



## Study for the Design of a Web Platform for Trading Green Certificates

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## Executive Summary

This report develops a study of the Chilean and international context to then provide recommendations regarding the design of a green certificate trading platform with a view to decarbonization of the Chilean energy sector.

One of the objectives set out in this study is the review of relevant background such as related platforms to capitalize on lessons learned or benchmarks, which can be followed in the development of the trading platform for Chile, in addition to defining the main bases and general requirements of the platform's design and development.

The review of twelve international green certificate trading platforms allowed to identify Carbon Trade Exchange, European Energy Exchange, BVRio Platform and Carbon Offset Platform as referents on good practices and experiences that should be considered in the design of the Chilean trading platform, both at the process and usability level.

It is important to assess the role played by the elements involved in the development of the web platform such as registry, financial intermediaries, banking institutions, green certificate buyers, project developers and a figure that serves as a settlement agent. The interactions between the components may be different according to the evolution of the market and the trading system determined for each stage.

Thanks to the contribution of interviews with relevant stakeholders at international level and considering the current situation in Chile, which has an incipient market with zero liquidity, a possible route was determined that would be convenient to follow for the implementation of the platform taking into account three-time horizons.

In the short term, the development of a trading platform is suggested considering a small-scale voluntary market. An agile trading process should be considered to promote market liquidity, as well as capacity building as a way of preparing for future markets. This will be the first step that will help in the possible revival of the exchange of green certificate ownership that currently exists in Chile, given that there is an important offer mainly of projects related to power generation.

With the implementation of the carbon tax reform, it will be necessary to adjust the platform to support auction mechanisms, if this trading channel is to be enabled, in addition to supporting the operations within the framework of a voluntary market for a first short-term stage.

In addition, in the medium term, it will be necessary to consolidate the platform considering the new market conditions and registry. In order to achieve these objectives, a line of work must be followed together with companies specialized in systems, as well as with market experts.

In the long term, it is recommended to work on trading mechanisms that ensure compatibility with other systems so that interaction with international markets is achieved. This will be

done by standardizing the guidelines of the platform to the most common international practices. In addition, if credits run out in the short term, it is possible that new certificates will be issued by the project owners, given that there is great potential.

Based on the recommendations in the short term, the main requirements were established for a platform that supports transactions considering an OTC spot type mechanism (which may present adjustments and modifications). In addition, the main stakeholders and the way each one interacts with the platform were identified. A proposal for a digital model was also developed and the main associated costs were detailed. These aspects can be modified in future stages of the project, understanding that the Chilean context may have changes in the future.

## Definitions, acronyms and abbreviations

For a better understanding of the document, the specifications of the terms used throughout the text are listed below:

Term/Acronym	Description
CAPE (Spanish)	Energy Project Savings Certificate
CAR	Climate Action Reserve
CARB	California Air Resources Board
CBEEEX	China Beijing Environmental Exchange
CCER	China Certified Emission Reductions
CDM	Clean Development Mechanism
CEC	Clean Energy Certificate
CERs	Certified Emission Reductions
CITSS	Compliance Instrument Tracking System Service
CO <sub>2</sub>	Carbon Dioxide
COP	Conference of the UNFCCC Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CTX	Carbon Trade Exchange
ECC	European Commodity Clearing
EEX	European Energy Exchange
EMS	Environmental Market Services
ERC	Energy Regulatory Commission
ETS	Emissions Trading System

EU	European Union
FAQ	Frequently Asked Questions
GEM	Global Environmental Markets
GHG	Greenhouse Gases
GWP	Global Warming Potential
ICAP	International Carbon Action Partnership
IETA	International Emissions Trading Association
IPCC	Intergovernmental Panel on Climate Change
ITMOs	Internationally Transferred Mitigation Outcomes
MA	Mitigation Action
MoE	Ministry of Energy
MoEnv	Ministry of the Environment
MRV	Measurement, Reporting and Verification
MtCO <sub>2</sub> e	Mega Ton of Carbon Dioxide Equivalent
MWh	Megawatt-Hour
NDC	Nationally Determined Contributions
NGGI	National Greenhouse Gas Inventory
NZX	New Zealand's Exchange
PMR	Partnership for Market Readiness
RAMSE (Spanish)	Energy Sector Mitigation Actions Registry
RECs	Renewable Energy Certificates
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
RFQ	Request for Quote

RGB	Red, Green, Blue
RUN (Spanish)	National Identification Number
RUT (Spanish)	Taxpayer Identification Number
SCX	Santiago Climate Exchange
SMA (Spanish)	Superintendence of the Environment
SEEE	Shanghai Emissions Trading System
TCX	Tianjin Emissions Trading System
UBC	Uniform Bank Code
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VCS	Verified Carbon Standard
VCUs	Verified Carbon Units
VERs	Voluntary Emission Reductions
WCI	Western Climate Initiative

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## 1. Introduction

During the last decades, climate change has become one of the main issues in the political, economic and social field at a global level; and sustainable development has become one of the current priorities due to the risks of inaction and the opportunities and benefits that come with taking over polluting human activities for society as a whole.

