action (BMWK).
- According to a Joint Declaration of Intent signed in November 2023 between Germany and the Netherlands, a new funding window of EUR 600 million will be launched during 2024.

Implementation agency

- H2Global relies on the "Hydrogen Intermediary Network Company" (HINT.Co) for its implementation.
- HINT.Co is a market maker which acts as an intermediary between the seller and buyer of renewable Power-to-X products.
- HINT.Co acts as a bankable off-taker, guaranteed by a foundation equipped with federal funds.

Source: H2Global. https://www.h2global-stiftung.com/project/h2g-mechanism

1 HINT.Co offers PtX project developers a 10-year Hydrogen Purchase Agreement (HPA) with a maximum budget of 300 MM EUR per project (2023).

2 HINT.Co enters into **long-term Hydrogen Purchase Agreements (HPA's)** on the supply side and **short-term sales contracts (HSA's)** on the demand side

The HPA defines the conditions and commitments between Hint.Co and the bidder, including sustainability requirements

- The rules that the bidder must comply with are established in the **Hydrogen Purchase Agreement (HPA).**
- The HPA sets **the technical conditions, product quality, delivery of the product, timelines, sales conditions, as well as the environmental conditions that must be met during construction and operation processes.**
- The grant notice stipulated that "*production of the Products and the Products itself [shall] meet sustainability criteria as well as* ***Additional Sustainability Requirements****. These requirements will be assessed during the tender process and will also be* ***reflected as obligations in the HPAs****.*"
- To operationalize these requirements, **H2Global collaborates with RSB*,** which was responsible for translating the content of the grant notice into **sustainability criteria beyond RED II criteria,** the so-called **Additional Sustainability Requirements (ASR).**
- According to the **Joint Declaration of Intent signed between Germany and Netherlands** in November 2023 for the implementation of a joint second H2Global window, common additional sustainability criteria will be included and based on the criteria developed within the first H2Global window, aiming to be aligned with OECD guidelines and the standards referred to therein.

* Further elements of the tender documents were elaborated with the support of other organizations such as TÜV SÜD, LBST - Ludwig-Bölkow-Systemtechnik GmbH, BET Büro für Energiewirtschaft und technische Planung, EY, as well as the law firms REDEKER SELLNER DAHS Rechtsanwälte and Freshfields Bruckhaus Deringer.

HPA Draft content

1. Background
2. Parties
3. Products to be delivered
4. Term
5. Delivery of products
6. Port of Delivery / Delivery Point
7. Delivery Schedule
8. Handling of the Product
9. Dispatch of Product to HSA Customer
10. Contract Fees
11. **Product Quality**
12. **Technical Product Specifications**
13. **Additional Product Specifications**
14. **Additional Sustainability Requirements (ASR)**
15. Certification
16. Reporting
17. Contract Price & Payment
18. "Take or Pay" Obligation
19. Liability Regime
20. Contractual Penalty
21. Termination Rights
22. Performance Bond
23. Force Majeure
24. Taxes, Duties and Charges
25. Amendment of HPA due to Regulatory Changes
26. Governing Law and Jurisdiction

Source: H2Global – Market Consultation: products, quantities, criteria. BMWK (2023)
Joint Declaration of Intent on the implementation of a joint tender under the H2Global instrument between Germany and the Netherlands (2023)
H2Global Term Sheet: Hydrogen Purchase Agreements (Draft 7 July 2022)

Additional Sustainability Requirements outline all the sustainability requirements beyond the RED II, RED III and Delegated Regulation

The product quality is determined on behalf of three dimensions in the HPA. All need to be adhered to during the contract term.

12 Technical Product Specifications

- Stipulate the required delivered product quality.
- Product specifications are established for each targeted hydrogen derivative: ammonia, methanol, e-kerosene
- Technical Product Specifications are derived from prevailing product specs of the "conventional" products.

13 Additional Product Specifications

- Respond to existing regulation
- Stipulate the sustainability criteria that need to be met by the seller and that's **aligned with the requirements of the RED II, III and Delegated regulation.**

14 Additional Sustainability Requirements (ASR)

- Stipulate the **sustainability criteria** for the production process **(besides RED II and III)**
- This criteria were **developed** with the support of **RSB.**

Source: H2Global Term Sheet: Hydrogen Purchase Agreements (Draft 7 July 2022)

RSB principles do not apply to H2Global products, yet they were used as the foundation for developing ASR

The **Roundtable on Sustainable Biomaterials (RSB)** is a global membership organisation that drives the just and sustainable transition to a bio-based and circular economy.

Their sustainability framework is underpinned by **12 key principles and their underlying criteria.**

RSB has three core areas:

- **Membership** – convene stakeholders (private and public sectors, NGOs and academia) to define best practices, generate interest for action and drive consensus, enabling collaboration for greater impact.
- **Programmes** – technical and strategic advice, hands-on implementation, staff training and research services through strategical partnerships, building capability to make change happen.
- **Certification** – Certification of feedstock production and novel technologies – including fuel, biomass and material products from bio-based and recycled carbon, providing clarity on best practice. Some RSB certification schemes are: RSB Global Fuels Certification (for fuels from bio-based and advanced feedstocks), RSB EU RED Fuel Certification (for biofuels), RSB CORSIA Certification (for SAF), among others.

RSB Principles & Criteria

Source: RSB Principles & Criteria (RSB, 2023)

RSB Principles & Criteria is an international standard that sets out the **requirements** for operations producing, converting and processing **biomass, biofuels or biomaterials** under the RSB certification system.

- The **RSB Principles** are general tenets of sustainable production and processing
- The **RSB Criteria** describe the conditions to be met to achieve these tenets, either immediately (minimum requirements) or over time (i.e. three years – progress requirements).

The RSB Principles & Criteria are complemented by a set of standards, procedures and guidance documents, which constitute **RSB's sustainability framework**.

RSB Principles & Criteria and relation with H2Global´s ASR

- **H2Global** mechanism covers REDII-RFNBO compliant **hydrogen derivatives** excluding biomass production, processing or transformation, **and thus, does not require RSB certification**, nor compliance with RSB principles.
- **H2Global bidders are required to meet ASR requirements.**
- While **compliance with RSB Principles & Criteria is not mandatory for H2Global bidders, it is recommended to consider them as valuable guidelines** which can serve as a reference for best practices to optimize the Environmental and Social Management and Reporting of the project.

The Project operator is responsable for the implementation of the Project's ASR

Participating Operator

- Legal entity or natural person that has entered into a formal agreement with the RSB Association ("Participating Operator Agreement") and that is responsible for the implementation of the requirements of all applicable RSB standards and procedures in all organizations listed in the scope of certification.
- This definition **does not apply for ASR**. The H2Global mechanism is not focused on **biomass nor its derivatives**, thus H2Global bidders are not required to comply with the RSB Principles & Criteria nor enter into any agreement with RSB.

Project Operator

- Can be defined as a legal entity or natural person responsible for overseeing the implementation of the **Additional Sustainability Requirements (ASR)** framework within a specific project context.
- The Project Operator is tasked that all sustainability criteria outlined in the ASR are met throughout the construction, operation and closing of the project. This role involves managing and coordinating activities to achieve compliance with ASR obligations and may encompass multiple organizations involved in the project.

As this work focuses on **H2Global's ASR** rather than on RSB's certification schemes, the analysis of ASR requirements and obligations will be centered around H2Global's definition of ***Project Operator.***

Additional Sustainability Requirements establish both environmental and social criteria

Additional Sustainability Requirements (ASR)

- Outline sustainability criteria for hydrogen derivatives' production within the H2Global framework.
- These criteria encompass sustainability aspects beyond those associated with RED II and III and delegated regulations, which are stipulated in the Additional Product Specifications.
- Developed with the support of RSB.
- ASR are contained in the HPA.
- Compliance with ASR is mandatory for awarded project operators.
- ASR are divided into environmental criteria and social criteria, which will be presented subsequently.

ASR Compliance

- Compliance with additional sustainability requirements shall be assessed during tendering procedure, before delivery of first products and during operational phase.
- There is a differentiation between **validation** and **verification** of requirements:
  - **Validation:** process of evaluating the reasonableness of the assumptions, limitations and methods that support a statement about the outcome of future activities.
  - **Verification:** process of evaluating a statement of historical data and information to determine if the statement is materially correct and conforms to criteria.

Environmental Requirements

1. Environmental Impact Assessment (EIA)
2. Environmental & Social Management Plan (ESMP)
3. Water
4. Desalination (if applicable)
5. Conservation
6. No release of toxic substances
7. Waste and pollutant management

Social Requirements

1. Social Impact Assessment (SIA)
2. Compliance with ILO standards
3. Living wage
4. Access to health services / health insurance
5. Local value creation / competence gains: stakeholder & local SME participation
6. Gender: active involvement of women in project; no gender-based violence/harassment
7. No forced resettlement / illegal land grabbing

Environmental Criteria

1. Environmental and Social Impact Assessment (ESIA)

ASR - Environmental & Social Criteria

Requirement:

- An environmental and social impact assessment, which considers the entire supply chain in addition to the production sites, must be carried out. Both assessments should comply with an international Environmental Impact Assessment (EIA) and be carried out by the project operator.
- Additionally, the project operator must have an annually (periodically) published environmental and social management plan (ESMP).

How to validate?

- **Draft EIA** acc. to IFC - Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts*, **or** Worldbank ESS1
- **Draft SIA** acc. to IFC - Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts* **or** RSB SIA guidelines (RSB-GUI-01-005-01) **or** Worldbank ESS1.
- Draft ESMP

How to verify?

- Final EIA and SIA
- Final ESMP

Please note:

The IFC – 1 Standard includes establishment of management programs, organizational capacity, stakeholder engagement, as well as grievance mechanisms.

General Recommendations:

- For the application, H2Global only requests a **draft ESIA** which should outline planned activities for gathering information and mapping impacts.
- Collaboration with **local partners for the development of the ESIA** is recommended, due to their local knowledge.
- **The contents of both documents, the local environmental studies and ESIA Draft, shall coincide.**
- It is recommended to develop the **ESIA in original language and then translate its final version to German, although English was accepted in 2023 tenders**.

Uruguay requires project developers to present environmental studies and request environmental authorizations for project construction and operation. Those are mainly issued by DINACEA and may be a good base for the elaboration of ESIA.

Key local regulation, laws and decrees need to be considered when drafting the ESIA:

- General Environmental protection Law (LGPA for its translation into Spanish, N° 17.283);
- Decree 349/005: Regulation on Environmental Impact Assessment and Environmental Authorizations
- Law 17.283 General Environmental Law (amended by Laws 16,466; 17,234 and 18,610 (applies for all sustainability requirements)

In Chile, projects susceptible of causing environmental impact must undergo an environmental assessment. Law 19,300 defines the activities and/or potential impacts that are required to present an EIA. Although there is currently no specific typology for hydrogen projects, they typically involve activities such as electricity generation units, maritime terminals, gas pipelines, production and handling of flammable gases, among others. Therefore, it is highly probable that any Power-to-X-project will need to undergo an Environmental Impact Assessment (EIA).

Key local entities:

- Environmental Assessment Service (SEA): revises and coordinates revision of the EIA by the concerned sectoral services and issues environmental authorizations.

Key local regulation, laws, and decrees:

- Law No. 19,300 on General Environmental principles: Governs the environmental and community participation requirements within the environmental assessment process.
- Decree N°40 (2012): Regulation of the Environmental Impact Assessment System.
- SEA Guidelines: there are specific guidelines with recommendations for the development of EIA for photovoltaic plants, wind farms, hydrogen production projects, among others.
- Participation Standards Guide for Energy Project Development of the Ministry of Energy.

2. Environmental & Social Management Plan (ESMP)

ASR - Environmental Criteria

- The Environmental and Social Management Plan (ESMP) is a "living" document, that provides a summary of the potential impacts of the project and respective mitigation plans.
- The ESMP describes how the operator will manage and monitor environmental and social issues during the project and how it will respond to changes, and how the ESMP will be revised in case of changes during the operational phases.
- It works as an instrument for validating and verifying compliance of the project with Additional Sustainability Requirements.

Planning, Monitoring, and Continuous Improvement

Source: Additional Sustainability Requirements. The H2 Global Mechanism (RSB, 2023)

A detailed explanation of the ESMP is provided in the next section.

Impact Assessment Guidelines

3. Water

ASR - Environmental Criteria

Minimum considerations

Requirements:

- The purchase of water to produce hydrogen must be sustainable so that no impairment of quality or scarcity at the site is contributed to the entire life cycle of the project. The sustainable use of water must be demonstrated in the context of the Environmental Impact Assessment (EIA).

How to validate?

- **Assessment of water availability and water scarcity** in the area
- **Water impact assessment** (as part of EIA, assessing impact on water table, natural watercourses and reservoirs)
- Water **management plan** (based on local rainfall conditions, including optimization of water use, wastewater reduction, water recovery)
- Water **sourcing** concept
- Consultation with relevant local stakeholders

How to verify?

- Updated plans and assessments
- Regular monitoring
- Documentation of water sourcing (e.g. contracts)
- Registration of volumes of water purchasing / use and documentation of usage at community level

Please note:

For the regional assessment, resources such as WRI Aqueduct Water Risk Atlas can be used https://www.wri.org/aqueduct

Specific considerations for dry regions

Requirement

- In dry regions, the use of **fossil water supplies and water intended for human consumption** must be excluded.

How to validate?

- Regions with medium to high water stress or more severe:
  - no use of fossil water supplies or drinking water
- Regions with low to medium water stress at most:
  - **Evidence** is provided that water resources are sufficiently available
  - Decision to use fossil water and drinking water supplies is supported with environmental and climatic information and data of the region of operation, including geological studies.

How to verify?

- Updated plans and assessments
- Regular monitoring
- Documentation of water sourcing
- Consultation with local and community stakeholders to verify operations did not interfere with their daily water usage

Please note:

- Dry Region means a province with high or extremely high-water stress according to the World Resource Institute's Aqueduct 3.0 Country Rankings, category province.
- Fossil Water means groundwater located in a body into which not a drop of water from precipitation or from riverbed leakage has penetrated over the last 12,000 years.

Further detail on **water impact assessment guidelines** and **key laws and entities** for Chile and Uruguay can be found in the **section below.**

4. Desalination of water*

ASR - Environmental Criteria

Specific considerations for desalination of water*

- The project operator must ensure that if desalination plants are used, a proof of the sustainable handling of residues from desalination is provided and the desalination must be carried out using renewable energies.

How to validate?

- Waste management plan (e.g. with principles from World Bank ESS3)
- Concept for energy supply

How to verify?

- Updated waste management plan
- Proof of waste treatment (methodologies, performance indicators and analysis)
- Proof of energy sourcing

*This criteria applies only if the project contemplates the use of desalination water.

Further detail on water impact assessment guidelines and key laws and entities for Chile and Uruguay can be found in the section below.

Source: Bird's-eye view of the biggest water desalination plant worldwide in Hadera, Israel. Generative AI, Ayub, https://stock.adobe.com/co/search/images

Source: Reverse osmosis system for water drinking plant, navintar, https://stock.adobe.com/co/search/images

5. Conservation

ASR - Environmental Criteria

Requirement

- The project operator must ensure that project areas along the entire value chain are not located in or directly on the border with nature reserves, landscape conservation areas, marine protected areas, protected areas (e.g. bird sanctuaries), areas with high biological diversity (e.g. rainforests), areas with high natural carbon stocks (e.g. wetlands) and in areas with important cultural sites.
- The project operator must maintain conservation status regarding biodiversity and natural carbon storage in order to avoid ecological consequential damage at the production location.

How to validate?

On behalf of a Draft EIA and Draft ESMP including:

- Land use plan
- Satellite images
- Documentation of assessment tools (e.g. GRAS* or IBAT**)
- Consultation of regional and local stakeholders
- The aspects detailed above shall be included in the draft EIA and ESMP

How to verify?

- Land use plan
- Satellite images before and after the operation activities
- Final EIA, Final ESMP
- Monitoring and Records as described in ESMP

Please note: For locally important conservation values and areas used for provisional services, local stakeholder consultations may need to be conducted.

* GRAS stands for Global Risk Assessment Services https://www.gras-system.org/
** IBAT stands for Integrated Biodiversity Assessment Tool https://www.ibat-alliance.org/

General Recommendations:

It is recommended to take international recognized areas of preservation into account, such as:

- IUCN protected areas.
- Ramsar Wetlands of International Importance
- World Heritage Sites selected by the UNESCO
- Biosphere Reserves of the UNESCO
- Areas identified as Alliance for Zero Extinction (AZE) Sites

Useful tools

Several public institutions offer public geographic information tools, such as:

- **Chile**: IDE, Minagri, Ciren, SEA and MINVU
- Uruguay: *Sistema de información territorial,* and SNAP.

Key local entities:

National system of Protected areas (SNAP): sets a list of priority species for conservation, identifies birds' conservation areas (IBA) and establishes geographic priorities for the conservation of terrestrial biodiversity.

- National directorate of territorial planning of the Ministry of Housing, Land Use Planning (MVOT)

Key local regulation, laws, plans and decrees:

- Law No. 17,234 Protected Areas: legal framework for the creation and management of protected areas in Uruguay, such as nature reserves, national parks, and marine protected areas.
- Law No. 15,939 Forestry Law: Regulates the conservation, management, and protection of forests in Uruguay, including areas with high biological diversity.
- Decree 16,408 ratifies the UN Convention on Biological Diversity

Key local entities:

- Environmental Assessment Service (SEA)
- National Forestry Corporation (CONAF): Responsible for the management of protected areas and the conservation of forests in Chile.
- Ministry of Housing and Urbanism (MINVU): establishes regulations and standards related to land use zoning, urban development and territorial planning such as General Ordinance of Urbanism and Construction (OGUC).
- Regional and Municipal Governments: Responsible for territorial planning at the local level.

Key local regulation, laws, plans and decrees:

- Law 19,300 on General Bases of the Environment
- Supreme Decree 40, 2012: Regulation of the Environmental Impact Assessment System
- Law 20,293 Protected Areas: Establishes the legal framework for the creation and management of protected areas in Chile, such as nature reserves, national parks, and marine protected areas.
- Law 20,417 on Recovery of Native Forest and Forest Promotion.

Note: the abundant wind resources in the Magallanes region have led to the development of large-scale hydrogen projects. This has raised concerns regarding the region's bird population. In response, a call for the elaboration of a public environmental baseline was launched in 2023, funded by the Ministry of Economy. The University of Magallanes was awarded and is currently developing the study.

6. No release of toxic substances (Pollution and Emissions)

ASR - Environmental Criteria

Requirement

- The project operator must implement an air management system and demonstrate an air pollution mitigation strategy.
- The project operator shall ensure to reduce air pollution from operations along the supply chain.
- The project operator must ensure that no toxic substances (Seveso Directive*) are released in air, water or land.