Nowadays, an important element for the evolution towards a green economy is to have instruments that allow to direct the flows of money for the financing of greenhouse gas mitigation actions in the most cost-effective way possible.

In line with the above, the bill that reforms the green tax was introduced to the National Congress in August 2018, providing flexibility to the instrument in which taxed establishments can participate in an offsetting system through the purchase of greenhouse gas emission reduction certificates contributing to direct financial flows for climate action, all in accordance with the objectives of the Paris Agreement.

Considering also the importance of sustainable development, the current energy context in Chile and the constant digitalization are rapidly transforming the national energy market.

In line with the objective set by the United Nations Framework Convention on Climate Change, various mitigation actions have been implemented, in which Chile took action by actively participating in the Kyoto Protocol (the first international agreement to reduce emissions from greenhouse gases) and then signing the Paris Agreement in 2016. In order to fulfill its international commitments, Chile promised to be carbon neutral by 2050, using its potential to generate energy with renewable sources and reforestation actions with native forest mainly.

The Paris Agreement will take over the Kyoto Protocol in 2020. Within the most relevant aspects, Articles 2 and 4 establish that countries voluntarily commit themselves to follow actions that allow compliance with the objectives of the Agreement, following the principle of common responsibilities, but differentiated to achieve social, economic and environmental justice through solidarity and cooperation between States. In addition, Article 6 proposes cooperative approaches based on markets and non-markets, within which mechanisms to implement Mitigation Actions (MA) with other jurisdictions that are aligned with sustainable development may be developed. Article 13 establishes the need for transparency of information related to the traceability of all aspects that make up the MA and its results.

In order to contribute to the monitoring of the fulfillment of the national goals, the Energy Sector Mitigation Actions Registry (RAMSE in Spanish) was developed in Chile where the measures taken by the sector in response to climate change are registered. This system was developed by the SGLMS consulting team for the Ministry of Energy of Chile during this year.

Together with the above, and following the trend of developing information technologies and their use in the generation of instruments that support the achievement of the aforementioned objectives, the general requirement to design a centralized market for green certificates that deliver an exchange mechanism and greater transparency in the accreditation of greenhouse gas (GHG) emission reductions arises, as well as other instruments that guarantee the generation of energy with renewable resources and also those related to energy efficiency.

Therefore, the purpose of this consulting service is the design of a trading platform for green certificates based on the analysis of the current Chilean context, the main characteristics

and interactions of the entities involved, and the technical requirements. In addition, a route of implementation of the platform and an assumption of future actions are included considering the evolution of the market in the medium and long term.

### **1.1. Suggestions for the Reader**

The objective of this report is the documentation of the information collected and investigated during the study carried out in relation to the design and development of a green certificate trading platform, allowing a detailed description of the requirements, conditions and technical terms necessary for the implementation stage.

The study carried out considers the review of trading platforms (national and international) that are already in operation, in addition to international experiences in this area. This allows establishing a baseline that includes good practices and lessons learned by other stakeholders, serving as guidelines for the design stage of the platform, object of this consulting service.

In order to guide the reader, this document is organized into eleven important sections: a section (1) oriented to the survey and review of relevant background; a section (2) for background analysis; a section (3) focused on the identification and analysis of best practices in the subject studied; a section (4) detailing the analysis of interviews conducted with international experts; a section (5) aimed at reviewing lessons learned; a section (6) that gives more detail about the green certificate trading process; a section (7) that provides an identification of general platform requirements; a section (8) detailing the proposal of a digital model; a section (9) that provides a summary of the costs associated with the implementation of the proposal; a section (10) that provides details on the implementation, and (11) a last section that includes a strategic analysis considering the current supply and demand of GHG emission reductions. In addition, it includes a section of conclusions and another regarding general recommendations. In the last section of annexes, the reader will find additional information available for the finished understanding of this document.

### **1.2. Scope of the Consulting Service**

This consulting service focuses on the delivery of a conceptual design proposal, both for the operation and the development of a certificate trading platform together with a digital design proposal. It should be taken into account that there are aspects that will be defined in this study but that could be modified, even in the development stage, as a result of changes in the relevant legal and institutional context, which are constantly evolving.

This consulting service also includes information from technology suppliers that will help in the possible development and/or implementation of the platform. There is also a section dedicated to the strategic analysis for the implementation of the platform, as well as a roadmap that considers its evolution depending on the conditions in the short, medium and long term.

## 2. Objectives

### 2.1. General Objective

The general objective of the consulting service is the design of a green certificate trading platform with a focus on reducing emissions, useful for both a voluntary and a regulated market linked to a potential carbon pricing instrument and that in the future would allow the interaction with international markets (for example, with the World Bank Warehouse), raising processes and requirements with different key actors that could be related to the platform (users, regulators, implementers, etc.) and defining an implementation roadmap.