How to validate?

- Air impact assessment (as part of EIA)
- Draft an Air Management System
- Draft an air pollution mitigation strategy
- Develop a HAZOP*-Study on design level

How to verify?

- Updated assessments of performance and impacts
- Contracts with Suppliers
- Monitoring and Records as described in ESMP
- Air pollution indicators
- HAZOP-Study at status of applying for operation permit

*HAZOP stands for Hazard and Operability Study. It is a structured and systematic technique for. system examination and risk management.
**Seveso-III Directive (Directive 2012/18/EU) is a European Directive on the control of major-accident hazards involving dangerous substances.

- Uruguay has strict regulation and enforcement against environmental contamination

Key local entities:

- Ministry of Environment: enforcement of environmental protection, imposes sanctions

Key local regulation, laws and decrees:

- Law 17,283 General Environmental Law (amended by Laws 16,466; 17,234 and 18,610. (applies for all sustainability requirements)
- Decree 135/2021: Air quality regulation
- Decree 182/013: Regulation for the Environmentally Sound Management of Industrial and Similar Solid Waste
- Decree 253/79: Water code (Código de Agua) and regulation for liquid waste

Key local entities:

- Ministry of Health
- Ministry of Environment
- Superintendency of Sanitary Services (SISS)

Key local regulation, laws and decrees:

- Law 19,300: General Environmental Law
- Specific air quality norms.
- Decree 148: management of hazardous waste
- Law 20,920: framework Law for Waste Management
- Guide for the description of air quality in the area of influence of projects that enter SEA.

7. Waste and pollutant management

ASR - Environmental Criteria

Requirement

- The operator must demonstrate that waste and pollutant management complies with ISO 14001* and how compliance with the standard is ensured.
- The project operator shall have a waste reduction / responsibility policy.

How to validate?

- Draft an Environmental Management System acc. ISO 14001 or World Bank ESS3 including waste management Develop an internal policy for waste reduction.
- Trainings, registries of volumes and types of produced waste, showing reductions over time.

How to verify?

- Final Environmental Management System (EMS).
- Monitoring and Records as described in ESMP.
- Implementation of internal policy for waste reduction.
- Trainings.

**ISO 14001 Requirements with guidance for Environmental management systems https://www.iso.org/*

Uruguay has a strict regulation against environmental contamination.

Key local entities:

- Ministry of Environment: enforcement of environmental protection and imposes sanctions

Key local regulation, laws and decrees:

- Law 14859 and Decree 253/79: Water code (Código de Agua) and regulation for liquid waste
- Decree 182/13 and amendments: Regulations for the management of industrial and similar solid waste

Chile promotes waste reduction and environmental responsibility policies an has strengthen it in the past few years with laws like 20,417 which establishes Extended Producer Responsibility. Additionally, it has regulations and laws for waste management.

Key local entities:

- Ministry of the Environment
- Superintendence for the Environment
- Ministry of health

Key local regulation, laws and decrees:

- Law 20,920: framework Law for Waste Management
- Law 20,417: for Recycling Promotion and Extended Producer Responsibility
- Decree148/2004: Sanitary regulation on the handling of hazardous waste.
- Supreme Decree 1/2013 : Regulation on the Registry for emissions and transfers of contaminants (RETC)

Social Criteria

2. Compliance with ILO standards*

ASR - Social Criteria

Requirement

- The project operator must demonstrate how to ensure that labour standards in production comply with the core labour standards of the ILO (International Labour Organization) standards.

How to validate?

- Code of Conduct
- Contract drafts
- Anti-discrimination policy
- Maternity (parental) leave policy

How to verify?

- Code of Conduct and Contracts
- Anti-discrimination policy
- Maternity (parental) leave policy
- Assessment reports
- Pay slips and registration in governmental / tax revenue institutions
- Interviews with employees to verify labour conditions

Please note: The following ILO Standards should be considered.

- ILO C014 - weekly rest
- ILO C029 - forced labour
- ILO C087 - Freedom of association and protection of the right to organize
- ILO C098 - right to organize and collective bargaining
- ILO C100 - right to equal pay (without discrimination on grounds of gender)
- ILO C105 - abolition of forced labour
- ILO C111 - discrimination
- ILO C138 - minimum age
- ILO C155 - occupational safety and health
- ILO C182 - worst forms of child labour
- ILO C183 - maternity protection
- ILO C187 - Promotional Framework for Occupational Safety and Health

Uruguay has ratified most ILO conventions and ISO health and safety norms. Specifically, Uruguay has ratified most conventions recommended by ASR. The only ones of the list on the left which haven't been ratified **are C183 and 187.**

Key local entities:

- Dinatra (National Directorate of Labour of the Ministry of Labour and Social Security)
- Plenary Interunion of Workers - National Workers' Convention (PIT-CNT)**
- Cross-union organization

Key local regulation, laws and decrees:

- Law 13,657: abolition of forced labour
- Law 17,940: right to form labour unions
- Decree 611/80 Regulation of right for overtime
- Law 19,973: Implementation of workplace norms
- Law 18,099; 19,251and 18,251: Regulation for subcontracting/loan work

Chile has ratified most ILO conventions. Specifically, from the list recommended by ASR, Chile has ratified most of them. The only ones of the list on the left which **haven't been ratified are C155 and 183.**

Key local entities:

- Labour Directorate (Ministry of Labour and Social Security): Oversight of legislation compliance.
- Ministry of Labour and Social Security: Regulates general labour laws.
- Ministry of Justice and Human Rights: Regulates antidiscrimination laws.
- Internal Revenue Service (SII): Regulates tax obligations and business registration.

Key local regulation, laws and decrees:

- Labour Code
- Law 20,545: Maternity Protection
- Law 19,249: Working Hours, Breaks, and Holidays
- Law 20,087: Employment Incentives
- Law 19,069: Trade Union and Collective Bargaining Regulations

*The 1st Social Criterion stands for Social Impact Assessment. The description for this criteria was provided above, within the description of the Environmental and Social Impact Assessment criteria.

**PIT CNT stands for *Plenario Intersindical de Trabajadores - Convención Nacional de Trabajadores* (PIT-CNT)

3. Living wage

ASR - Social Criteria

Requirement

- The project operator must ensure that all workers that are performing the organization's activities are paid a living wage according to UN Global Compact*.

How to validate?

- Living wage in the respective country
- Contract (drafts)
- Supplier code of conduct (draft)
- Collective agreement (draft)

How to verify?

- Contracts
- Supplier code of conduct
- Collective agreement

Living Wage Global compact website
https://livingwages.unglobalcompact.org/

Uruguay has sectoral minimum wages .

Key local entities:

- Wage Councils and Collective Bargaining*: Tripartite commissions (involving unions, government, and employers) that negotiate minimum wages.
- Dinatra (National Directorate of Labour of the Ministry of Labour and Social Security)

Key local regulation, laws and decrees:

- Law 10,449 and Law 18,566: Implementations of Wage Councils
- Law 17,829 and Law 19,210: Regulation for wage retentions

* Wage Councils and Collective Bargaining, in Spanish: *Consejos de Salarios y negociación colectiva*

Chile mandates that the minimum wage should be at least the country's established base wage.

Key local entities:

- Ministry of Labour and Social Security
- Ministry of Finance
- Work inspection:

Key local regulations, laws, and decrees:

- Labour Code
- Law 20,281: modifies the Labour Code regarding base salaries
- Law 20,940: modernizes the labour relations system and governs collective negotiations

4. Access to health services / health insurance

ASR - Social Criteria

Requirement

- The project operator must ensure that all workers that are performing the organization's activities are paid a living wage (according to UN Global Compact).

How to validate?

- Develop an internal policy

How to verify?

- Policy implementation
- Contracts of employment
- Contracts with health service / insurance providers.

*https://livingwages.unglobalcompact.org/

Uruguay has universal healthcare that is funded by contributions of employers, government and employees.

Key local entities:

- Integrated National Health System (SNIS): National Universal Healthcare Provider
- General Inspection of Labour and Social Security (IGTSS) enforces workplace health and safety norms

Key local regulation, laws and decrees:

- Law 18,211 cointegrates previous health services into the SNIS
- Decree 371/022 regulates the IGTSS

Chile mandates all companies to affiliate with an employers' mutual, "*Mutual de Seguridad*" to cover the risks of occupational accidents and professional illnesses of their workers. This system includes inspection and oversight mechanisms to ensure compliance with occupational safety and health standards in companies. It operates as part of the country's social security system, managing the risks associated with workplace accidents and illnesses.

Key local entities:

- Labour inspection
- Labour safety institute administrates social security against occupational accidents and professional diseases.

Key local regulation, laws and decrees:

- Law No. 20.123, which establishes provisions regarding subcontracting and outsourcing
- Law 16744 establishes norms regarding workplace accidents and occupational diseases

5. Local Value Creation / Competence Gains

ASR - Social Criteria

Requirement:

- The contribution to local value creation as well as the participation of local and civil law actors is to be ensured, e.g., by ensuring the competence gains of local actors and by actively involving local SMEs in the project. Women must be actively involved in the implementation of the project. The tenderer shall provide evidence of compliance with these requirements.

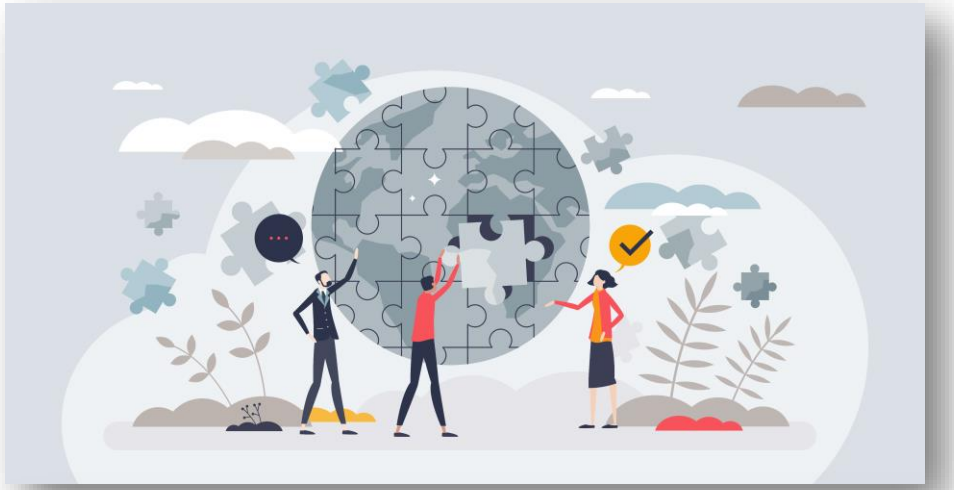
How to validate?

- Action plan with key targets regarding:
  - Stakeholder engagement
  - Regional capacity building
  - Involvement of local SMEs
  - One of the following:
    - i) Creation of year-round and/or long-term jobs
    - ii) Establishment of governance structures to support empowerment of rural communities
    - iii) Use of locally produced bioenergy
    - iv) Shareholding options, local ownership, joint ventures, and partnerships with local communities
    - v) Social benefits for local communities such as building and servicing of clinics, homes, and schools

How to verify?

- Evidence/status of fulfillment of the key targets defined in the action plan
- Measurement of the key targets, with disaggregated reporting data to report benefits achieved for women, indigenous communities, and vulnerable people

Further detail on local value creation and related laws and entities for Chile and Uruguay can be found in the section RSB principle 5 below.



Source: Teamwork in sustainability and make green future together tiny person concept. Social work and nature friendly community with strong partnership and collaboration for clean planet vector illustration, VectorMine, https://stock.adobe.com/co/search/images

6. Gender

ASR - Social Criteria

Requirement

- The project operator must follow a zero-tolerance policy towards gender-based violence and harassment.
- Moreover, the project owner must run a confidential complaint procedure.

How to validate?

- On behalf of an internal policy.

How to verify?

- Through the policy's implementation
- On behalf of the establishment of an internal complaint procedure
- With reports of complaints and how they were processed.

Uruguay has the below mentioned legal instruments in place that promote local labour involvement and equal opportunities.

Key local entities:

- Public Employment Centers (CePE) of the Ministry of Work and Social Security (MTSS)

Key local regulation, laws and decrees:

- Decree 255/010 and Law 18,516: Regulation of the distribution of labour of skilled and unskilled workers on government and subcontractor projects, includes programs that promote female labour participation.

Chile has institutions and regulations to prevent gender-based violence and promote labour involvement of women. The law also mandates the confidentiality of procedures, indicating that in case of an employer's internal investigation, it must be conducted in strict confidentiality.

Key local entities:

- Ministry of Women and Gender Equality: works towards the elimination of all forms of discrimination against women
- Labour Inspection

Key local regulation, laws and decrees:

- Labour Code
- Law 21,643 regulates sexual harassment and violence in the workplace
- Law 20,348 safeguards the right to equal pay for man and women

Note: Chile has released **a green hydrogen action plan 2023-2030** which presents 18 lines of action. Among them is prioritizing **gender perspectives** in the hydrogen industry, aiming to address women's needs in infrastructure and facilities. The plan seeks to boost female participation, particularly in leadership roles, and narrow gender gaps in green hydrogen trainings.

7. No forced Resettlement / Illegal Land Grabbing

ASR - Social Criteria

Requirement:
- Forced resettlement or illegal land grabbing must be ruled out.

How to validate?
- Land use plan, satellite images before project start
- Plan of stakeholder consultation about land rights and land use prior to operations
- Grievance procedures
- Policies to avoid involuntary resettlement
- No verification possible in case there are disputes about the tenure agreements of the land among stakeholders

How to verify?
- Contracts / records of land ownership or lease
- Records of stakeholder consultation
- No legal claims against the operation
- No news clippings linked to forced resettlement before/ after the operation

Please note: **Free, Prior and Informed Consent (FPIC)** is a specific right that pertains to indigenous peoples and is recognized in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). It allows them to give or withhold consent to a project that may affect them or their territories.

The FPIC-360° (https://fpic360.org) tool can be used to implement and monitor FPIC processes.

Urban planning is governed by territorial planning instruments such as the Communal Regulatory Plan (PRC) or Communal Territorial Plan (PTC). To protect individuals from forced displacement, Uruguay implements legal provisions addressing expropriation and compensation processes, ensuring fair treatment for those impacted by urban projects. Although Uruguay does not have specific laws dedicated exclusively to indigenous affairs, it recognizes the rights of indigenous peoples and has ratified the Convention No. 169 of the ILO, which establishes standards for indigenous rights indigenous consultation.

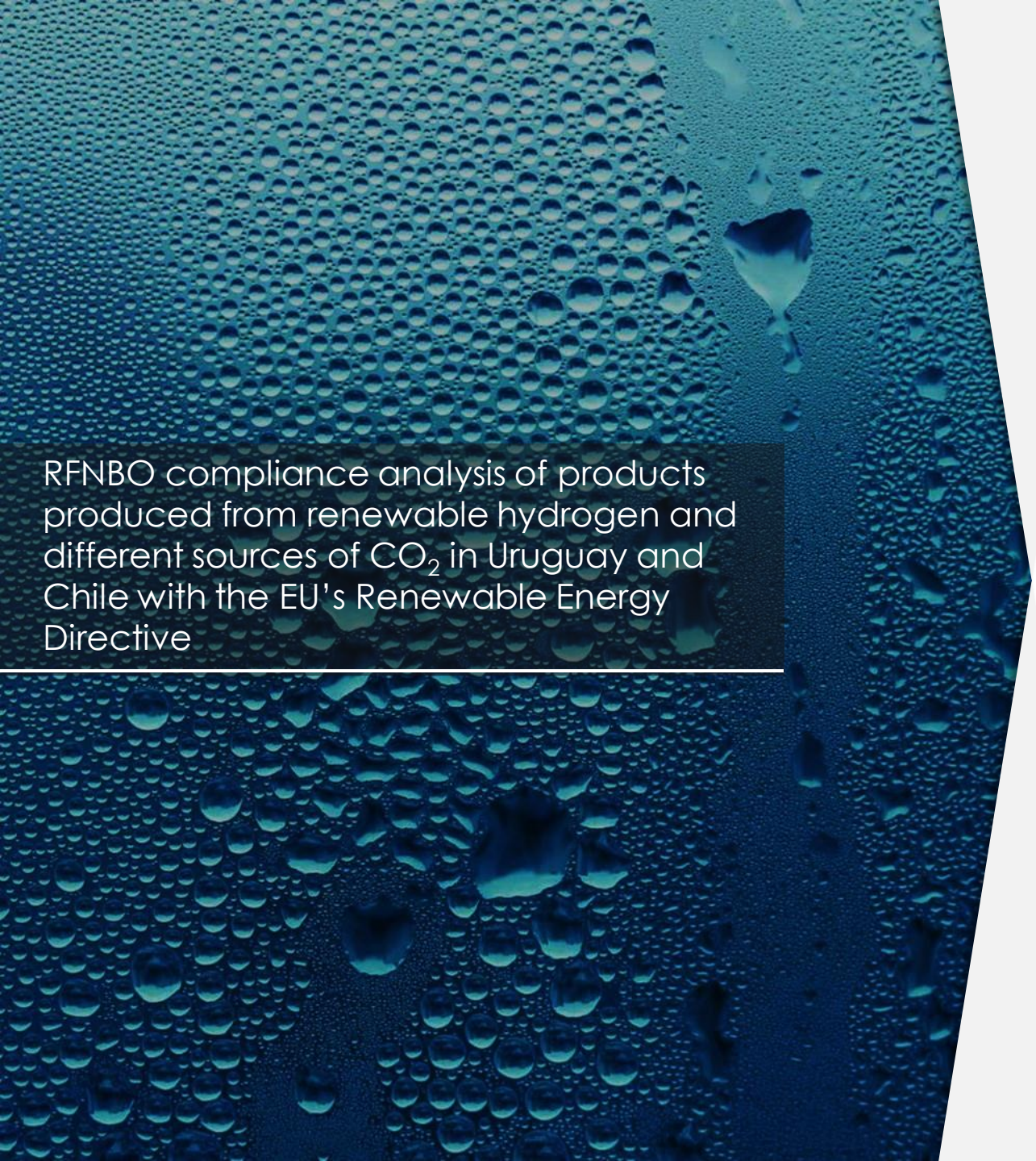
Key local entities:
- Ministry of Housing, Land Use Planning (MVOT) through the National Directorate for Territorial Ordering
- National Committee for Territorial Ordering

Key local regulation, laws and decrees:
- Law No. 18,308 on Territorial Planning and Sustainable Development
- Decree No. 382/007 on Expropriations
- Departmental Guidelines for Territorial and Sustainable and land categorization shall be reviewed for the specific project site

The right to property is established in the constitution. Projects that entail resettlement of communities require the preparation of an EIA and a consultation with indigenous people (Following ILO C169 standards). Regulation regarding urban areas and land use guidelines are regulated through territorial planning instruments, Additionally, aspects outlined in the General Law of Urbanism and Construction (OGUC) shall be considered.