### 2.2. Specific Objectives

The specific objectives that guided the study carried out are detailed below.

Table 1 Specific Objectives of the Consulting Service

Code	Specific Objective
O1	Identify and analyze at least three international experiences for the realization of a benchmark between the different existing platforms. This analysis should include the identification of good practices that can be landed in the Chilean context.
O2	Perform the survey of requirements and processes of the computer system by holding regular meetings with the technical counterpart of the project, thus collecting all the necessary information for the correct development of this project.
O3	Prepare the flowchart and a proposal for a digital model of the structure of the platform that is user-friendly for different types of users, easy to complement or modify in the future and with an attractive and functional graphic interface.
O4	Define an implementation roadmap for this platform that fits the times defined by the technical counterpart.
O5	Perform a strategic analysis regarding whether it is convenient to program an internal platform or hire a service provided by an international third party, showing advantages and disadvantages of both alternatives.

### **3. Methodology**

The work methodology considers, first, the integration of knowledge and skills from two entities: SGLMS and MEXICO<sub>2</sub>.

SGLMS Engineering and Management is distinguished by combining the use of information, engineering and business technologies for process management solutions of different scales. For its part, the Mexican Carbon Platform, MEXICO<sub>2</sub>, promotes the creation of environmental markets from the financial sector. Both teams work together with the aim of generating a comprehensive study that delivers a proposal under a broad vision of the problem.

On the other hand, a methodology based on the planning of short work cycles is considered with the objective of analyzing the problem and the requirements in an iterative and incremental manner. In this way, it is possible to generate an agile and flexible work before the requirements and needs that may arise throughout the consulting service.

#### **3.1. Information Survey Methodology and Orientation**

For information gathering, the following activities are considered:

- Coordination of meetings with internal and external stakeholders.
- Conduct interviews with relevant stakeholders.
- Review of web material.
- Documentary review.

## 4. Background Review

### 4.1. General Background

In order to determine and focus on critical aspects and background that could guide the study, a review of the current situation in Chile is carried out.

Recently there has been a growing interest in the generation of tradable green certificates due to the increased awareness and consensus that has been generated around the multiple problems that climate change is generating. Countries are increasingly aware of environmental problems, so they seek solutions with a focus on joint global action, aligned with international initiatives such as the Paris Agreement.

In accordance with the above, the Ministry of Energy has requested the SGLMS consulting service for the development of the platform for the energy sector mitigation actions registry, an instrument that supports and standardizes the process for registering such initiatives and emission reductions of greenhouse gases associated with them. In addition, it is expected that this initiative will facilitate the tracking and visualization of the results, as well as the registry of the actions on the platform, so that they can be associated with certificates in the operational stage, after their calculations have been validated and verified by the corresponding stakeholders.

In line with this, and other activities, the preliminary Climate Change Framework draft bill presented by the Ministry of the Environment (MoEnv) stipulates in its Article 13 the creation of a system in which the Ministry of Environment would establish GHG emissions limits to individual or groups of emitting sources; In its Article 14 stipulates that the surplus in the fulfilment of the emission limits will be certified as an emission reduction by the Ministry of the Environment and they would in turn be able to sell this surplus. Also allows those regulated entities to implement mitigation projects and use the certified reductions to either achieve the standard or transfer those reductions to third parties. emission standards.

Chile had an important participation in the Clean Development Mechanism (CDM) of the Kyoto Protocol, so its participation in the international exchange of green certificates with the capabilities already installed is possible. In addition, considering the existence of the green tax covering about 33 million tons of carbon dioxide, the possible addition of flexibility mechanisms such as the acquisition of emission reductions (also known as offsets), and the possible development of a carbon market at the national level, it would be feasible to use certificates issued by CDM, Verified Carbon Standard (VCS) and Gold Standard (GS) projects. In addition, there is the possibility of including certifications linked to the Energy Sector Mitigation Actions Registry (RAMSE in Spanish), Energy Project Savings Certification (CAPE in Spanish) and Huella Chile.

In order to achieve the task mentioned in the previous paragraph, it is essential to create a trading platform, not only for emission reductions but also for the set of instruments that can qualify as green certificates in such a way that transparency in the management of certificates is ensured and the ability to mitigate the effects of climate change is enhanced.

This document refers to green certificates as the instruments that represent certificates issued by projects related to the generation of electricity with renewable energy sources, energy efficiency and GHG emission reductions. These projects are usually verified by an entity that certifies the validity of their activities. For the purposes of this document, the green certified terms, environmental commodities and instruments and securities can be used interchangeably, given the different denominations at international level.



Currently, the World Bank has made progress in its Warehouse initiative (a platform that allows to communicate and trade its Internationally Transferable Mitigation Results (ITMOs) between countries). Given this context, several factors are studied in this document that will contribute to linking with global trading platforms.

It should be noted that this would be the first platform of this type in Chile, given that, in the market of existing certificates in the national territory, brokers are used as intermediaries to carry out the transactions (such as, for example, SCX, Santiago Climate Exchange).

#### **4.2. Ministry of Energy (Chile)**

The Ministry of Energy (MoE) is the institution responsible for developing and coordinating in a transparent and participatory manner, the different plans, policies and standards for the development of the country's energy sector.

Currently, and with the objective of fulfilling the country's commitment under the Paris Agreement, the MoE seeks the implementation of the Energy Sector Mitigation Plan through instruments developed such as the National Energy Policy 2050, the GHG Mitigation Plan in the Energy Sector and the Energy Route 2018-2022. This will be done through the execution of actions associated with the Energy Route, such as the design and development of a Measurement, Reporting and Verification System of actions (currently RAMSE, recently completed project and under the maintenance and support stage) and implementation of a green certificate trading platform.

#### **4.3. Platform for the Registry of Mitigation Actions in the Energy Sector**

The Government of Chile, through the MoE, being part of the Partnership for Market Readiness initiative (PMR, Partnership for Market Readiness), and in order to expand and strengthen the action against climate change, developed the RAMSE platform, an instrument that supports the implementation of GHG emission mitigation policies and the accounting for gross emissions associated with them.

The main objective of this platform is the energy sector mitigation actions registry and its emission reduction results, supporting the understanding of their contribution to Chile's compliance with the NDC under the Paris Agreement. This fact led to the evolution of the MRV system for the energy sector mitigation actions that was under development financed by the PMR-Chile project (of the World Bank), so that additional attributions to the original conceptual design were delivered to move towards a registry platform of the energy sector mitigation actions.

Derived from the above, a strategic analysis is also carried out to determine how convenient it is to build an internal platform, or perhaps rely on national or international external services that could result in a different platform proposal.

Annex 1 contains detailed information on the general process of the RAMSE system operation, which describes its main functions, as well as the users and roles of platform participants.

In addition, a study of the graphic profile of the MoE website has been carried out in order to standardize the visual aspect of a possible platform that could be linked in some way. Annex 2 contains the corresponding description.

#### **4.4. Green Certificate Markets**

As mentioned above, it has been determined that for the purpose of this work and to ensure alignment with the objectives of mitigating climate change effects in Chile, green certificates denote instruments that refer to three main environmental commodities: Renewable Energy Certificates (also known as RECs), energy efficiency certificates (recognized as White Certificates) and GHG emission reductions (also called offsets). Given the emergence of an international market, they may also refer to ITMOs (International Transferred Mitigation Outcomes).

Green certificates respond to environmental policies determined by different jurisdictions with the objectives of penalizing polluting entities and also promoting clean energy generation and energy efficiency projects. These instruments are validated by international standards and can be sold, exchanged or traded according to established legislation.

The standards to which these certificates are subject consider rigorous methodologies that vary depending on the type of project in question, as well as the entities that formulate the certification procedures.

In green certificate markets, specifically in carbon markets, a document trading system associated with emission reductions achieved through mitigation actions is designed, rewarding entities that reduce GHG pollution. This market represents the place whereby governments, companies or institutions can buy and sell GHG reductions that are duly backed by a standard or regulation. Due to the global and non-regional consequences of GHG accumulation, it is possible to consider that these transactions can be carried out by different jurisdictions among themselves, bilaterally, multilaterally or in a domestic market. This dynamic of operation is applicable to renewable energy and energy efficiency projects with their respective modifications.

An overview of voluntary carbon and energy generation markets with clean sources, respectively, is presented below.

##### **4.4.1. Voluntary Carbon Market**

The Kyoto Protocol of the UNFCCC is an international agreement whose main objective was to limit and reduce GHG emissions through binding mitigation objectives. This laid the foundations for the so-called Kyoto mechanisms, which refer to market instruments to fight against climate change. These mechanisms were: international emissions trading, joint implementation and the Clean Development Mechanism (CDM).

The CDM positioned itself as the first global investment and environmental credit scheme of its kind and brought with it the advent of Certified Emission Reductions (CERs) or offsets as a standardized emission offset instrument. In addition, it was consolidated as a verification and accreditation body for potential CERs generating projects and laid the foundations for the development of voluntary carbon markets and the different mechanisms for generating certified emission reductions that are used in mandatory carbon markets.

Voluntary carbon markets emerged as an alternative to regulated compliance markets under the Kyoto Protocol. These are trading systems that allow companies, governments, civil associations, individuals and any person to voluntarily acquire GHG emission reductions from voluntary carbon projects verified by international standards, which by their activity neutralize or avoid CO<sub>2</sub> or other greenhouse gas emissions with the respective equivalences.

Buyers of emission reductions can respond to motivations such as Corporate and Social Responsibility, market reputation and corporate image of companies, market trends by environmentally friendly products and services. It also highlights the interest in complying with obligations to regulated carbon pricing policies that allow the use of emission reductions or the trading of these credits in their flexibility mechanisms.