Key local entities:
- Environmental Impact Service (SEA)
- CONADI: National Indigenous Development Corporation
- Ministry of housing and urbanisms (MINVU)

Key local regulation, laws and decrees:
- Law 19,300: According to Law 19300, projects that entail resettlement of communities or significant alteration of the livelihoods and customs of human groups will require the preparation of an Environmental Impact Assessment (EIA).
- Law 19,253: Establishes norms for the protection, promotion, and development of indigenous peoples, and creates the National Indigenous Development Corporation.
- Law 20,249: regulates Indigenous communities' Coastal Marine Space and establishes it as a priority when grating maritime border concessions.
- Consultation with Indigenous Peoples: Process of dialogue between the State and indigenous peoples, aiming to reach an agreement or obtain consent regarding legislative or administrative measures that may directly affect them. This process is based on the provisions of Convention No. 169 of the International Labour Organization (ILO).
- Supreme Decree 47/1992: establishes the General Law of Urbanism and Construction (OGUC)
- Departmental Guidelines for Territorial categorization shall be reviewed for the specific project site



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP2

2.1 Overview of RSB Additional Sustainability Requirements for H2Global

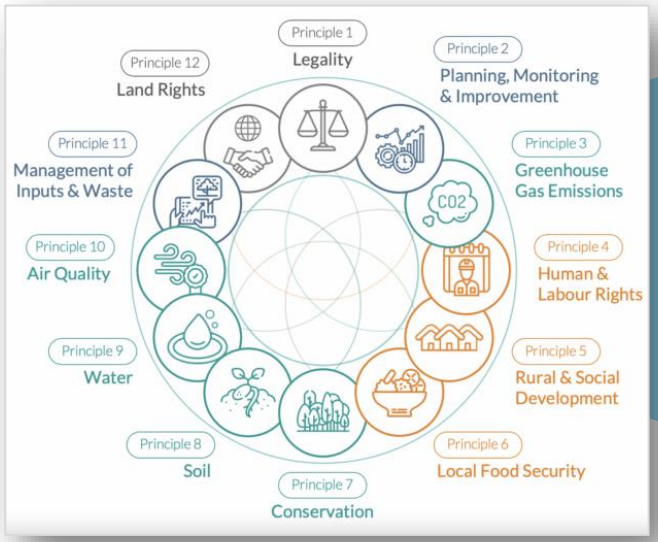
2.2 ESMP compliance and execution requirements assessment

2.3 RSB Rural and Social development and Water criteria assessment

2.4 Recommendations for compliance with key ASR for Project Developers in Chile and Uruguay exporting to the Netherlands

Following Principle 2 of RSB's Principles & Criteria helps to improve the Environmental Social Management Plan (ESMP)

THE 12 RSB PRINCIPLES & CRITERIA



Principle 2
Planning, Monitoring & Improvement

Source: RSB Principles & Criteria (RSB, 2023)

Planning, Monitoring & Improvement

Principle 2 on "Planning, Monitoring & Continuous Improvement" of RSB's 12 Principles & Criteria follows the guideline that sustainable operations are required to be planned, implemented and continuously improved through an open, transparent and consultative impact assessment and management process and an economic viability analysis.

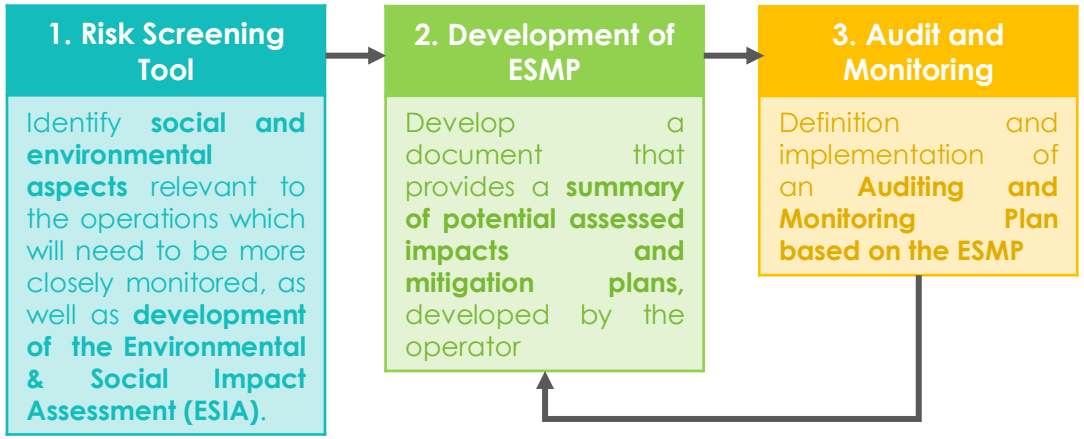
H2Global does not require formal compliance with this Principle, nevertheless it may serve H2Global applicants in improving their ESMP.

To comply with this Principle, a process called **Impact Assessment** must be completed. This refers to the entire process of screening, impact evaluation, and development of an **Environmental and Social Management Plan.**

Source: Impact Report 2022 (RSB, 2022)

Environmental & Social Management Plan

The **Environmental and Social Management Plan (ESMP)** is a **"living" document,** developed by the operator, that provides a **summary of the potential impacts of the project and respective mitigation plans.** The ESMP describes how environmental and social issues will be managed **during the project**, how changes over time of the project will be responded, and how the ESMP will be revised in case of changes during the operational phases. **Environmental and Social Management and Monitoring measures** should be included when carrying out the ESIA representing the backbone of the ESMP that will be **periodically updated** during the development and operational phases of the project, acting as a base for the Auditing and Monitoring Plan.



Source: Own elaboration of Hinicio based on Additional Sustainability Requirements. The H2 Global Mechanism (RSB, 2023)

The ESMP addresses **operational phases of the project** and is **periodically updated according to changes through the lifecycle**

What is the Scope of the ESMP?

- It assumes the **role of a summary document** that pulls together all baseline studies, reports, impact assessments, mitigation, management, monitoring and evaluation plans into one comprehensive summary document that will act as the overall plan for operations.
- **ESMP** is a validation and verification instrument before delivery of first products and during operational phases.
- **Project phases** that must be covered are Construction, Operation, and Decommissioning.

Main Objectives

The objective of setting up an ESMP is to demonstrate the authorities and stakeholders that **environmental and social objectives and activities comply with the national regulatory authority stipulations and guidelines (which may be local, provincial, national and/or international),** and achieve **good environmental and social performance.**

Environmental & Social Standards

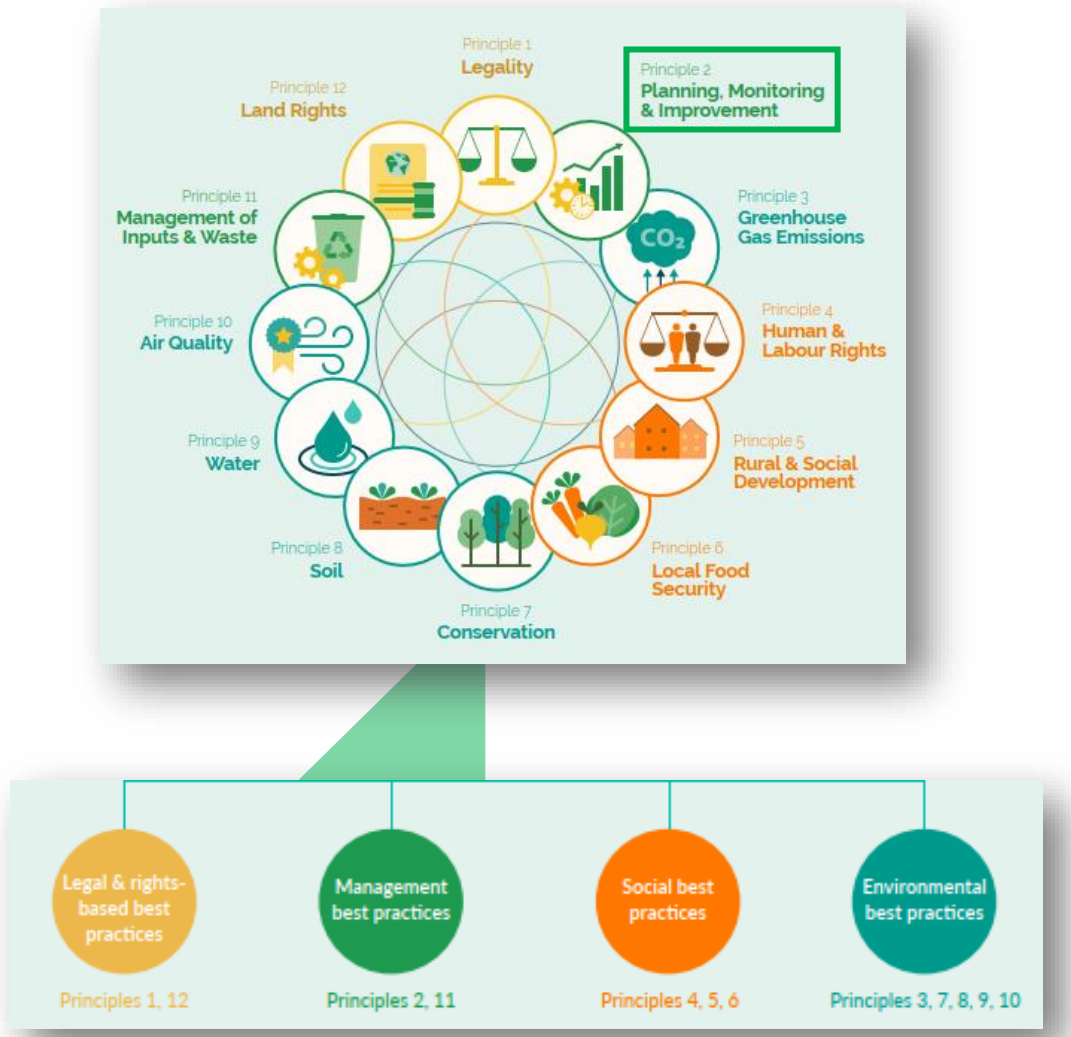
- ✓ Ensuring compliance with **H2Global guidelines, such as the Additional Sustainability Requirements**
- ✓ Ensuring that there is **sufficient allocation of resources** on the project budget so that the scale of **ESMP related activities is consistent with the significance of project impacts**;
- ✓ Realizing **environmental and social goals and objectives** for the project;
- ✓ Verifying environmental and social performance through **information on impacts as they occur.**

Management Objectives

- ✓ Responding to **changes in project implementation** not considered in the impact assessment process so far;
- ✓ Detecting **short- and long-term trends** and responding to **unforeseen events;**
- ✓ Providing **feedback for continuous improvement** in environmental, social and operational performance.

Source: Additional Sustainability Requirements. The H2Global Mechanism (RSB, 2023)

The ESMP indicates how **the project will be managed to ensure compliance with Additional Sustainability Requirements**



Source: RSB Principles & Criteria (RSB, 2023)

How can the ESMP ensure compliance with Additional Sustainability Requirements?

The ESMP is based on the ESIA and describes **environmental and social impacts** from the project, **mitigation measures** to avoid and reduce those, and a **Monitoring Plan** to guarantee that targets are being met. All these aspects are **key for ensuring that Environmental and Social Criteria will be addressed when developing the project.**

Compliance with **Environmental Criteria** can be validated through Environmental Management Systems for air and waste management, for example, while compliance with **Social Criteria** can be validated on behalf of records from early-stage and transversal Stakeholder Consultations and Stakeholder Engagement processes, as well as the implementation of regional good labour practices.

The ESMP is a relevant document to validate and verify compliance with Additional Sustainability Requirements.

Locally relevant examples of documentation and proof to be included in the ESMP by Uruguayan and Chilean project developers are presented in the following slides.

Preparing an ESMP involves carrying out an **Environmental and Social Impact Assessment** as well as a **Stakeholder Engagement**

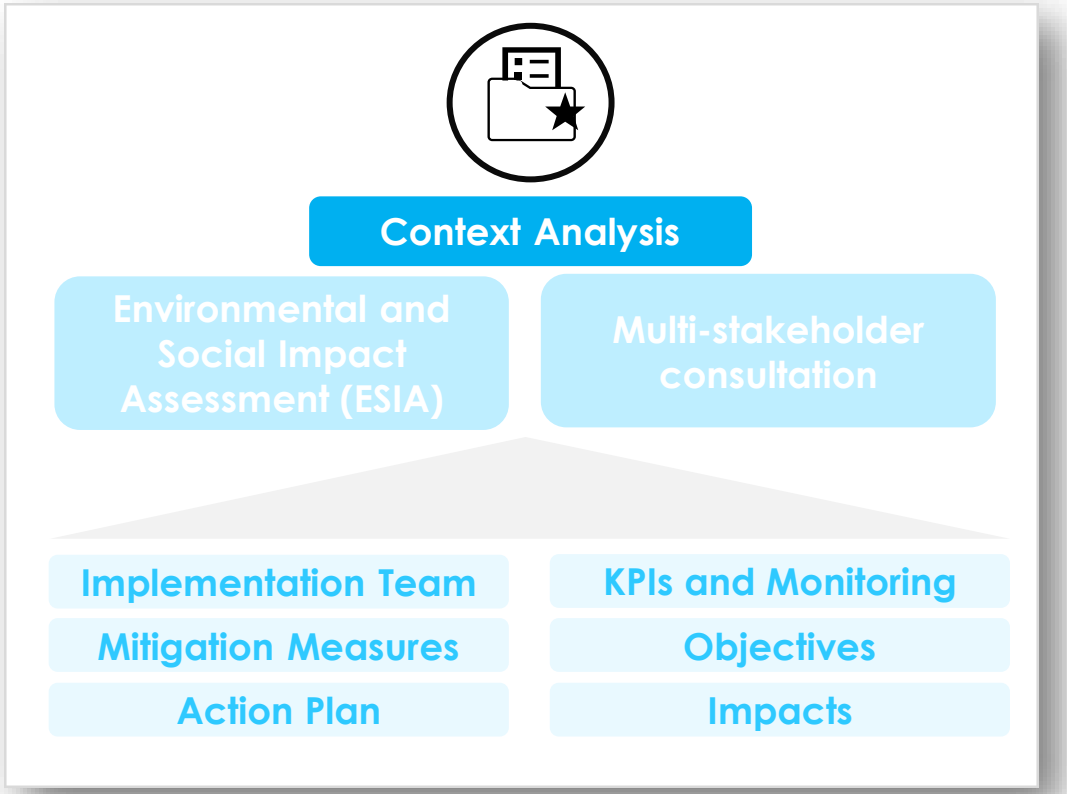
How to prepare an ESMP according to H2Global guidelines?

To draft an accurate ESMP, RSB prepared an **Impact Assessment Guideline**[1] providing guidance on how to identify potential risks of a project, the Screening process[2], and a description of the ESMP with relevant content to consider and the suggested structure.

For preparing the ESMP, an **Environmental and Social Impact Assessment (ESIA)** must be carried out, considering the **entire supply chain**[3].

The Impact Assessment includes a **Stakeholder Engagement process**, and an exercise that involves **identification and mapping of interested and potentially affected parties by the development of a project**[4]. Effective stakeholder engagement is one of the key principles of sustainable development defined by RSB.

The ESMP needs to **cover specific areas of Management functions,** such as solid waste management, outgrower-management or resettlement policy/plan, among others.



Source: Additional Sustainability Requirements. The H2Global Mechanism (RSB, 2023)

[1] The Impact Assessment Guideline was developed by RSB for helping auditors to get a better understanding of key aspects to be considered during the **certification process**. Nevertheless, this guide is helpful to understand how to prepare the ESMP.
[2] For achieving a successful Screening process, RSB developed a Screening Tool intended to help operators to identify the social and environmental aspects relevant to their operations which will need to be more closely monitored, and if a more detailed study or assessment of a particular aspect of the standard is required.
[3] The ESIA must be elaborated according to an international Environmental Impact Assessment standard, i.e., IFC - Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts, or World Bank ESS1
[4] There are various guideline documents that have been developed by different organizations on stakeholder engagement. One generic toolkit is from the World Bank, the Energy Sector Management Assistance Program (ESMAP) and the International Council on Mining and Metals (ICMM) which focuses on community development.

In its Impact Assessment Guidelines, RSB proposes the following **structure for the Environmental and Social Management Plan**

#	Section Title	What should Project developers do?
1	**Introduction**	Explain the context and purpose of the ESMP
2	**Process Information**	Outline the applied Impact Assessment process
3	**Details of ESMP**	Provide details of the Environmental and Social Assessment Practitioners as well as their expertise. Also describe the scope of the ESMP and provide definitions of terms
4	**Project Description**	Describe the project, or alternatively cross reference to the project description in other documents (such as EIA or SIA)
5	**Management Objectives**	Describe the management objectives for setting up the ESMP
6	**Roles and Responsabilities**	Allocate roles and responsibilities for preparing, implementing, monitoring, and reviewing the ESMP, including requirements for record keeping, reporting, auditing and updating the ESMP.
7	**Context**	Describe the context (may also refer to other documents, ESIA reports or studies): environmental context; social and economic context; and applicable laws, standards and policies
8	**Impact and mitigation measures**	Describe the results of the screening and the specialist impact studies as well as mitigation measures that have been defined
9	**Monitoring**	Specify the Monitoring Program
10	**Performance Assessment**	Explain how the results of the monitoring will be evaluated
11	**Other programs**	Describe other social and environmental program developed and implemented by the operator.
12	**Action Plan**	Describe the Action Plan in detail, including activities, timeframe, responsibility, and budget
13	**Revision**	Describe the revision process of the ESMP, records of the revision and main changes
14	**Annexes**	Include relevant maps, organigrams, operational procedures, licenses, records of communication, specialist studies, monitoring reports, etc.

Source: Own elaboration Hinicio based on the Impact Assessment Guidelines (RSB, 2017)

Impact Assessment Guidelines

The ESMP must include a **Monitoring Program** and a **Performance Assessment** to continuously track risks

#	Section Title	What should Project developers do?
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Source: Own elaboration Hinicio based on the Impact Assessment Guidelines (RSB, 2017)

Monitoring Program

A **Monitoring Program** is an essential process for **continual improvement** also necessary for compliance with RSB's Principle 2 that should be included in the ESMP. Monitoring programs serve to **evaluate if the management objectives and targets have been achieved**, **to ensure that information gaps are addressed** and to **detect potential problems** as early as possible when they arise.