Currently, voluntary carbon markets develop on a small scale and face challenges such as low demand for emission reductions and a consequent oversupply of instruments. Therefore, since the costs for the certification and permanence of the projects are high, there are few motivations that encourage the emergence of new projects. By 2017, the amount of emission reductions generated worldwide was 62.7 MtCO<sub>2</sub>e, while the number of withdrawn reductions was reduced to 42,862.7 MtCO<sub>2</sub>. Since 2013 this market has experienced a contraction and in 2016, the total volume of reductions generated was 63.4 MtCO<sub>2</sub>e equivalent to \$191.3 million dollars. However, that same year only \$76 million circulated in the primary market while the equivalent of \$107 million was traded in the secondary market. These figures give an overview of the small size of these markets.

#### **4.4.2. Emission Reductions**

Emission reductions, offset credits, offsets or carbon credits are market instruments that represent the reduction, removal or avoidance of the emission of a ton of CO<sub>2</sub> equivalent that have been achieved through emission reduction projects. In order to comply with parameters that guarantee their environmental integrity, projects and reductions must meet certain characteristics: be real and additional, transparent, measurable, permanent, verified, synchronous, enforceable, registered, traceable, removable and must take into account the possible GHG leakage and avoid double counting.

This instrument stands out for being cost-effective to offset emissions when initiatives to reduce emissions indoors have been exhausted or their implementation is economically unfeasible.

#### **4.4.3. Standards for the Development of Mitigation Action Projects**

In order to guarantee the environmental integrity of the emission reduction projects, they should be endorsed by an entity and verified by independent third parties. In response to this need, voluntary international standards have emerged that establish their own guidelines to ensure the quality of emission reductions. These standards validate the viability and risks of the project, as well as the proposed way to calculate and reduce or avoid emissions. Once the project implementation and tracking stage is reached, third parties carry out verifications that evaluate the mitigation results.

In the event that the results are favorable, the standards validate the amount of emission reductions through their respective registries. These reductions have a unique serial number that can be tracked before the buyer of such reduction decides to withdraw it.

Some of the existing voluntary standards are:

- Verified Carbon Standard (VCS)
- The Gold Standard (GS)
- Live Plan
- Climate Action Reserve (CAR)

Voluntary standards respond to the specialized demand for emission reductions in areas or sectors not covered by the CDM. Generally, their costs are cheaper than those of the CDM and project registry is carried out faster. Table 2 contains the most relevant information on some voluntary standards.

Table 2 Developers of Emission Reduction Project Standards

Name	Developer	Sectors	Source
Verified Carbon Standard	Verra	<ul style="list-style-type: none"> <li>• Mining-Energy</li> <li>• Industrial</li> <li>• Transportation</li> <li>• Waste</li> <li>• Agricultural</li> <li>• Forest</li> <li>• Mangrove Swamps</li> <li>• Grasses</li> </ul>	<a href="https://verra.org/project/verra-program/">https://verra.org/project/verra-program/</a>
Live Plan	Live Plan Foundation	<ul style="list-style-type: none"> <li>• Forest</li> </ul>	<a href="http://www.planvivo.org/">http://www.planvivo.org/</a>
The Gold Standard	World Wildlife Fund (WWF) and other Non-Governmental Organizations (NGOs)	<ul style="list-style-type: none"> <li>• Renewable energies</li> <li>• Energy efficiency</li> <li>• Ecological stoves</li> <li>• Forest</li> </ul>	<a href="https://www.goldstandard.org/">https://www.goldstandard.org/</a>
Climate Action Reserve	State of California	<ul style="list-style-type: none"> <li>• Forest</li> <li>• Waste</li> <li>• Mining-Energy</li> <li>• Grasses</li> <li>• Energy efficiency</li> <li>• Industry</li> <li>• Urban woodland</li> </ul>	<a href="http://www.climateactionreserve.org/">http://www.climateactionreserve.org/</a>

#### 4.4.4. International Transfer of Mitigation Results

Regarding the initiatives for the development of transfers between different jurisdictions, the proposals made at the 24<sup>th</sup> Conference of the Parties (COP 24) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Katowice should be noted. At that Conference, the Parties adopted the so-called "Rule Book" in which a series of guidelines are established for the implementation of the Paris Agreement. However, there was a lack of consensus regarding the rules for market mechanisms that will govern ITMOs. Although there is great expectation for the implementation of rules and procedures concerning Article 6 during COP26, it is very possible that their implementation takes several years.

Analysis have been carried out on the accreditation systems for existing carbon pricing instruments and the main considerations that should be considered for the future development of new systems and instruments under the Paris Agreement and the market and non-market mechanisms of Article 6.

Table 3 discusses the main points that should be considered in the framework of the future implementation of Article 6 for the development of a Chilean green certificate market and its respective platform.