Monitoring programs may cover **construction, operational and/or decommissioning** phases of a project. A robust monitoring program shall include:

- ✓ Specific questions to be answered
- ✓ Frequency of monitoring
- ✓ Responsibility for carrying out monitoring and analysis
- ✓ Targets and indicators to be used in monitoring
- ✓ Significance thresholds
- ✓ Responsibility for implementing adaptive management responses when required
- ✓ Reporting requirements

Performance Assessment

Along with the development of the Monitoring Plan, a Performance Assessment shall track the **measures to achieve good performance.** The Performance Assessment has for objectives:

1. Identify trends, causes and impacts;
2. Assess performance and compliance;
3. Modify practices and procedures for mitigation; and
4. Modify the Monitoring Program when required.

Action Plan

The Action Plan shall **detail and document all progress requirements**, including targets and indicators, and should be continuously improved. The Action Plan addresses **both immediate and long-term actions and effects** on the impacts identified in the final version of the ESIA.

Recommendations when writing the ESMP and useful guidance for **addressing Additional Sustainability Requirements**

General Recommendations

The ESMP must include mitigation measures to **reduce negative impacts and enhance positive impacts**. This includes avoidance, mitigation and compensation of impacts, where avoidance should always be given priority and compensation is a last resort. Whenever compensation is not possible, **the proposed project may be rejected due to unmitigable impacts.**

The ESMP is a document that must be **constantly updated** to remain aligned with the progress of the project. The updates should always be done alongside continued stakeholder engagement processes.

Despite not all eventualities can be foreseen, **mitigation measures must be specific and time dependent**. Measure can be separated in categories, in one hand those that will be implemented immediately, and on the other hand those that will be implemented over a specified period.

Any requirements for continuous improvement should also be covered under the ESMP.

Source: Impact Assessment Guidelines (RSB, 2017)

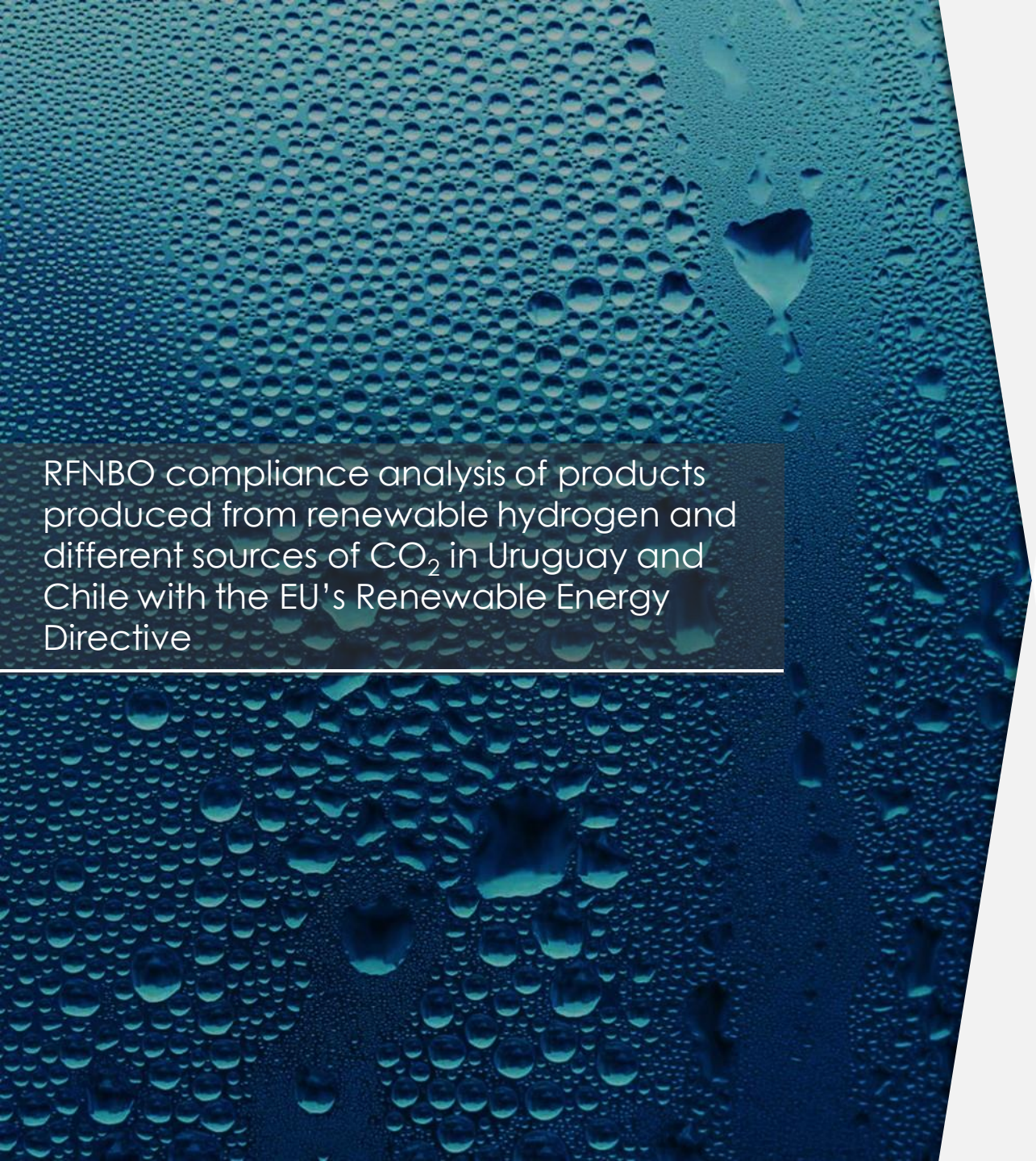
In summary, what is the ESMP?

It is a "living" document that is constantly updated and improved as the project advances.

It provides a **summary of the potential impacts** assessed and the developed mitigation plans.

It describes **how the operator will manage and monitor environmental and social issues** during the project and how it will respond to changes in the management of these issues over time.

Source: Additional Sustainability Requirements. The H2Global Mechanism (RSB, 2023)



RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

CONTENT WP2

2.1 Overview of RSB Additional Sustainability Requirements for H2Global

2.2 ESMP compliance and execution requirements assessment

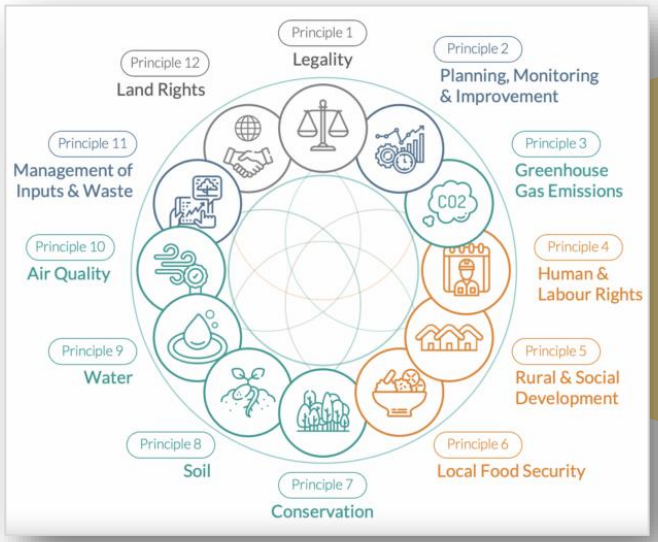
2.3 RSB Rural and Social development and Water criteria assessment

2.4 Recommendations for compliance with key ASR for Project Developers in Chile and Uruguay exporting to the Netherlands

Principle 5th: Rural and Social Development

RSB's Principle 5 focuses on **supporting the development** of local, rural and indigenous people and communities

THE 12 RSB PRINCIPLES & CRITERIA



Principle 5
Rural and Social Development

Source: RSB Principles & Criteria (RSB, 2023)

Rural and Social Development

Rural and Social Development is the 5th Principle of RSB Principles & Criteria and aims to **support the social and economic development of local and rural communities**. In accordance with RSB's Guideline, this Principle only applies to Regions of Poverty which have a Human Development Index (HDI) lower than 0.74, based on the United Nations HDI.

Neither Uruguay nor Chile are considered Regions of Poverty, since their HDI's are 0.83 and 0.86, respectively. Thus, under the RSB scenario, this Principle does not apply to either of the two countries.

Nevertheless, **Additional Sustainable Requirements developed by H2Global include social criteria such as local value creation and gender equality**, which are aligned with practices supported in Principle 5. Therefore, social practices established under this Principle can be used as guidelines for complying with ASR.

Sources: RSB Screening Tool (RSB, 2021); United Nations Human Development Insights (UN, 2022)

How can project developers support Social Development?

- Social development refers to the improvements in livelihoods, inclusion of different members of the community in the activities that contribute to the development of the region, as well as safe access to adequate income.
- The contribution to local value creation as well as the participation of local and civil law actors is to be ensured, e.g. by ensuring the competence gains of local actors and by actively involving local stakeholders and women in the whole lifecycle of the project.
- Activities such as the provision of social infrastructure such as schools and clinics, or capacity building programs and access to trainings are good practices encouraged for social development.

Sources: RSB Rural and Social Development Guidelines (RSB, 2018); Additional Sustainability Requirements for H2 Global (RSB, 2023)

Contribution to local value creation and women's involvement must be ensured **not only during the development** of the project

Improving the socioeconomic status of local stakeholders

Local value creation standards recognize the importance of job creation and income generation in the pursuit of the countries' economic growth. This benefits and has positive impacts on both local economy as well as local communities by increasing acquisition of goods and services. **It is important to highlight that local value creation and workforce inclusion should not be limited to the development stages of projects, but during the whole lifetime of the project. Involving local workforce and services just in development stages due to e.g. lower wage reasons without providing trainings to foster local knowledge and expertise does not comply with a sustainable involvement.**

Operators shall provide evidence of compliance with contribution to local value creation. To ensure the competence gains of local actors, operators shall assess ways in which the **permanent** and local labour can be promoted, as well as enhancing job creation potential. Based on local needs, measures that significantly optimize the benefits to local stakeholders shall be implemented, such as:

- **Creation of jobs**, year-round and/or long-term. For this, it is relevant to estimate the existing capacity at local and regional levels to cover the demand for labour, and to estimate the quantity of jobs that may be created as well as types of specific skills needed during the whole lifecycle of the project.
- **Development of training programs** for project personnel focussing on identified needs and required skills.
- **Provision of local employment** with different capacities by hiring a minimum percentage of local workforce
- **Promotion of social benefits** for the local community through the investment and implementation of socially oriented projects (e.g. support for local public health and education).

Benefitting and encouraging participation of women

RSB and H2Global show commitment with gender equity and recognize the contributions that women can make to sustainable development. According to this, gender equality and environmental sustainability are interconnected aspects, and by fostering female engagement in the industry and promoting gender equality, several sustainable development goals (SDG's) can be achieved.
In order to comply with RSB's and H2Global's Standards, a project developer and operator should actively promote gender equality, by addressing potential gender pay gaps and by committing with zero-tolerance policies towards gender-based violence and harassment, which shall be anchored in corporate ethic policies and be ensured through confidential complaint procedures. Compliance with local regulations and international best practices regarding gender equity may be demonstrated by:

- **Balanced workforce** through the lifecycle of a project with a representative percentages of hired women
- **Trainings regarding gender aspects** for both workers and management in charge of employment protocols
- **Equal remunerations** for both man and women, without any gender-related discrimination
- **Existence of an accurate infrastructure** for gender needs
- **Female recruitment initiatives** specifically addressed to women

Sources: RSB Rural and Social Development Guidelines (RSB, 2018); Additional Sustainability Requirements. The H2 Global Mechanism (RSB, 2023)

Uruguay and Chile support Social Development through **local regulations and commitment with International Standards**

Both Uruguay and Chile are members of the International Labour Organization (ILO) since 1919, ratifying several ILO Conventions. This facilitates demonstrating that labour standards comply with the core labour standards of the ILO which is requested by H2Global's Social Additional Sustainability Requirements. This compliance may be validated by Code of Conducts and Contracts, antidiscrimination policies, and interviews with employees to verify labour conditions, among others. Both countries also have an institutional and regulatory framework as well as initiatives and incentives that promote local value creation, competence gains, gender equity, and living wages.

Uruguay

Labour regulations are controlled and monitored by the **Ministry of Labour and Social Security**. The country has full freedom of association and has also a Intersyndical Convention, the ***"Plenario Intersindical de Trabajadores-Convención Nacional de Trabajadores"*** (PIT-CNT), that participates in wage rounds and ensures compliance with the country's standards.

Initiatives on supporting local value creation and gender equality are promoted through the H2U Program* **that aims to ensure integrated and sustainable coordination, planning and articulation throughout the development of the hydrogen derivatives' economy at the national level**. One of the five axes is **"Capacity Generation"**, which states that:

- The generation of local capabilities is a key element to enhance the development of green hydrogen and avoid possible gaps between supply and demand in terms of personnel for operational, technical and engineering areas.
- Gender aspects will be considered in order to provide equal opportunities and to reduce possible existing gaps.
- Professional training and specialization will be enhanced towards tertiary education focused on hydrogen and its derivatives.

Sources: Hoja de Ruta del Hidrógeno Verde y derivados en Uruguay (MIEM, 2023)

Chile

The ***"Dirección del Trabajo"***, through the **Ministry of Labour and Social Security**, oversees compliance with obligations, rights, and labour regulations from the employment contracts.

Regarding promotion of local value creation and gender equity in the renewable hydrogen industry, there are incentives such as:

- One of the **Green Hydrogen National Strategy** pillars is "Green hydrogen as an engine for local development". This seeks to ensure continuous involvement of communities to the projects, and to disseminate knowledge of green hydrogen.
- The ***"Plan Nacional de Equidad Laboral"*** (National Plan for Labour Equity), seeks to increase levels of female laboral engagement, reduce barriers to access and increase permanence of women in the labour market. The goal is to reach the average of 63.8% of female labour participation in the OECD countries by the year 2030.
- Within the ***Plan de Acción de Hidrógeno Verde 2023-2030*** (Green Hydrogen Action Plan 2023-2030), gender equity is promoted within different measures. One of those is providing technical assistance to the green hydrogen industry for the sustainable incorporation of women into the labour force, and elaborating recommendations with gender approaches for evaluation, installation and operation of projects for production and consumption of green hydrogen and derivatives.

Sources: Estrategia Nacional de Hidrógeno Verde (Ministry of Energy of Chile, 2020); Plan Nacional de Equidad Laboral (Ministry of Women and Gender Equity, 2022); Plan de Acción de Hidrógeno Verde (Government of Chile, 2024)

Both Uruguay and Chile prioritize **human principles and rights**, and safety and health, and reject any kind of discrimination, forced and compulsory labour, and any form of child labour. Furthermore, **the countries promote best practices related to the participation of local and civil law actors and women** to contribute to social development. These alignments, in addition to best practices procedures, facilitate project developers ensuring compliance with H2Global's Social Criteria aligned with RSB's 5th Principle Social and Rural Development.

*The members of the H2U Program are Uruguayan public organizations involved in green hydrogen matters, including the Ministry of Industry, Energy and Mining, Ministry of Environment, URSEA, UTE, among others,

Uruguay secures key social aspects through implemented laws – Overview

Uruguay has a regulatory framework with legally binding legislations that demonstrate commitment with labour security and gender equity. Those are regulated, controlled, and monitored by the Ministry of Labour and Social Security. The country has yearly Wage Councils, and labour laws prohibit forced labour and child labour. Furthermore, because of being member of the ILO, Uruguay has ratified several conventions regarding key social aspects. The regulations presented in the table are considered relevant regarding social aspects:

Regulation	Social aspects addressed
UNIT-OSAS 18,000	***"Implementation of ISO 18000 Occupational Health and Safety Assessment Series in Uruguay"*** OHSAS 18000 assists organizations in managing and controlling their health and safety risks. It is an internationally accepted occupational health and safety management system that can be assessed by a third party
Decree No. 255/010 and Law 18,516	***"On the distribution of the labour of skilled and unskilled workers on government projects"*** For any work of the state or subcontractor of the state, non-permanent skilled and unskilled positions must be filled locally and by means of lottery
Law 10,449 and Law 18,566	***"The regime of wage councils is implemented" and "Principles and Rights for collective bargaining"*** Set up wage councils: tripartial commissions of unions, government and employers that determine minimum wages for their sectors
Law 19,973	***"Regulation of active employment policies aimed at promoting access to gainful employment for youth between 15-29 years, women, workers above the age of 45 and workers with disabilites"*** Framework against unemployment of disadvantaged workers, for example wage subsidies and professional education programs
Law 16,713 and Law 20,130	***"Social Security Law" and "Reformation of Social Security"*** Establish and amend the framework for social security and pensions
Law 18,211	***"Creation of the National Integrated Health System"*** Establishes an integrated universal healthcare system
ILO Conventions	***International Labour Organization Conventions*** Uruguay has ratified several ILO Conventions, such as: • C029 - Forced Labour Convention, 1930 (No. 29) • C105 - Abolition of Forced Labour Convention, 1957 (No. 105) • C182 - Worst Forms of Child Labour Convention, 1999 (No. 182) • C100 - Equal Remuneration Convention, 1951 (No. 100) • C102 - Social Security (Minimum Standards) Convention, 1952 (No. 102) • Among others

Source: IMPO - Centro de Información Oficial; International Labour Organization

Chile ensures social aspects through implemented legislation
Overview

The Chilean Labour Code is the regulations' body that governs the private labour in Chile, that includes legislation regarding protection to workers, individual employment contracts, and job training, among others. There are several binding legislations that ensure labour security, gender equity, and protection to child. As member of the ILO, Chile has ratified several conventions regarding forced labour, protection of children and young persons, equality of opportunity and treatment, among others. Relevant regulations regarding social aspects are presented in the table.