Table 3 Considerations for the Implementation of Article 6 of the Paris Agreement

Criterion	Description of relevant considerations
<b>Governance and accounting</b>	<ul style="list-style-type: none"> <li>Article 6 has given rise to the approach of mixed governance systems between the public sector and the private sector.</li> <li>There is a growing trend in which public policy makers rely on accreditation services managed by the private sector.</li> <li>It is seen as a possibility that public accreditation systems for carbon pricing instruments use registries appropriate to their needs, provided by private suppliers through tenders.</li> <li>The use of blockchain technologies to create unique traceability routes for each transaction has been proposed.</li> <li>It is very likely that national registries will be developed and coexist with an international registry of the UNFCCC.</li> <li>For the supervision of the cycle of activities of carbon projects, it is important to diversify the geographical distribution of the entities responsible for their validation and verification as to encourage participation and reduce transaction costs.</li> </ul>
<b>Scope and eligibility</b>	<ul style="list-style-type: none"> <li>An allocation model of the verification entities has been proposed, managed by the governance body of the accreditation systems, which contemplates the setting of mandatory fees to avoid incentives that encourage poor checks and to regulate prices.</li> <li>It is necessary that the scope of the sector field to generate reductions in ITMO emissions is restricted to avoid the inclusion of incompatible sectors and activities with the objective of limiting the increase in temperature to 1.5°.</li> <li>It is convenient to align the crediting periods of the projects with the cycles of NDC implementation to enable their scaling. The implementation of technological periods can also be considered (time horizons in which new technologies can mature and enter into the market).</li> <li>The reduction of crediting periods for complex and highly dynamic sectors is recommended, as well as their extension for those sectors and projects that depend on constant cash flows for long periods of time.</li> <li>It has been discussed whether these should be restricted to the areas covered by the conditional NDCs to ensure the additional criterion of the activities and projects.</li> <li>The restriction of activities and projects only to sectors covered by the NDCs to ensure strong transfers has also been considered.</li> <li>It is possible that restrictive policies for the commercialization of ITMOs are implemented in order to prevent an oversold phenomenon</li> </ul>

## Environmental integrity

that involves risks for NDCs implementation of the countries where projects and activities are developed.

- Operationalization to accredit mitigation co-benefits from adaptation activities would enable broader participation but would also involve considering the implementation of strict additional tests and new approaches for measurement, reporting and verification.
- Due to their alignment with the goals of the Paris Agreement, it is possible that adaptation activities, in addition to mitigation activities, will be included in the future in the different sector fields eligible for the generation of ITMOs.

- Under the Paris Agreement, the establishment of conservative emission baselines and the limitation of crediting periods will ensure the ambition and compliance of NDCs.
- Buyers and sellers of ITMOs will need to implement the relevant measures to reflect the use of the credits transferred for NDC compliance.
- Inventories and registries should be prepared on a common basis established by the rules of the Intergovernmental Panel on Climate Change (IPCC) and methodologies that enable comparability.
- It has been suggested that, in order to perform the ITMOs accounting, one possibility is the implementation of a “Buffer Registry” backed by the NDC inventory and the GHG inventory, which starts in zeroes and reflects the sum of transfers and acquisitions.
- It is quite possible that post-2020 climate policies will generate the need to make adjustments to prevent double counting through voluntary standards.
- In order to prevent double counting, it is also relevant to ensure transparency in voluntary and regulated markets.
- In order to ensure transparency, it is planned to submit transfers of voluntary market emission reductions to the accounting guidelines in Article 6.
- Another alternative refers to the reformulation of the meaning of carbon credit ownership and to consider them as “sponsorship of government reduction objectives”.
- In order to ensure widespread mitigation of global emissions, it is possible to implement a system for automatic cancellation of a certain amount of credits at the time of issuance, or to establish discount rules.
- The mechanisms of cancellation and discount of credits must be elaborated based on the particular characteristics of the Parties.

## Monitoring, reporting and verification

- The standardization of monitoring, reporting and verification (MRV) processes could imply the migration at sectorial levels, even if it implies greater complexity.
- Allowing the issuance of trading credits that could be expressed in terms other than tons of carbon dioxide equivalent would imply:
  1. A considerable deviation from MRV mechanisms



### Contributions to sustainable development

2. It would facilitate the participation of some countries whose NDC is oriented to the scaled implementation of renewable energy
3. It would make mechanisms to prevent double counting and preserve the environmental integrity of projects and activities more complex.

### Connection with other carbon pricing instruments

- Sustainable development is very likely to play an important role in the design of the market-based mechanisms of the UNFCCC.
- The monetization of the benefits associated with sustainable development could be observed.
- The connection of the ETSS implemented in the same region and the subsequent appearance of a reserve of credits could facilitate the emergence of international credits.
- The connection of ETSSs should be restricted to programs that are not affected by the over-allocation of credits to certain industry branches.
- The emergence of international credits will not be possible until MRV requirements are standardized.
- Accreditation mechanisms could be considered to discourage fossil fuel subsidies or combine accreditation mechanisms with other instruments such as feed rates for renewable energies or competitive auctions.

Once the considerations determined by the jurisdiction specifying the type of green certificate market are contemplated, specific actions must be taken in order to meet the objectives. One of the essential elements is the place where certificate transfers take place, that is, a trading platform.

#### 4.4.5. Renewable Energy Certificate Market

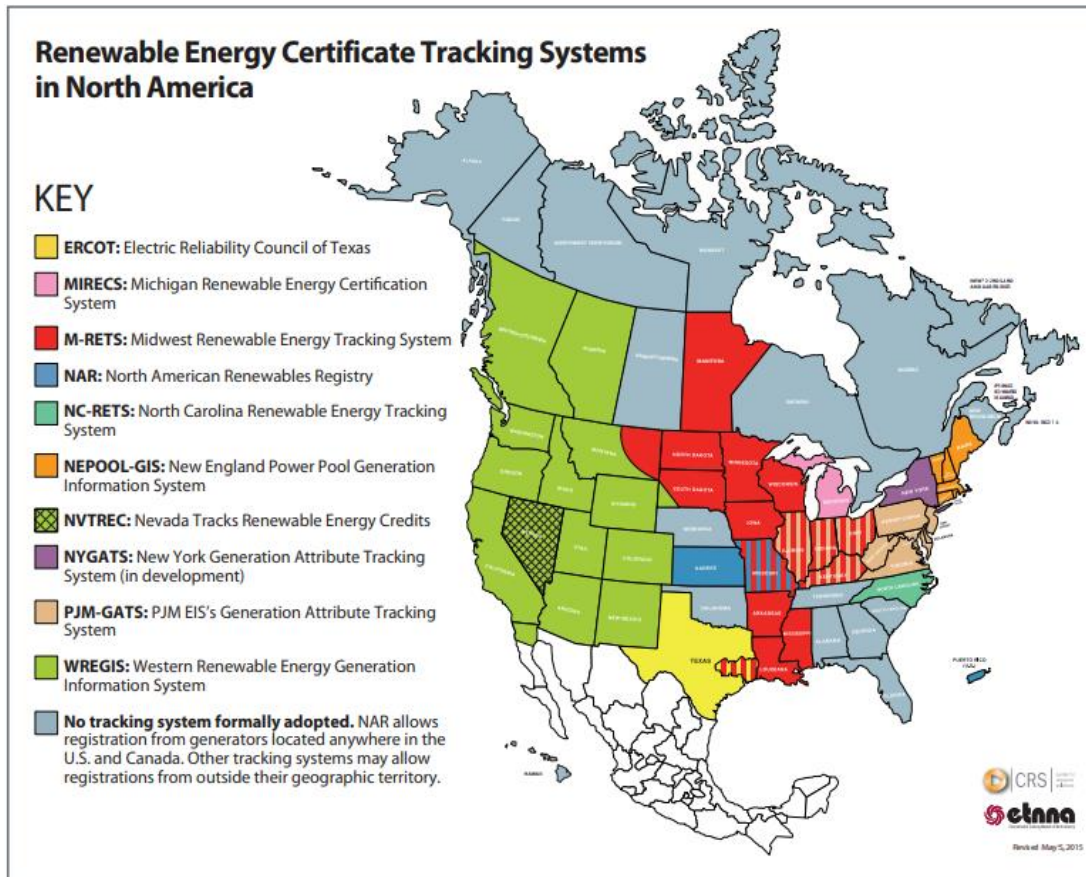
Renewable Energy Certificates (RECs) represent environmental benefits that correspond to energy units: a renewable energy certificate is equivalent to one Megawatt-hour (MWh). These can be sold separately or together with the base electricity supply.

RECs have been used internationally and their use has been extended, although the name of the certificates may vary between different jurisdictions. In the United Kingdom, these types of certificates have been used since 2002 to comply with renewable energy obligations. In Australia certificates have been implemented since 2001. More recently, India has initiated a market for RECs to meet the obligations of acquiring renewable generation through two exchange systems. In Mexico, the Energy Regulatory Commission (ERC) created the Clean Energy Certificates (CEC) market to facilitate compliance with a new regulation. Annex 3 contains detailed information on the Mexican case.

In the United States, these instruments were implemented to follow up on electricity generated by renewable energies. RECs were created after the approval of renewable energy portfolio standards, in addition to fuel diversification requirements. Certificates are acquired by users who are required to meet a certain percentage of renewable energy consumption. In addition, they are used in voluntary markets to facilitate sustainability goals.

All United States participate in a regulated market for RECs. There are ten REC tracking systems throughout the country, which are shown in Figure 1. These systems are responsible for verifying that each certificate is counted only once by assigning a serial number for each MWh generated with renewable energies.

Figure 1 REC Tracking Systems in the United States



Source: National Energy Renewable Laboratory

By 2015, there was an incipient interaction between regional REC tracking systems, allowing them to be exported and imported. With the use of electronic systems, administrative requirements were reduced to avoid double counting.

On the other hand, the role of regulators is essential in forced markets. Its main function is to ensure compliance with regulations and provide public information. In this sense, the regulator requires that generation plants use tracking systems to send the compliance information. In addition, registries are capable of influencing the level of public information that would serve to support certificate holders in the identification of markets with potential demand.