Regulation	Social aspects addressed
Law No. 20,348 Ministry of Labour and Social Security; Subsecretary of Work	***"Safeguards the right to equal remuneration"*** Legal amendments to safeguard equal pay for men and women in the same job, both in the public and private sectors.
Law No. 21,643 Ministry of Labour and Social Security	***"Amends the labour code and other legal bodies regarding the prevention, investigation and punishment of labour, sexual harassment or violence in the workplace"*** Introduces a series of amendments to various legal texts, including the Labour Code, in order to strengthen regulations on the prevention, investigation and punishment of workplace harassment, sexual harassment or violence in the workplace.
Law No. 21,271 Ministry of Labour and Social Security	***"Adapts the labor code on the protection of children and adolescents in work"*** Explains the changes to the Labor Code to regulate adolescent labor and the situations in which it is prohibited.
Law No. 21,015 Ministry of Social Development and Family	***"Encourages the inclusion of people with disabilities in the labor market"*** Encourages labor inclusion of people with disabilities under equal conditions, prohibiting any discriminatory act based on their condition.
Decree 131 Ministry of Labour and Social Security	***"Creates National advisory committee for the eradication of child labour and the protection of child workers"*** Guarantees compliance with national or similar strategies, plans, programs or similar that are in force, focused on the prevention and progressive eradication of child labour and the protection of adolescent workers.
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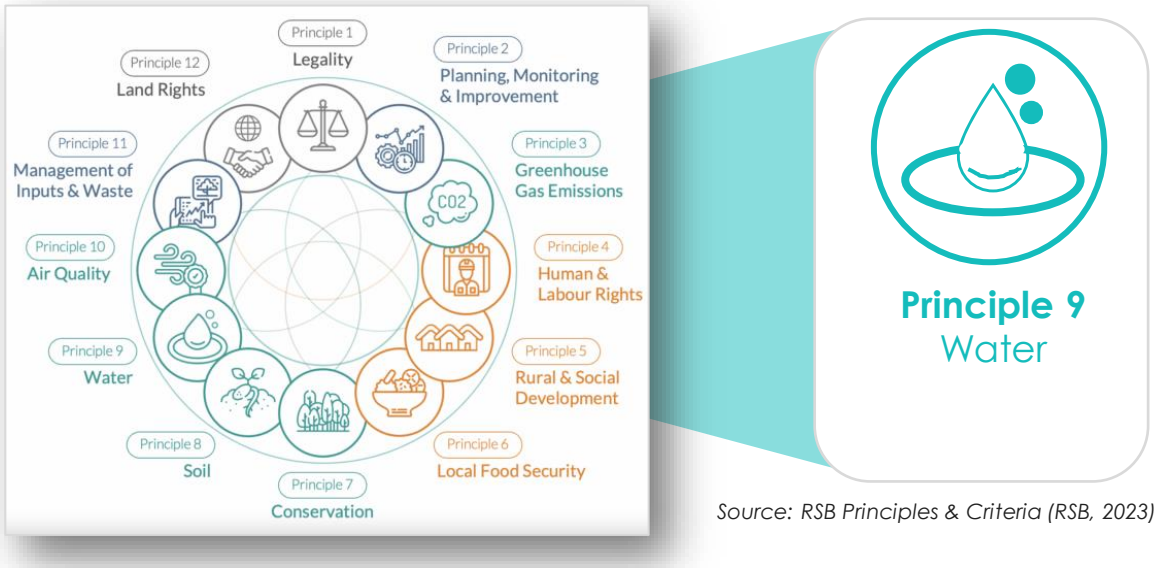
Source: Biblioteca del Congreso Nacional de Chile; International Labour Organization

Principle 9th: Water

Principle 9 focuses on **maintaining or enhancing quality and quantity of water resources and water rights**

THE 12 RSB PRINCIPLES & CRITERIA



Source: *RSB Principles & Criteria (RSB, 2023)*

Preparing for the Water Impact Assessment

To carry out a successful Water Impact Assessment, it is relevant to understand some concepts that will facilitate its development:

1. **Geographical knowledge** to understand the water ecosystem and site where the project will be developed.
2. **Identification of the areas** that will be both environmentally and socially impacted by the project
3. **Establishment of a baseline** that exhibits the current status of the zone that will be affected by the project.

Sustainable use of water

Water has become an area of concern around the world, since industrial upscale has led to limited water availability, deterioration of water quality, and concerns of local communities around the protection of water supplies. Aligned with this concern, RSB has included Principle 9: Water into its 12 Principles & Criteria, which focuses on water impacts by addressing the following aspects:

- Criterion 9a: Identify and protect existing water rights, both formal and customary
- Criterion 9b: Design and implement a water management plan to minimize and monitor impacts
- Criterion 9c: Minimize water depletion
- Criterion 9d: Enhance or maintain the quality of water resources

For ensuring efficient use of water resources, operators must develop a Water Management Plan that contains good water management practices to optimize water use, such as implementing water-saving practices to increase the efficiency of the water use, as well as potential impact on water resources due to the development of the project.

In case that potential impacts on water resources are sufficiently "significant", a Water Impact Assessment must be carried out (as part of the EIA). This includes identifying, assessing and mitigating potential impacts on water resources, in order to comply with RSB's standards which are the base of H2Global's Additional Sustainability Requirements.

Source: *RSB Water Impact Assessment Guidelines (RSB, 2018)*

Before assessing possible water impacts of a project, it is essential to set a reliable **baseline of the current state of water resources**

Baseline Conditions

Prior to the development of a project and to the Water Impact Assessment, it is crucial to establish a baseline with information of the current state of water resources and their use within the vicinity of the site. Setting a baseline helps to:

- Facilitate the identification and rating the significance of expected impacts.
- Enabling operators and stakeholders to determine whether the facility is likely to have an impact on water resources during the operational phase.

How to set the baseline?

1. **Planned water use:** Quantify what the operation's planned water use is likely to be, considering that processes differ on water requirements, such as electrolyzer requirements or cooling systems, as well as estimated human consumption in the project sites. This will allow to assess the impact of the operations on water availability in the basin, and to adjust the water sourcing strategy to the results of the impact assessment.

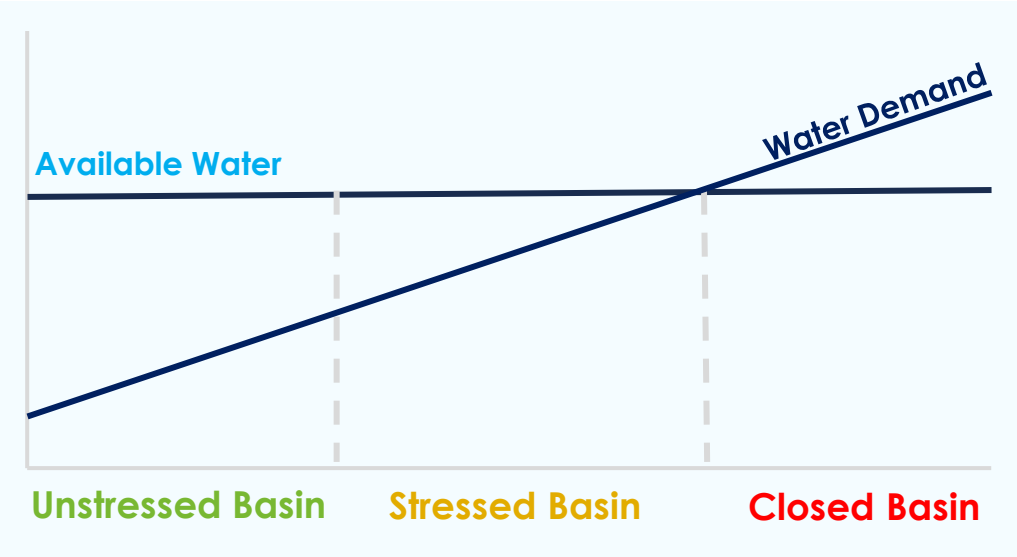
2. **Stress of the basin:** Determine whether the basin considered for the project is an unstressed, stressed or closed basin. That is, whether there is sufficient water available for carrying out the operations. The level of stress in a basin reflects the amount of water being used relatively to the amount of water available for use. Knowing the type of the considered water basin will help to understand if the selected project site is an appropriate zone for developing the project and how to manage the available water resources appropriately.

Source: RSB Water Impact Assessment Guidelines (RSB, 2018)

Relevant parameters to consider when establishing the baseline	
Nature of local resources	Location and physical description of resources.
Water use rights	Nature of the rights, levels of access, extent of water use by communities.
Water quantity	Stress of the basin, seasonal flows, ecological requirements .
Water quality	Nutrient concentration, suspended solids, coliform bacteria, pH, turbidity, and salinity.

Source: RSB Water Impact Assessment Guidelines (RSB, 2018)

Relationship between available water & water demand in different basin types



Source: Own elaboration Hinicio based on RSB Water Impact Assessment Guidelines (RSB, 2018)

During the development of the project, **it is essential to identify and ensure water rights as well as human and ecosystem needs**

If the project is not aligned with the local rights, the operator is unlikely to achieve compliance with RSB Principle 9 which is aligned with H2Global's Sustainable Goals.

The following aspects are relevant when identifying and protecting water rights as well as human and ecosystem needs:

- **Water rights:** prior to the development of a project which will impact on water resources (i.e. renewable hydrogen or e-fuels production) it is relevant to understand **the right to withdraw water**. **Distribution of water resources legitimate claimants** through the granting, transfer, review and adaptation of water rights. This includes formal laws but also customary rights.

- **Customary water rights:** these rights refer to **communal use of water**, where typically **communities or user groups have set rights to allocate water to some degree.** In most cases of customary water law, the private ownership of water is not recognized, and **water is recognized as property of the community.**

- **Water for basic human needs:** project developers need to ensure that the planned or existing project does **not impact on the right of water access for domestic and subsistence needs.**
- Both water abstraction from water courses as well as use of groundwater must be considered, since they both can affect water needs for communities and domestic water supplies.

- **Replenishment capacity:** this refers to the capacity for water tables, courses and tanks to be refilled by water inputs, such as rain and runoffs. **Water withdrawn can not exceed water inputs during the same period, so that the resources are not depleted.**

- **Water for environmental requirements:** protection of water release into river systems shall be ensured and prioritized, to maintain or restore freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these. Governments and water management authorities are realizing the importance of ensuring environmental flows through the management of infrastructure such as dams, or through reducing abstraction from the river system.

- **Instruments for water allocation:** there are several arrangements for water allocation, **depending on water availability and the respective regional regulatory framework**. This may be administrative allocation, market allocation or communal processes, among others. **Understanding those in the regional context where the project will be developed is crucial to ensure water supply for the project.**

Hinicio

Source: RSB Water Impact Assessment Guidelines (RSB, 2018)

A complete Water Assessment process includes identification of **potential impacts and Mitigation & Monitoring measures**

There is a large number of potential impacts linked to the use of surface and groundwater associated with renewable hydrogen and derivatives' projects development. The table below* provides an overview list of key aspects and impacts on water resources along the whole project lifecycle: project development, construction and operations. It should be noted that for a complete Water Impact Assessment, both direct impacts associated with the operation as well as potential secondary/cumulative impacts must be considered.

Aspect	Impact Assessment
Land clearing and preparation	• Loss of aquatic habitat and biodiversity • Increased turbidity of water bodies due to erosion • Loss of access to rivers and wells for adjacent communities • Decrease on stream flows and groundwater levels due to vegetation change
Impoundment, installation of dams	• Change in volume/seasonality of stream flow • Changes in flooding • Health risks associated with the creation of temporary habitat for vectors of disease
Irrigation and abstraction for process and non-process applications	• Loss of ecological functions, aquatic habitat, and biodiversity • Competition/loss of access to water for other users • Increased depth of the groundwater table • Sediment run-off (non-point source pollution)
Management and disposal of liquid or solid co-products and wastes	• Eutrophication due to run-off or leaching • Reduced water quality, increased salinity • Loss of aquatic biodiversity • Contamination of water by leachate from solid waste storage areas • Contamination of stormwater
Construction and operation of infrastructure for water storage and transport	• Health risks associated with the creation of a temporary habitat for vectors of disease • Safety risks particularly for children

*RSB's Water Impact Assessment Guidelines (2018) exhibits an extensive table with potential impacts for biofuel/biomaterial projects development. The impacts shown in the table above are shown to provide help when identifying risks since they may also when developing a RFNBO project.

Mitigation and Monitoring

Besides identifying and weighting the project's impact on water, just as described for the ESMP, proposing mitigation measures and monitoring plans plays a crucial role to successfully demonstrate how those impacts shall be managed during the project and how eventual changes will be addressed. This is crucial for ensuring compliance with Sustainability Criteria required by both the RSB Standard and H2Global application requirements (2023).

Mitigation measures will depend on the nature and extent of the water impacts, the local context and the practical constraints; and shall focus on eliminating or reducing negative impacts, its severity or its likelihood of occurring. Mitigation measures may be, for example, the use of closed water circuits and the reuse of condensates. These mitigation strategies must be captured in the ESMP.

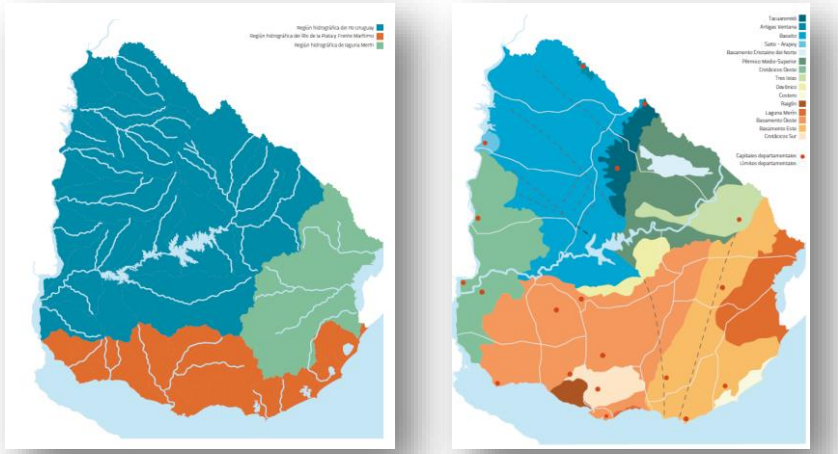
Monitoring Strategies are required to ensure good water resources management and an early detection of any potential social impacts and conflicts. Effective monitoring should provide information on water quality, surface and groundwater patterns to establish seasonal variations and intra-annual variations, etc. It is also good practice to involve not only the resource management authorities, but the local community as well. Recommendations with respect to what water indicators should be monitored, when, by whom and how, should be included. These monitoring strategies must be captured in the ESMP.

Source: Own elaboration Hinicio, based on RSB Water Impact Assessment Guidelines (RSB, 2018)

Uruguay presents **suitable water resources** due to its **surface as well as groundwater availability throughout the country**

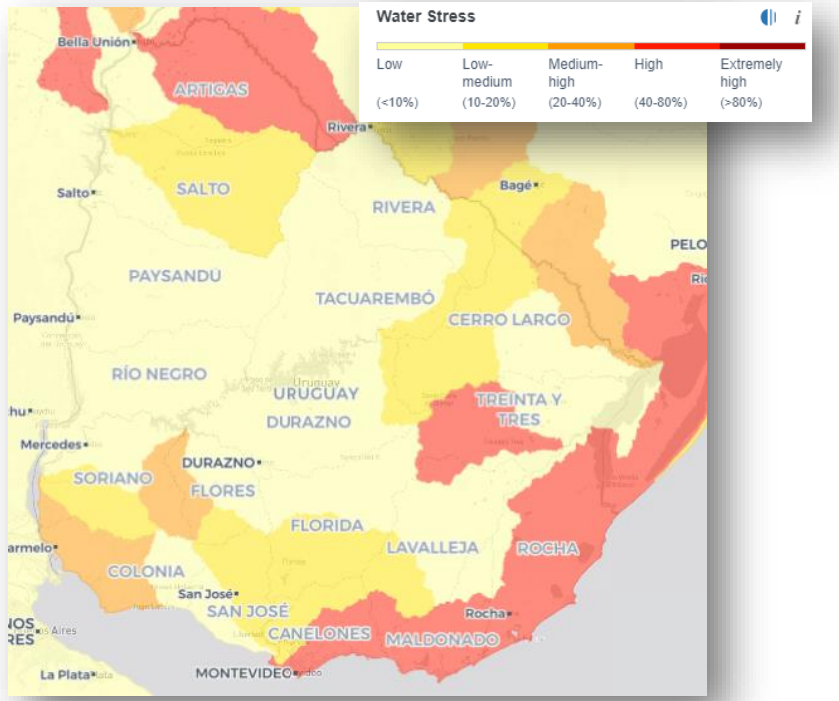
Water resources in Uruguay

According to the Green Hydrogen Roadmap of Uruguay (2022), the country has a **significant rainfall system and water availability**, making the existence of fresh water abundant and suitable to produce renewable, electrolytical hydrogen. According to the country's estimated hydrogen production of around 1 million tonnes in 2040, **the required volume of water would be significantly lower than current volumes of water used for other industrial processes*.**
Uruguay's high water availability relays on the country's access to the Atlantic Ocean and to the large number of rivers with important basins that cover several areas of the country. Uruguay's surface water resources are distributed in **three hydrographic regions: *Río Uruguay*, *Río de la Plata y Frente Marítimo*, and *Laguna Merín***. Regarding groundwater, Uruguay **has several aquifers** that cover the national territory.**



Uruguay's hydrographic regions

Source: Plan Nacional de Aguas Uruguay (MVOTMA, 2017)



Water Stress Atlas for Uruguay

For regional water assessments, H2Global suggests to employ the WRI Aqueduct Water Risk Atlas. According to this source, **Uruguay is classified as a low water stressed Region (in most of the territory) for year 2030 in a Business as Usual (BaU) scenario.**

Source: WRI Aqueduct Water Risk Atlas

*The potential water consumption identified for the development of the entire green hydrogen and derivatives roadmap by 2040 represents 0.8% of the water available for irrigation use in the agricultural sector and 4% of the water available for industrial consumption in 2022. These values represent the total authorizations granted by DINAGUA, including surface and groundwater and reservoirs (MIEM, 2023).
**Most relevant aquifers are Guarani Aquifer System, Raigon Aquifer System (which is the most productive in the south of the country), Mercedes Aquifer, Salto Aquifer, Chuy Aquifer and Arapey Aquifer.

Water management is regulated by **rigid legislations supervised by a robust institutional framework**

In addition to Uruguay's favorable water conditions, **the country shows socio-economic stability and counts with stakeholders that are responsible for promoting sustainable water use principles and institutional arrangement for water management**. There are several laws and regulations promoting sustainable water use, and the following entities that are principal stakeholders in charge of water management, should be involved when carrying out the water assessment for a project:

General Laws for water use

All project developers who are seeking to develop a renewable hydrogen and/or derivatives projects in Uruguay, should consider the following legislation and policies:

- **Article 47 of the Constitution**
- **Law N° 14.859. Water Code**
- **Law N° 18.610. National Water Policy. Guiding Principles**
- **National Water Plan****

These legislations establish the principal guidelines regarding the access of communities to drinking water and water for sanitation, management of water by legal entities, and sustainable use of water*.

They are also aligned with RSB's criteria for Definition of water rights, Customary water rights, and Water for basic human needs. Thus, the compliance with the aforementioned legislation facilitates compliance with RSB's Principles & Criteria and therefore H2Global's Additional Sustainability Requirements.

*For basins and aquifers there are Regional Councils and Basin and Aquifer Commissions that promote sustainable and participatory water management by considering basins as a management unit. These must be considered depending on the location of the project.
**Link to the National Water Plan

National Authorities

Ministry of Environment	The Ministry of Environment of Uruguay (MA) is responsible for the formulation, implementation, monitoring, evaluation and protection of the environment and sustainable development, as well as for the execution of the national environmental policy, established by the Executive Power. **The MA coordinates the two environmental entities mentioned below, DINAGUA and DINACEA.**
DINAGUA	The *Dirección Nacional de Aguas* (DINAGUA) is the Uruguayan water authority and is in charge of defining water policies at a national level. **When applying for the right for water use, request must be submitted to this entity.** Both groundwater and surface water intakes, whether direct extractions or dams, require an application to this agency, which decides, after evaluation of the availability of the resource, if the use permit is issued.
DINACEA	The *Dirección Nacional de Calidad y Evaluación Ambiental* (DINACEA) is the environmental authority reporting to the Environmental Ministry in Uruguay, and is responsible for defining environmental management policies at a national level. This agency is responsible for **requesting Environmental Impact Assessments (EIA), where water impacts assessment and management plans must be included,** and for establishing the terms of reference to develop those.

Authorities regulating water services

OSE	The *Obras Sanitarias del Estado* (OSE) is a decentralized service that **provides the public drinking water service**. OSE is the only agency responsible for water supply, at a national level for the entire country, and for attending the country's users regarding water resources.
URSEA	The *Unidad Reguladora de Servicios de Energía y Agua* (URSEA) is the entity responsible for **regulating water and sanitation services**, at a national level, by monitoring basic services provided by the State, ensuring safety of water for human consumption and managing sanitation services.

Applicable regulations and potential impacts depend on the national context but **also on specific project characteristics**

Considering Uruguay's water availability and the presented institutional framework, **the country exhibits suitable conditions for ensuring compliance with RSB's 9th Principle and H2Global's Additional Sustainability Requirement for Water**. The country is classified as a **low stressed water region** in most of the territory and **water availability is high** because of several surface as well as groundwater sources. Therefore, national conditions suggest that **projects developed in the country are likely to comply with Water Sustainability Criteria**. Nevertheless, the **local context for the specific project sites must be particularly analyzed**, since project impacts on water will depend on the production site, geographic aspects, water sources and supplies, among other aspects.

Legislation for specific water aspects

Applicable regulation to a project will depend on the project's characteristics, as the regulatory framework varies based on specific factors like the chosen water source, and the geographic location and hydrographic region, among others. For each particular case, project developers will have to focus on different legislations depending on the inputs:

- **Use of surface water,** such as reservoirs and rivers, is legislated by Law N° 14.859, Decree 368/018, which establishes measures such as maximum established limits of flow to be extracted.
- **Use of groundwater** may require construction of wells through one or more aquifer systems. Use of groundwater is legislated by Article 47 Law N° 14.859 and the construction of wells is regulated by Decree 86/004 and must be executed by companies authorized by the water authority.
- **Use of water from the Guarani Aquifer** is regulated by Decree 214/000 that establishes the management of groundwater belonging to the Guarani Infrabasaltic* Aquifer. The Guarani Aquifer System is transboundary and is shared within Argentina, Brazil, Paraguay and Uruguay. It is a considerable economic and social resource, with a growing demand for its use. Therefore, the use of water from the Guarani Aquifer has its own legislation.
- **Wastewater discharge** must be aligned with Decree No. 253/79, and will depend on the project discharges, such as the specific classification of the domestic and industrial effluents and conditions and treatment of the wastewater from water plants.

By complying with these regulations, adherence to environmental aspects supported by RSB's Sustainable Framework such as respecting water availability for allocation and guaranteeing replenishment capacity may be ensured.

Tools and Platforms

There are several tools that have been developed by Uruguayan Institutions that are **useful for project developers when characterizing the project sites, describing water sources, classifying territories,** and other relevant inputs for the Water Impact Assessment:

- The Water Resources Viewer is a public website developed by the DINAGUA that offers access to information on water resources inventory, water utilization and hydrological statistics.
- The National Environmental Observatory is a platform that offers public environmental information, gathers monitoring data on different parameters, and documents prepared for specific topics through web access. It is a valuable tool that contributes to the governance of water resources. The responsible entity for its implementation is the Ministry of Environment, through the DINACEA.
- The Uruguayan Institute of Meteorology (INUMET) provides public meteorological and climatological data, such as precipitation indexes, water balances, average temperature, etc.

Source: IMPO - Centro de Información Oficial

*The concept "Infrabasaltic" refers to a geological classification of the aquifer.

Uruguay has a **well-defined national regulatory framework in force to regulate water use rights**

In the last decades, **Uruguay has subscribed many international agreements*** regarding sustainable management of natural resources, demonstrating alignment with global targets and rectifying this with the approval of laws. The following table summarizes **Uruguay's most relevant National environmental regulations related to Water Resources Management in this context,** that define water management and promote sustainable use of water **:

Regulation	Implicance for water use
Article 47 of the Constitution	Access to drinking water and sanitation is declared a fundamental human right. Surface water and groundwater constitute a unitary hydraulic public domain resource ruled by the state. The public sanitation service and the public water supply service for human consumption shall be provided exclusively and directly by state-owned legal entities.
Law No. 14,859	***"Water Code"*** Executive power is the highest authority and has the power to formulate the National Water Policy, limit uses, and to define priorities. The first priority of water use is given to the supply of drinking water to the population.
Law No. 18,610	***"National Water Policy"*** Establishes guiding principles for water, such as sustainable management, as well as institutional arrangement for Uruguay's waters. All inhabitants have the right to access to drinking water and sanitation, and all persons shall refrain from causing negative or harmful environmental impacts on water resources, adopting the necessary preventive and precautionary measures.
Decree No. 205/017	***"Approval of the National Water Plan"*** The aforementioned regulation is established as an instrument of the National Water Policy for planning at the national, regional and local levels for public and private action in the water sector.
Decree No. 368/018	***"Approval of measures for the uses of public waters to ensure the flow that allows the protection of the environment and environmentally appropriate management criteria for hydraulic works"*** When employing surface water sources, the exploitation regime shall not affect environmental flows. There is an established limit of flow to be extracted for each type of hydraulic work. The use of surface water is assumed to be realised by means of a reservoir or a set of reservoirs and not by direct intake.
Decree No. 253/79	***"Prevent environmental pollution through water control"*** Sets up conditions for the disposal of domestic and industrial effluents, wastewater and rejects from water plants. It establishes quality standards of the discharges for the preservation of water courses and proposes classification.
Decree No. 84/004	***"Technical Standard for the construction of frilled wells for groundwater collection"*** Governs the construction of wells for the use of groundwater from one or more aquifer systems. When more than 50 l/s are extracted from the well, a Prior Environmental Authorization must also be obtained.

Source: IMPO - Centro de Información Oficial

*International Agreements that Uruguay has subscribed regarding sustainable management of resources are Law No. 13,462 (1965), Law No. 14,145 (1974), Law No. 15,337 (1982), Law No. 16,221 (1991), Law No. 16,408 (1993), Law No. 16,517 (1994), Law No. 17,593 (2002), Law No. 17,732 (2003), Law No. 18,913 (2010), Law No. 19,439 (2016), Law No. 19,267 (2018), Law No. 19,773 (2019).

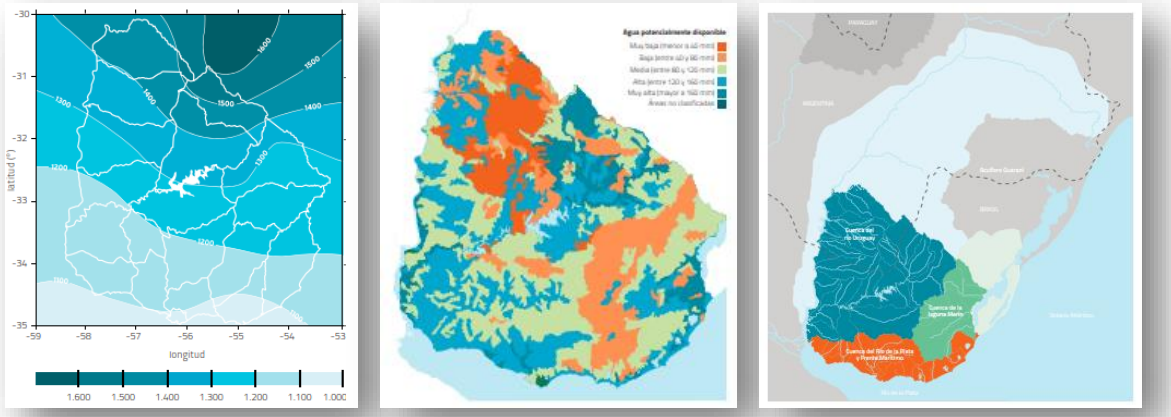
**The regulations presented in the table are considered the most significant for project developers whose projects will have an impact in Uruguay's water resources.

How can project developers **in Uruguay** demonstrate **sustainable water use to comply with H2Global Sustainability Standards?**

1. Characterization of the zone

- The scope of the Water Assessment will depend on the nature of the water resources and drainage areas where the operation will extract, channel and redistribute water, as well as the nature of existing water resource data for the area. Characterization of the water resources such as basins, water, groundwater, and water quality will be key to identify the applicable regulation and potential impacts and mitigation measures.

- Geographic characterization can be based on reports, models, and studies from specialized companies. Looking into the tools provided by Uruguayan entities, such as the National Environmental Observatory, as well as global platforms such as the WRI Aqueduct Water Risk Atlas, is recommended when characterizing the project sites.



Source: Plan Nacional de Aguas Uruguay (MVOTMA, 2017)

Examples of site characteristics to have in consideration: Average annual precipitation, Potential available water capacity*, and Hydrographic regions in the regional context.

*The Potential Available Water Capacity refers to the potential water storage capacity of soils.

2. Identification of applicable local regulations, stakeholders and required authorizations

- Once the project site is well characterized, applicable legislation and regulation should be recognized. Authorizations and required permits will depend on the water source that a project developer chooses, e.g., surface water courses, groundwater, residual water, desalinated water, reservoir, etc. and will always depend on each specific project and local context.

- Once the water sources have been defined, applications for the corresponding water usage rights are submitted to the competent agency at a national level, DINAGUA. The application for water use rights is submitted considering the specific water source, presenting the required information and documentation. After evaluation of the availability of the resource in the zone, DINAGUA may issue the permit or reject it. The resolution specifies the maximum flow that can be taken (depending on the water source) and will require the submission of periodic affidavits.

- The Resolution granting the rights of use is documented in the Public Water Registry, which contains the registrations of grants, modifications or extinctions of private water use rights and the information related to the applicants of these rights. Water use permits are temporary and periodically renewed and can have different extensions depending on the permit, which may be 1, 5 or even 10 years. Resolutions registered regarding the granting of private use rights for public waters can be found in the Public Water Registry.

Relevant Institutions

URSEA

DINAGUA Dirección Nacional de Aguas

Ministerio de Ambiente

OSE

Hinicio

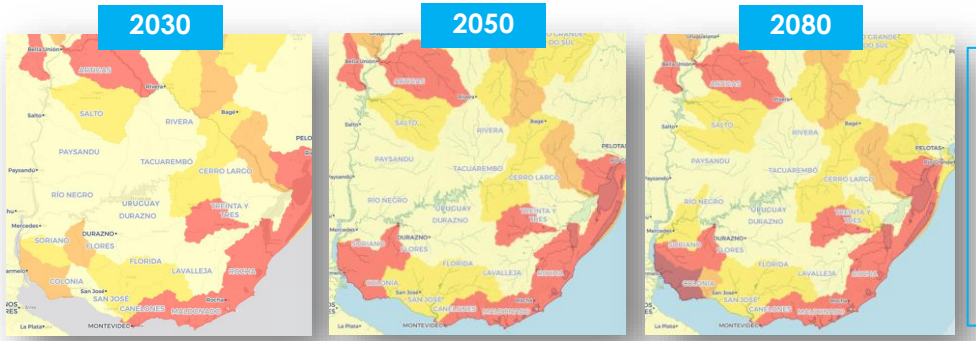
How can project developers **in Uruguay** demonstrate **sustainable water use to comply with H2Global Sustainability Standards?**

3. Impact Assessment, Mitigation and Monitoring

- A detailed and precise Water Impact Assessment is key for demonstrating compliance with Sustainability Requirements, such as H2Global's Additional Sustainability Requirements.
- Identifying potential risks, rating them, and proposing realistic Mitigation Measures as well as viable Monitoring Plans, provides credibility and reliability to a project proposal. The sustainable use of water must be demonstrated in the context of the ESIA and be must be monitored according to the ESMP.
- For such processes, RSB's Impact Assessment Guidelines, IFC Performance Standards and EIA Guidelines from the Uruguayan Ministry of Environment can be used as guidelines.
- According to the legislation presented above, Uruguay's regulatory framework and sustainable targets are in line with H2Global's and RSB's Principles, facilitating project developers to comply with both national and international standards when developing a project.

Relevant additional insights

- The purchase of water to produce hydrogen must be sustainable so that no impairment of **quality or scarcity** at the site is contributed to the entire life cycle of the project.
- To ensure sustainable use of water, the water supply should be designed **to minimise water consumption for production needs**, such as use of closed water circuits and reuse of condensates (for electrolysis and CO2 capture processes, for example).
- **The location of a project is determining for complying with water rights for human needs**. If the implementation of a project is far enough from boreholes for domestic water supply, this may ensure that the water supply for the project will not affect local communities.
- If the water to be used is limited to surface water, then it **may not be necessary to undertake an assessment of groundwater sources.**
- **Uruguay's National Water Plan was last updated in year 2017.** As such, data regarding water sources may present variations. Therefore, it is recommended to:
  - Complement the information with additional databases (project developers)
  - Update the National Water Plan (Public Authorities)
- Although Uruguay is not considered a water stressed Region neither today nor in 2030, projections for further years should also be considered, since most of the **countries, including Uruguay, are likely to present higher water stress levels over time**. The WRI Aqueduct Water Risk Atlas offers projections for years 2030, 2050 and 2080 in pessimistic, optimistic, and Business as Usual cases.



The figures show Water Stress in Uruguay for years 2030, 2050 and 2080 in a BaU case. Although most of the territories are not expected to present drastic Water Stress level increase, Water Stress in Southwest Regions are projected to raise within the years. Such projections should be considered when choosing the project site and the available water sources, specially for renewable hydrogen production processes.

Chile's extensive coastline provides the country with **abundant seawater resources for producing renewable hydrogen**

Water resources in Chile

Water availability is different in each region because of the great extension of the country. Chile exhibits variant weather conditions throughout the country. On one hand, **Northern Regions are drier geographies**, such as the Atacama desert, one of the driest places on earth, while on the other hand, **Southern Regions exhibit several continental water resources**, such as surface water like rivers and lakes, as well as large quantities of rain and snow.

In addition to continental water, the country has non-continental water sources that can be used, and this is also because of its geography. Chile's access to the Pacific Ocean is due to its more than 6,000 km extensive coastline. This provides the country with **abundant non-continental water resources, like seawater, that can be employed for renewable hydrogen production through electrolysis.** According to the National Green Hydrogen Strategy, it is expected that **most of the green hydrogen produced in Chile will use seawater as feedstock, as well as wastewater,** in order to avoid further water stress.

Water rights and concessions, depending on the type of water used, are granted by two entities:

- Chile's Political Constitution grants **private property rights for water** called "*Derechos de Aprovechamiento de Aguas*" (DAA). These are granted by the State, and they regulate the use of continental water flows. The ***Dirección General de Aguas*** **(DGA) is the entity in charge of granting and constituting DAA.**
- For the use of non-continental water (seawater) a **maritime concession is required.** These are granted by the Ministry of National Defense of Chile through its **Subsecretary for the Armed Forces (SS.FF.AA.) The maritime concession grants the right to use and therefore install infrastructure for the utilization of seawater in a specific area of the country's maritime territory.**

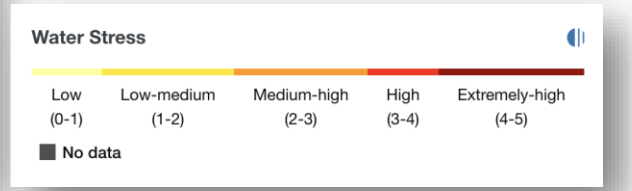
The use of wastewater and seawater should not impact the water rights destinated for human consumption or those used for industrial and other activities.

Water Stress Atlas for Chile

According to the WRI Aqueduct Water Risk Atlas, by year 2030, Chile is expected to be **a high to extremely-high water-stressed region in most of the territory.** Northern Regions are expected to face more water scarcity, while Southern Regions are likely to expect lower water stress because of several surface and groundwater resource availability.

In Chile, there are currently **more than fifteen water scarcity decrees** within eight regions of the country, which means that more than six million people in more than hundred communes live in drought.

Sources: WRI Aqueduct Water Risk Atlas; DGA (2023)



Sources: National Green Hydrogen Strategy (Ministry of Energy of Chile, 2020); Disponibilidad del recurso hídrico en el desarrollo del hidrógeno verde y sus derivados en Chile (GIZ, 2023); Desalination of seawater and reuse of water waste for the production of Green Hydrogen and Derivatives in Chile (GIZ, 2023); PERMISOS, DERECHOS Y CONCESIONES NECESARIOS PARA UN PROYECTO DE DESALACIÓN (ACADES, 2022)

Both desalinated seawater as well as treated wastewater may be **potential water sources for renewable hydrogen projects**

Potential sources for hydrogen production

Due to the considerable water stress levels in Chile, considering water security is crucial during project development. In Chile, **water is considered a human right and water for human needs is the priority**. The country's demographic, socioeconomic and water infrastructure conditions may increase the territory's susceptibility to adverse impacts on its water security, therefore access to water for local communities must be carefully supervised when examining water source availability for a planned project.

Because of Chile's water scarcity, considering the use of surface water from rivers and lakes for industrial uses, such as renewable hydrogen production, could trigger potential conflicts regarding water availability for domestic uses. Under this scenario, alternative **water sources such as desalination and reuse of treated water are likely to be more viable options.**

Chile has a track record in both developing and operating desalination plant projects. **Currently, 22 desalination plants in operation are leveraging the country's extensive coastline, and there are more than 20 projects under development in various stages.** The Antofagasta Region, where several renewable hydrogen and derivatives projects are announced, represents more than a 70% of desalinated water production that is mainly used by the mining industry[1].

Regarding treated water, **Chile's wastewater treatment has a coverage higher than 98%**. Despite most wastewater is treated, no more than 5% is reused. This water source may also be used for renewable hydrogen production, presenting an interesting opportunity for project developers seeking to develop renewable hydrogen and derivatives projects in the country, with more than 1,150 million of cubic meters of wastewater available[2].

MAE is a flagship in wastewater utilization for ammonia production project in Chile

The **Volta project**, by MAE, considers the development of a Power-to-Ammonia project in Northern Chile.

The project **excludes the use of continental waters** in all its stages. Instead, it will employ mainly **treated wastewater from communities in the area** and it will be complemented with water from nearby desalination plants.

Source: Environmental Impact Assessment "Volta Project - Green Ammonia and Hydrogen Plant".

Key considerations

To develop a desalination project, a maritime concession under the *Decree 340* must be acquired along with a series of permits. For the concession it is important to consider the Indigenous communities' Coastal Marine Space under *Law 20,249*. A project of this nature will most likely have to be submitted to the Environmental Impact Assessment Service (SEIA) and the SEA has prepared a special guide to orient desalination project developers through the process.

In Chile, there is no legislation for the reuse of wastewater. Currently, a *Bill of Law* is under consideration in Congress, which aims to regulate and promote systems for wastewater treatment and reuse.

Sources: [1]Reuse and Desalination (ACADES); [2]Disponibilidad del recurso hídrico en el desarrollo del hidrógeno verde y sus derivados en Chile (GIZ, 2023) Disponibilidad del recurso hídrico en el desarrollo del hidrógeno verde y sus derivados en Chile (GIZ, 2023); PERMISOS, DERECHOS Y CONCESIONES NECESARIOS PARA UN PROYECTO DE DESALACIÓN (ACADES, 2022)

Chile has regulations in place that **address RSB's criterion related to water**

Baseline conditions and management plans

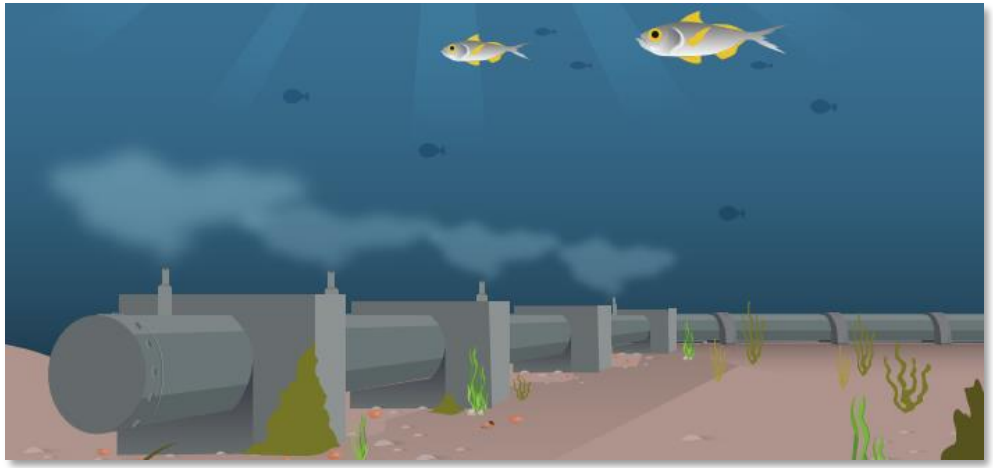
When projects are required to conduct an Environmental Impact Assessment (EIA), such as the ones with submarine outfalls, they must establish an **environmental baseline**, as stipulated by *Law 19,300*. This baseline comprises a detailed description of the project's or activity's area of influence to address the potential impacts on its environment.

The baseline includes a specific water topic:

- Description of the physical environment, including **water quality and quantity**.

The EIA also includes a description of the effects and environmental impacts, **mitigation actions, and a monitoring** plan for the relevant environmental variables. ***Decree 40* also establishes that when applicable, the EIA must include plans for environmental mitigation, compensation and remediation.**

Disposal of brine through multiple diffusers



Source: Guía para la descripción de proyectos de plantas desalinizadoras en el SEIA (SEA, 2023)

Water for environmental requirements

The requirements for water use related to the environment are focused on continental water:

The DGA has a regulation, *Decree 14,* to determine the minimum ecological flow of rivers and lakes (superficial continental water sources). It corresponds to the **minimum flow required to maintain the biological diversity of the watercourse in good conditions**.

The General Bases of the Environment and the Regulation of the Environmental Assessment System (*Law 19,300*) also establishes that, **when necessary, it will be mandatory to have a management plan for the use of natural resources**, such as water, to ensure the maintenance of water flows, among other objectives.

Quality of water resources

When desalinated seawater is treated, the desalination process generates a reject water commonly named brine, a water high in salt content and other elements, that must be returned to the sea, this under the standards of *Decree 90*.

Water desalination technologies are mature and feature brine disposal systems designed to minimize impacts on the marine ecosystem. One such system involves the use of multiple diffusers, as illustrated in the figure.

The use of non-continental water does not affect the quality of continental water sources.

Sources: SEA; DGA; SS.FF.AA.; Sequías y Seguridad Hídrica en Chile; Climate Change Observatory

Three **main entities were identified among those in charge of water management** in Chile in the context of RSB water criteria

The following entities are the principal stakeholders in charge of water management in the country to be considered when carrying out the water assessment for a project:

Authority	Role regarding water management
Dirección General de Aguas – Ministerio de Obras Públicas – Gobierno de Chile	***Dirección General de Aguas* – DGA (General Water Direction) is the Chilean water authority** reporting to the Public Works Ministry **and is responsible for safeguarding water quality and quantity.** When applying for the right for water use, the request must be submitted to this entity. Both groundwater and surface water intakes, whether direct extractions or dams, require an application.
SEA – Servicio de Evaluación Ambiental – Gobierno de Chile **SEA**	***Servicio de Evaluación Ambiental* – SEA (Environmental Assessment Service) is the environmental authority reporting** to the Chilean Ministry of the Environment. This agency is responsible of the SEIA, a preventive environmental management instrument regulated under *Law 19,300* and *Decree 40* of the Ministry of the Environment. **The SEIA is responsible for determining whether the projects or activities, which according to regulations require an Environmental Impact Assessment (EIA) or Declaration (DIA) comply with current standards, through a Resolution of Environmental Qualification.**
Subsecretaría para las Fuerzas Armadas – Gobierno de Chile **SS.FF.AA.**	***Subsecretaría para las Fuerzas Armadas* - SS.FF.AA. (Subsecretary for the Armed Forces** is part of the Ministry of National Defense of Chile and its mission is to collaborate with the ministry in the formulation of policies and management of administrative matters. One of the SS.FF.AA. objectives is to manage the sea and lake coastline through **granting of maritime and aquaculture concessions.**

Tools and Platforms

There are several tools that have been developed by Chilean Institutions that are **useful for project developers when characterizing the zones, describing water sources, classifying territories,** and other relevant inputs for Water Impact Assessment:

- The **Drought and Water Security Platform** is a public web developed by the Centre for Climate Science and Resilience (CR2) of the University of Chile, that offers access to data on climate and water availability over the last six decades, as well as changes in land cover and sectoral water uses.
- The **Climate Change Observatory (OCC)** gathers monitoring data on different environmental parameters (such as temperatures, precipitation, and solar radiation, among others), and will have a decentralized climate change data platform, through which its information will be openly available to the community. It is led by the Chilean Ministry of Science, in collaboration with the Ministry of Foreign Affairs and the Ministry of the Environment.
- The **SEA guides** present and describe methodologies useful for describing maritime ecosystems and desalination plant projects (among many others), aiding in the development of EIAs and DIAs required for submission to the SEIA.

Hinicio

Sources: SEA, DGA, SS.FF.AA., Sequías y Seguridad Hídrica en Chile; Climate Change Observatory

The main Chilean regulations related to **water are not under the same governance**

Despite the progressive increase in the installation of seawater desalination plants in Chile, there is **no specific regulation concerning their extraction**, processing, treatment, distribution, **as well as their use by industrial activities,** or for human consumption. Currently, existent regulation is for obtaining maritime concessions or authorizations and they **depend on the type of use of water**. The most significant regulations for project developers are presented in the table.

Bill of law

Currently, the Congress is working in two Bills of Law related to the use of seawater for desalination purposes and the reuse of wastewater:

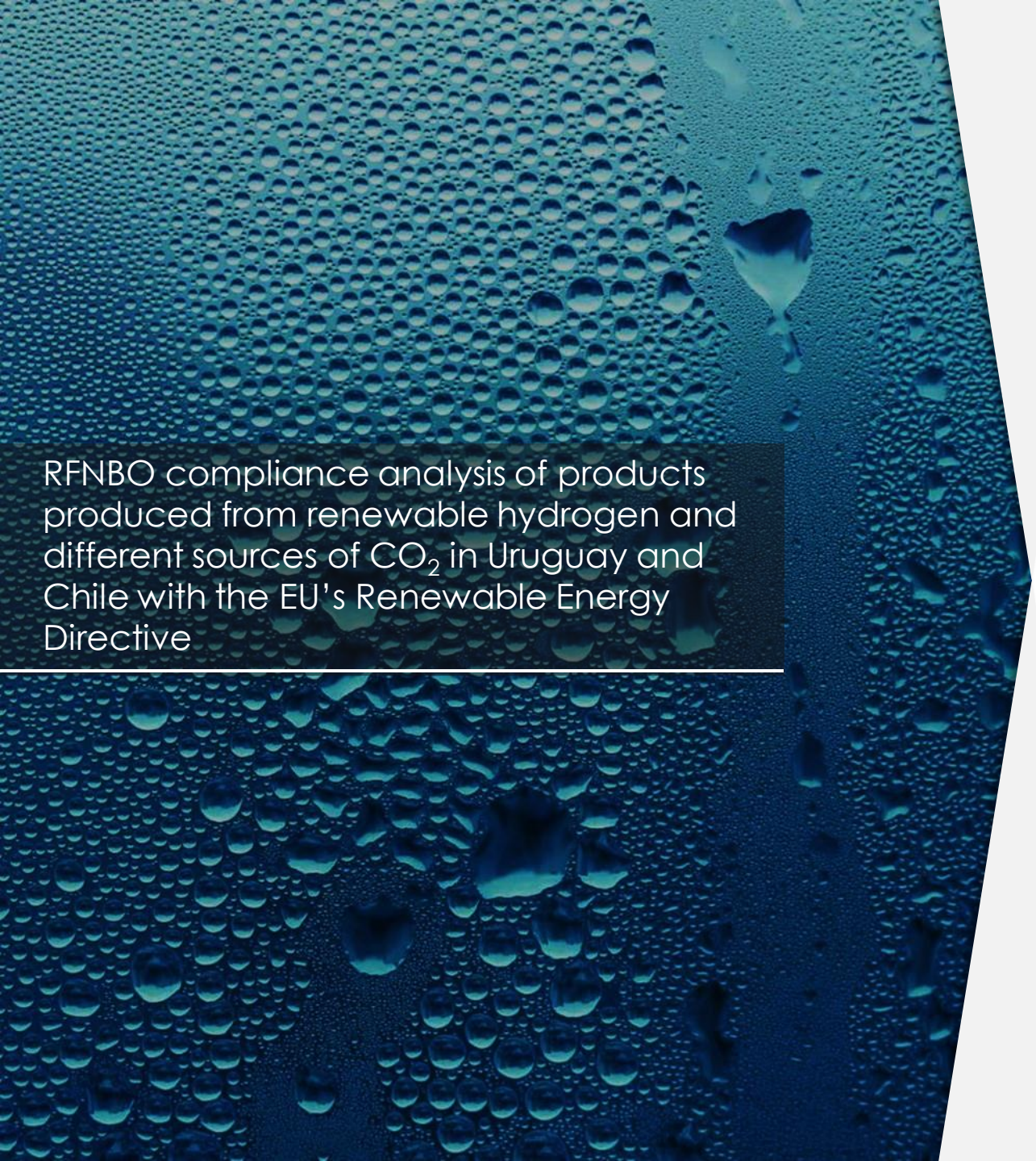
1. **Regulate and promote systems for wastewater treatment and reuse**[1]. This Bill is in the first constitutional procedure.

2. Modifies norms to **allow the development of water infrastructure and desalination projects**, in order to use the water obtained for subsistence and irrigation purposes[2]. This Bill is in the presidential approval process since December of 2023.

Sources: [1]Law Draft – Wastewater; [2]Law Draft - Desalination

Regulation	Implicance for water use
Article 19.24 of the Constitution Ministry General Secretariat of the Presidency	It **establishes ownership of water use rights**. The article states that "private rights over water, recognized or constituted in accordance with the law, shall grant their holders ownership over them". Additionally, says that the State of Chile may grant administrative concessions or special contracts over any existing deposits in maritime waters under national jurisdiction.
DFL 1,122, 1981 Ministry of Justice	***"Water Code".*** Enshrines access to water as an essential and inalienable human right and establishing its character as a **national asset for public use.** It also defines water use rights (DAA), their requirements, limitations and regulating aspects such as the duration of the rights to use it.
Decree No. 14, 2013 Ministry of Environment	***"Regulation for the determination of the minimum ecological flow rate".*** Establishes the criteria for determining the minimum ecological flow rate, in accordance with the provisions of Article 129 bis 1 of the Water Code.
Law No. 19,300, 1994 Ministry General Secretariat of the Presidency	***"General Bases of the Environment and the Regulation of the Environmental Assessment System".*** Articles 5-11 of this law establishes projects or activities likely to cause environmental impact, such as submarine outfalls, in any of their phases, must be submitted to the Environmental Impact Assessment System. See also Decree No. 40 Article 3.o.
Decree No. 40, 2013 Ministry of Environment	***"Approves Regulations for the Environmental Impact Assessment System".*** It establishes the provisions governing the Environmental Impact Assessment System and Community Participation in the Environmental Impact Assessment process, in accordance with the precepts of Law No. 19,300, on General Bases of the Environment.
Law No. 20,249, 2008 Ministry of Planning	***Indigenous communities' Coastal Marine Space.*** Native Peoples' Marine Coastal Space is a delimited marine space whose administration is given to indigenous communities or associations of them, whose members have exercised customary use of this space.
Decree No. 340, 1960 Ministry of Treasury	***"Maritime Concessions Law".*** Defines concessions as those "granted on national assets of public use whose control, supervision and oversight corresponds to the Ministry of National Defence, whatever the use for which the concession is intended and wherever the assets are located".
Decree No. 90, 2001 Ministry General Secretariat of the Presidency	***Emissions regulation for liquid waste.*** It establishes the maximum concentration of pollutants allowed for liquid waste discharged by emitting sources into marine and continental surface water bodies in Chile. Among the various pollutants, it defines the concentration of chlorides, an element of the brine.
Law No. 21,075, 2018 Ministry of Public Works	***Collection, reuse and disposal of greywater.*** It regulates the collection, reuse and disposal of greywater, which is the domestic wastewater from bathtubs, showers, sinks, toilets, sinks, sinks and others, sinks and others. It excludes sewage.

Note: Chile has released a green hydrogen Action Plan 2023-2030 which presents 18 lines of action. Among them is the regulatory enabling framework, which encompasses the action of promoting specific and enabling regulations for seawater desalination.



CONTENT WP2

General recommendations for **compliance with Additional Sustainability Requirements by H2Global**

- H2Global, as well as other support mechanisms, aim to promote the scale up of the sustainable produced hydrogen while reducing the price gap versus business-as-usual alternatives. It also aims to accelerate the adoption for sustainably produced hydrogen and contribute to the environment and climate. As result, high sustainability standards are established for H2Global.
- This trend does not only apply to H2Global, it shows the market trends. Most industrial sectors are facing national or sectorial decarbonization goals and seeking to transitioning towards more sustainable alternatives and will rely on imports to meet their demand.
- Countries like Uruguay and Chile have **an opportunity to become exporters of competitive and sustainable hydrogen.** Therefore, it is advisable to begin considering **internationally validated environmental and social criteria** and size this opportunity.
- It is important for national standards to transition towards the adoption of internationally recognized standards. However, the development of regulations and laws requires consensus and often takes long time.
- This document aims to assess the alignment of national regulations with H2Global ASR. While not exhaustive, it serves as a starting point.

General recommendations

- As a first step to facilitate demonstrating compliance with ASR, the **elaboration of guidelines that compare the alignment and gaps between existing national regulations and the requirements outlined by H2Global ASR** in detail is recommended. This might be developed by interested groups such as associations (I.e. H2 associations) or by the public sector.
- Project developers are encouraged to **stay updated with local regulations** and upcoming updates to ensure compliance.
- Despite Chile and Uruguay having high social and labour standards, ensuring compliance with all ASR may require extra efforts, compromising **activities beyond the national mandatory requirements**, such as development of training programs and initiatives to support gender equality.

Recommendations regarding H2Global

- Project developers are recommended to keep track of upcoming updates of the H2Global Mechanism and market consultation instances, as the new window might present some updates. For example, the first H2Gobal funding window, the BMWK held an international consultation session of market players, where feedback instances where opened.
- It shall be taken into account that H2Global has previously requested the support of specialized entities with deep technical knowledge to help in the review of the bids received and assess compliance with the tender requirements.
- Coherence between ESIA and technical documents of the project should be checked for the tender document's preparation.
- Seek alignment between national regulations with ASR, as well as with international standards, to ensure comprehensive compliance.

General recommendations for **compliance with Additional Sustainability Requirements by H2Global**

Regarding Water Use

- Prioritizing human water consumption should be a key consideration when assessing the project's water supply, regardless of its regulatory status.
- Careful consideration shall be given not only to community relations but also to the perception of the local population regarding the project's development, particularly when assessing the water supply.
- When assessing the water supply and its baseline, future scenarios (both pessimistic and optimistic) regarding water stress shall be duly considered.
- Adherence to international standards regarding the emission of waste produced from desalination, aimed at protecting the marine ecosystem, shall be considered.

Regarding Social Engagement

- Collaboration with local entities, including universities and technical institutions is encouraged, as it could enable local development, enhancing local gains, and promoting sustainable job creation in the region.
- Early engagement with the local community and sectorial public services might facilitate the identification of local needs and facilitate the proposal of pertinent measures to create local value and competence gains, following ASR.

Regarding Land assessment

- Compatibility of the projects area shall be verified against national territorial plans and classification of use from early development stages.
- National reserve zones and natural parks, as well as areas of international conservation interest, such as UNESCO and RAMSAR, shall be excluded for the project development.

For Impact Assessment Processes

- It is recommended to explicitly state how your project complies with each ASR for each category.
- Labour conditions shall be specified for the ESIA elaboration for the H2Global mechanism. Even if they are governed by national law, it is recommended to explicitly state how compliance will be ensured.
- Consideration of local criteria and ASR from the beginning of the elaboration of the EIA is crucial to avoid duplicating efforts.
- Relate qualitative mitigation measures with quantitative key indicators using a detailed methodology (e.g., low/medium/high risks or priority). This helps categorize the relevance of an impact and understand where to focus the attention.
- For the elaboration of the ESIA all phases of the project shall be considered, including construction, operational phases, and decommissioning.
- Prioritize engagement with local companies for the elaboration of the ESIA due to their knowledge and understanding of local contexts.

Recommendations for **project developers within Uruguay's specific country context**

For Impact Assessment Processes

- For Environmental and Social studies, credible and reliable sources must also be references. Therefore, tool provided by National Entities, such as Water Resource Viewer by DINAGUA, the National Environmental Observatory by DINACEA and public available data from INUMET should be used, as well as sources recommended by H2Global or RSB such as the UN HDI and the World Resources Institute. Contracting external companies whose area of expertise are Environmental Impact Assessment may be helpful for carrying out the project development successfully, since procedures may be long and require precise details.
- Project developers should be constantly informed about modifications of national legislation and H2Global's ASR, since these may present changes within different funding windows. The Additional Sustainability Requirements analyzed in this study are based on last H2Global's funding window launched in year 2022. This was used as reference since Additional Sustainability Requirements for the upcoming funding window in year 2024, between the Government of the Federal Republic of Germany and the Government of the Netherlands should be based on those.

Regarding Water Use

- Due to the large availability of water bodies such as aquifers and rivers in Uruguay, project developers might be able to use surface and groundwater sources for their renewable hydrogen projects (considering all water uses: electrolyzer consumption, cooling water for equipment, for workers consume, among others).
- Thus, identifying and understanding the correct applicable legislation is essential. Decree 368/018 for the use of surface water and Decree 86/004 for the use of groundwater shall be considered.
- In case the water supply source for the project is a transboundary water body, specific applicable regulations and should be considered. That is the case of the Guarani Aquifer which is across four countries and is regulated by Decree 214/000 which establishes the management of water from the Guarani Aquifer. This may require more prolonged processes because of the geographic characteristics of the transboundary aquifers
- Regarding water use rights, permits are temporary and have a limited extension. Therefore, it is important to be aware of the extension of the water use permit issued.
- The project site may currently not present water stress levels, nevertheless projections for future years and in different scenarios must always be considered. As it was exhibited above, water stress levels in Uruguayan Southwest Regions are more likely to increase. Selecting project sites with guaranteed available water in the long-term water may facilitate water supply.

Regarding Social Engagement

- Social and stakeholder engagement processes are relevant to enhance communication with local communities. Developing Social Communication Plans can ensure clear communication with local actors, foster understanding, and build support, minimizing misunderstandings in advanced project stages, such as construction and operational phases,
- Both H2Global and RSB schemes are strongly engaged with social development of local communities and local value creation. Therefore, proposing measures such as knowledge training or health programs that enhance the country's development should be promoted. For proposing adequate measures, it is relevant to understand local communities' needs, which may be limited access to education or health services. This will be key for ensuring competence gains of local actors.

Recommendations for **public entities to support stakeholders seeking to develop projects in Uruguay**

- The Ministry of Housing and Territorial Planning of Uruguay (MVOTMA) published in 2017 the National Water Plan. This provides information regarding hydrographic regions in Uruguay, institutional framework, impacts of water use, and further information regarding hydric resources. This is an extensive and helpful data source, nevertheless it is recommendable to keep track on data since it may present considerable changes through the years.

- Adhering to as many ILO Conventions as possible can facilitate project developers ensuring compliance with H2Global's standards, since project operators must ensure that labour standards comply with the core labour standards of the ILO. From the twelve ILO standards that should be considered according to H2Global, Uruguay has ratified ten of them. Therefore, ratifying to the two others left: *ILO C183 – Maternity protection*, and *ILO C187 – Promotional Framework for Occupational Safety and Health*, may facilitate project developers to comply with this requirement.

- Guidelines provided by the Ministry of Environment to develop an Environmental Impact Assessment are helpful for companies seeking to develop projects in Uruguay. As in the recent years several foreign project developers have been showing interest in developing renewable hydrogen and derivatives projects in Uruguay for its water and biogenic CO_2 resources, guidelines may also be provided in English. This is also helpful for project developers seeking to apply for fundings, since documents may be requested in English.

- As in the recent years international fundings for renewable hydrogen projects have been announced, providing guidelines that coordinate both national legislation with international requirements, such as H2Global's ASR, RSB's Principles & Criteria, and IFC Performance Standards would help project developers on understanding how to ensure compliance with both national and international criteria. These may be developed by Hydrogen Associations, for example, whose members may provide a comprehensive understanding on the matter.

- If remarkable interest in a region or site is identified for developing renewable hydrogen and derivatives projects, coordination between the involved entities may facilitate key logistic aspects for less difficult development of projects, such as common use infrastructure and port logistics. This may reduce both environmental impacts as well as social aspects by contributing to communication with local actors.

Recommendations for **project developers within Chile's specific country context**

For Impact Assessment Processes

- Carefully considering the project site is crucial, as it can significantly impact various aspects related to local communities and water use.
- Examining successful cases in the country and adopting a local/regional perspective depending on the project's location is recommended.
- It is recommended to adhere to national regulations, as the standards are generally aligned with the international standards recommended by H2 Global.
- Engaging with local experts for these processes is advisable.

Regarding Social Engagement

- Early engagement and transparency with the local community is crucial. It is recommended to have strict monitoring measures and foster transparency regarding pollution, noise and waste. The implementation of mitigation measures and compensation programs can minimize the risk.
- Communication plans are vital to avoid community opposition, specially during project construction.
- It is recommended to follow RSB social guidelines, with measures such as the promotion of gender salary equity, the employment of women and the creation of local jobs.

Regarding Water Use

- Is key to consider the community concerns regarding the use of water, specifically desalinated water in the northern region and surface water in the south.

Desalination

If the considered supply source is seawater, the following challenges shall be considered:

- There are some regulatory gaps for desalination process and lack of clarity in the governance, that though actions of the green hydrogen action plan 2023 – 2030 will be addressed. The progress should be monitored.
- Desalination requires the obtention of maritime concessions. The process for obtaining the concessions usually requires a significant amount of time.
- It shall be taken into consideration that the Chilean law prioritizes the preservation of coastal use associated with Indigenous communities' Coastal Marine Space.
- It is important to consider the local/regional context. For the development of a desalination plant, access to the coastal border is required. The coastal border in the northern regions have specific territorial development plans and some are being updates. On the other hand, the attractive zones with compatible with industrial development near the most demanded areas are usually scarce, which might present a challenge.
- When considering the disposal of the residues of desalination, it is recommended to look at international standards.
- Foster the protection of maritime ecosystem, be proactive and communicate measures, especially in communities with maritime productive activities.
- It is recommended to learn form previous successful experiences and to seek support from local entities and unions with extensive experience in the matter such as the Association of Desalination Plants (ACADES).
- Infrastructure such as pipelines might be required for the transport of desalinated water. It is recommended to foster the development of common user infrastructure to reduce environmental impact, reduce the risk of social rejection and lower costs.

Waste water

- Similar challenges were found when considering the supply from wastewater, as there is a lack of clarity in terms of regulation and governance regarding the feasibility of using it. It is very case by case and each project has to interpret the regulation, generating uncertainty.

Recommendations for **public entities to support stakeholders seeking to develop projects in Chile**

- Because of Chile's extensive coastline, most projects are expected to use seawater for renewable hydrogen production. Increasing clarity, organizing governance, and reducing regulatory gaps is crucial for the development of renewable hydrogen and derivatives projects. As the development of legislation may require long times, providing guidelines regarding water management and use in the country would clarify project developer' possible concerns.
- There are still some regulatory gaps regarding water use legislation. To explicit laws regarding water use and the respective responsible is crucial to decrease uncertainties of project developers. Also, expediting the process of regulation that promotes wastewater reuse is needed. Adhere to international standards regarding waste emissions from desalination to protect the marine ecosystem is also recommendable to align with international standards.
- Chile has ratified several of the ILO conventions. Within the twelve ILO Standards that H2Global recommends to consider, Chile has already ratified ten of them. Adhering to the two others, *ILO C155 – Occupational safety and health*, and *ILO C183 – Maternity protection*, may facilitate project developers to comply with H2Global's ASR regarding compliance with ILO Standards to ensure that labour standards comply with the core labour standards of the ILO.
- The SEA provides several Environmental Assessment Guidelines, whether for desalination plant project description, green hydrogen project description, among others. This is helpful for project developers seeking to develop renewable hydrogen and derivatives projects in the country, specially to orient foreign stakeholders that may not be familiarized with Chile's regulatory framework. Therefore, it would be useful to provide guidelines in English, also considering that application for international fundings may be in that language.
- The Northern and Southern Regions of the country, especially the Antofagasta and the Magallanes Regions, have been of interest for project developers because of their favorable conditions for renewable hydrogen production. Coordination and enabling commonly used infrastructure between the involved parties and responsible entities is crucial for facilitating projects' logistic aspects, such as ENAP's *Hydrogen Enabling Infrastructure Plan Magallanes*, aimed to facilitate the enabling infrastructure for the development of renewable hydrogen and derivatives projects for both national and international companies.
- Alignment and coordination of both national and international standards is useful for project developers who are seeking whether on applying for international fundings or who are seeking to export to other Regions such as Europe. As the targets may differ within the Regions, alignment between national and international standards such as H2Global's ASR and RSB's Principles & Criteria, would facilitate ensuring compliance with both national and international environmental and social criteria. These may be supported by national entities, such as Hydrogen Associations, to help project developers on understanding and coordinating those aspects.

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ANNEXES

Annex 1 – Biomass sustainability requirements

The Renewable Energy Directive sets binding requirements for sustainability and GHG emissions savings criteria relevant to evaluate the biogenic CO2 potential for RFNBO production

Sources	Details
Renewable Energy Directive, Article 29, paragraph 1	Energy from biofuels, bioliquids and biomass fuels shall be taken into account for the purposes referred to in points (a), (b) and (c) of this subparagraph only if they fulfil the sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10: (a) contributing towards the Union target set in Article 3(1) and the renewable energy shares of Member States; (b) measuring compliance with renewable energy obligations, including the obligation laid down in Article 25; (c) eligibility for financial support for the consumption of biofuels, bioliquids and biomass fuels. However, biofuels, bioliquids and biomass fuels produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues, are required to fulfil only the greenhouse gas emissions saving criteria laid down in paragraph 10 in order to be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph. This subparagraph shall also apply to waste and residues that are first processed into a product before being further processed into biofuels, bioliquids and biomass fuels. Electricity, heating and cooling produced from municipal solid waste shall not be subject to the greenhouse gas emissions saving criteria laid down in paragraph 10. Biomass fuels shall fulfil the sustainability and greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 if used in installations producing electricity, heating and cooling or fuels with a total rated thermal input equal to or exceeding 20 MW in the case of solid biomass fuels, and with a total rated thermal input equal to or exceeding 2 MW in the case of gaseous biomass fuels. Member States may apply the sustainability and greenhouse gas emissions saving criteria to installations with lower total rated thermal input. The sustainability and the greenhouse gas emissions saving criteria laid down in paragraphs 2 to 7 and 10 shall apply irrespective of the geographical origin of the biomass.

Annex 1 – Biomass sustainability requirements

The Renewable Energy Directive sets binding requirements for sustainability and GHG emissions savings criteria relevant to evaluate the biogenic CO2 potential for RFNBO production

Sources	Details
Renewable Energy Directive, Article 29, paragraph 2	Biofuels, bioliquids and biomass fuels produced from waste and residues derived not from forestry but from agricultural land shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 only where operators or national authorities have monitoring or management plans in place in order to address the impacts on soil quality and soil carbon. Information about how those impacts are monitored and managed shall be reported pursuant to Article 30(3).
Renewable Energy Directive, Article 29, paragraph 3	Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land with a high biodiversity value, namely land that had one of the following statuses in or after January 2008, whether or not the land continues to have that status: (a) primary forest and other wooded land, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; (b) highly biodiverse forest and other wooded land which is species-rich and not degraded, or has been identified as being highly biodiverse by the relevant competent authority, unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes; (c) areas designated: (i) by law or by the relevant competent authority for nature protection purposes; or (ii) for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature, subject to their recognition in accordance with the first subparagraph of Article 30(4), unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes; (d) highly biodiverse grassland spanning more than one hectare that is: (i) natural, namely grassland that would remain grassland in the absence of human intervention and that maintains the natural species composition and ecological characteristics and processes; or (ii) non-natural, namely grassland that would cease to be grassland in the absence of human intervention and that is species-rich and not degraded and has been identified as being highly biodiverse by the relevant competent authority, unless evidence is provided that the harvesting of the raw material is necessary to preserve its status as highly biodiverse grassland.

Annex 1 – Biomass sustainability requirements

The Renewable Energy Directive sets binding requirements for sustainability and GHG emissions savings criteria relevant to evaluate the biogenic CO2 potential for RFNBO production

Sources	Details
Renewable Energy Directive, Article 29, paragraph 4	Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land with high-carbon stock, namely land that had one of the following statuses in January 2008 and no longer has that status: (a) wetlands, namely land that is covered with or saturated by water permanently or for a significant part of the year; (b) continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 %, or trees able to reach those thresholds in situ; (c) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 %, or trees able to reach those thresholds in situ, unless evidence is provided that the carbon stock of the area before and after conversion is such that, when the methodology laid down in Part C of Annex V is applied, the conditions laid down in paragraph 10 of this Article would be fulfilled. This paragraph shall not apply if, at the time the raw material was obtained, the land had the same status as it had in January 2008.
Renewable Energy Directive, Article 29, paragraph 5	Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land that was peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil.

Annex 1 – Biomass sustainability requirements

The Renewable Energy Directive sets binding requirements for sustainability and GHG emissions savings criteria relevant to evaluate the biogenic CO2 potential for RFNBO production

Sources	Details
Renewable Energy Directive, Article 29, paragraph 6	Biofuels, bioliquids and biomass fuels produced from forest biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall meet the following criteria to minimise the risk of using forest biomass derived from unsustainable production: (a) the country in which forest biomass was harvested has national or sub-national laws applicable in the area of harvest as well as monitoring and enforcement systems in place ensuring: (i) the legality of harvesting operations; (ii) forest regeneration of harvested areas; (iii) (iii) that areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands and peatlands, are protected; (iv) that harvesting is carried out considering maintenance of soil quality and biodiversity with the aim of minimising negative impacts; and (v) that harvesting maintains or improves the long-term production capacity of the forest; (b) when evidence referred to in point (a) of this paragraph is not available, the biofuels, bioliquids and biomass fuels produced from forest biomass shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 if management systems are in place at forest sourcing area level ensuring: (i) the legality of harvesting operations; (ii) forest regeneration of harvested areas; (iii) that areas designated by international or national law or by the relevant competent authority for nature protection purposes, including in wetlands and peatlands, are protected unless evidence is provided that the harvesting of that raw material does not interfere with those nature protection purposes; (iv) that harvesting is carried out considering the maintenance of soil quality and biodiversity with the aim of minimising negative impacts; and (v) that harvesting maintains or improves the long-term production capacity of the forest.

Annex 1 – Biomass sustainability requirements

The Renewable Energy Directive sets binding requirements for sustainability and GHG emissions savings criteria relevant to evaluate the biogenic CO2 potential for RFNBO production

Sources	Details
Renewable Energy Directive, Article 29, paragraph 7	Biofuels, bioliquids and biomass fuels produced from forest biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall meet the following land-use, land-use change and forestry (LULUCF) criteria: (a) the country or regional economic integration organisation of origin of the forest biomass: (i) is a Party to the Paris Agreement; (ii) has submitted a nationally determined contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC), covering emissions and removals from agriculture, forestry and land use which ensures that changes in carbon stock associated with biomass harvest are accounted towards the country's commitment to reduce or limit greenhouse gas emissions as specified in the NDC; or (iii) has national or sub-national laws in place, in accordance with Article 5 of the Paris Agreement, applicable in the area of harvest, to conserve and enhance carbon stocks and sinks, and providing evidence that reported LULUCF-sector emissions do not exceed removals; (b) where evidence referred to in point (a) of this paragraph is not available, the biofuels, bioliquids and biomass fuels produced from forest biomass shall be taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 if management systems are in place at forest sourcing area level to ensure that carbon stocks and sinks levels in the forest are maintained, or strengthened over the long term.
Renewable Energy Directive, Article 29, paragraph 8	By 31 January 2021, the Commission shall adopt implementing acts establishing the operational guidance on the evidence for demonstrating compliance with the criteria laid down in paragraphs 6 and 7 of this Article. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 34(3).
Renewable Energy Directive, Article 29, paragraph 9	By 31 December 2026, the Commission shall assess whether the criteria laid down in paragraphs 6 and 7 effectively minimise the risk of using forest biomass derived from unsustainable production and address LULUCF criteria, on the basis of the available data. The Commission shall, if appropriate, submit a legislative proposal to amend the criteria laid down in paragraphs 6 and 7 for the period after 2030.

Annex 1 – Biomass sustainability requirements

The Renewable Energy Directive sets binding requirements for sustainability and GHG emissions savings criteria relevant to evaluate the biogenic CO2 potential for RFNBO production

Sources	Details
Renewable Energy Directive, Article 29, paragraph 10	The greenhouse gas emission savings from the use of biofuels, bioliquids and biomass fuels taken into account for the purposes referred to in paragraph 1 shall be: (a) at least 50 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations in operation on or before 5 October 2015; (b) at least 60 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations starting operation from 6 October 2015 until 31 December 2020; (c) at least 65 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations starting operation from 1 January 2021; (d) at least 70 % for electricity, heating and cooling production from biomass fuels used in installations starting operation from 1 January 2021 until 31 December 2025, and 80 % for installations starting operation from 1 January 2026. An installation shall be considered to be in operation once the physical production of biofuels, biogas consumed in the transport sector and bioliquids, and the physical production of heating and cooling and electricity from biomass fuels has started. The greenhouse gas emission savings from the use of biofuels, biogas consumed in the transport sector, bioliquids and biomass fuels used in installations producing heating, cooling and electricity shall be calculated in accordance with Article 31(1).

Annex 2 – Case Study Assumptions

Assumptions for carbon footprint calculation

Factor	Value	Unit	Source
Emissions from processing	0.02	gCO_2eq/MJ	Hinicio Internal Database
Emissions from end-use (combustion)	68.9	gCO_2eq/MJ	Annex B – Commission Delegated Regulation (EU) 2023/1185
Emissions from the supply of inputs (elastic)	0.8	gCO_2eq/MJ	Hinicio Internal Database
Emissions from the supply of inputs (ex_use)	68.9	gCO_2eq/MJ	Methanol carbon content

Assumptions for maritime transportation emissions

Factor	Value	Unit	Source
Fuel consumption	87.9	87.9 kg-fuel oil/nautical mile	Heikkilä, Grönholm, Majamäki & Jalkanen, 2024
Emissions factor	3.11	3.11 $kgCO_2$/kg-fuel oil	Istrate, Iribarren, Dufour, Ortiz Cebolla, Arrigoni, Moretto, Dolci, 2022
Vessel capacity	35,500	t	-

Hinicio

RFNBO compliance analysis of products produced from renewable hydrogen and different sources of CO_2 in Uruguay and Chile with the EU's Renewable Energy Directive

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