Governments usually establish an electronic tracking system to verify compliance. In this case, a pre-designed system is generally contracted as the international standard for renewable energy certificates, which can be modified according to the requirements of the



countries. Electricity generators in Spain, Taiwan and Turkey have chosen to use this system.

The main purpose of green certificate trading platforms is to allow users access to information, as well as serving as a meeting point between the participating stakeholders, that is, supply and demand. A direct effect of implementing a platform is that market dimensions become more transparent: prices, terms, demand and supply size, etc.

#### **4.4.6. Entities Participating in the Green Certificate Market**

By identifying the participants of the green certificate market, the bases for the future definition of users who interact with the platform and the roles that must be defined in it are consolidated (that is, the access permits and actions that can be assigned to the different users).

In order to enable the process of buying and selling green certificates, the intervention of stakeholders that facilitate the organization of the flow of interactions is necessary. These entities are the financial intermediaries, the settlement agent and the registries. The latter have a very important role and generally have their own team to manage their processes and operations, which is independent of the other stakeholders in the process. Below there is a description of each of the stakeholders.

##### **4.4.6.1. Buyers**

In a voluntary market, users participate to mitigate consequences derived from their own activities. In a regulated one some entities are forced to fulfill certain responsibilities. These determined obligations and entities are chosen according to considerations established by public policies, such as the maximum number of tons of GHG emitted annually or compliance with a certain percentage of energy consumption by clean or renewable sources.

These participants generally belong to the same jurisdiction; however, cases have recently been registered where entities from different jurisdictions exchange certificates. There is even the initiative established under Article 6 of the Paris Agreement to enable the exchange of certificates internationally as described above and these transfers can be made between private or between jurisdictions.

##### **4.4.6.2. Certificate Holders**

They are the organizations that carry out various activities aligned with objectives of environmental mitigation actions, such as renewable energy, energy efficiency and other GHG emission reduction projects. These projects must be verified and certified under standards as described above. Those who acquire green certificates in a primary market and wish to trade them in the future are also included.

##### **4.4.6.3. Determined National Authority**

It is the entity responsible for attributing validity to the standards by which the developer projects exercise mitigation activities that can be tradable. An example is the Ministry of the Environment, which has the authority to determine whether a mitigation action meets the requirements of the CDM. This could be applicable to the future international market (as

established in Article 6 of the Paris Agreement), the green tax offsetting system or a potential ETS, or similar system, in Chile.

On the other hand, the Superintendence of the Environment (SMA), in coordination with MoEnv, could be the entity in charge of determining the guidelines for the green tax offsetting system and development of the offset registry system under the green tax. In the case of the international market, the entity in charge is not yet defined.

#### **4.4.6.4. Third Party Verifier**

In the market of green certificates, it is necessary the existence of institutions and instruments that verify the mitigation actions registered by the issuers, that guarantee the fulfillment of the existing regulations, delivering reliability with respect to them.

The Third Party Verifier is, then, that institution approved for this role whose main objective is to check that the issuer complies with the accepted standards and verify the degree of veracity of the information provided by the issuer regarding the emission reduction calculations, and other mitigation actions, acting as a third party in the process of registering mitigation initiatives. In order to achieve this, it is necessary to follow the principles of transparency, accuracy, consistency, comparability and completeness.

The procedure considers, first, the review of the information provided by the issuer, delivering a final opinion supported by a verification document. The document issued by the verifying entity is a means of validating the standards used.

#### **4.4.6.5. Registry**

The registries serve as a central repository for all information related to the official project portfolio. Likewise, its responsibility extends to ensuring that registered projects are unique, issuing serial numbers of emission reductions generated by projects to confer traceability and recording withdrawals and cancellations, avoiding all double counting.

Among the competencies for a registry to work as a facilitating instrument for the green certificate trading, the following are distinguished:

- Systems and protocols for user registry
- Availability of protocols, instructions and clear formats to provide requested information
- Information validation systems and protocols (both the identity of the users and the veracity of the information provided in the projects)
- Agile and rigorous management of public and sensitive information
- Exchange of information with green certificate holders, validating and verifying entities, settlement agent, platform or the general public
- Information processing
- Information filtering and sorting
- Systems and protocols to rule out project splicing or double accounting
- Systems and protocols to enable the change of project and certificate status
- Display of project status (listed, registered)
- Clear systems, protocols and formats to provide the necessary information to enable the issuance of green certificates to their respective holders
- Deployment of instruments issued (active, withdrawn or canceled)
- Systems for controlled instrument issuance (enable options for gradual issuance according to verification dates)

- Systems to execute the transfer of instruments from registries to external accounts
- Systems and protocols to proceed with the transfer, withdrawal and cancellation of green certificates
- Damping systems and protocols to enable the cancellation of instruments in cases where projects present incidents with inverse phenomena to the purpose of the project (for example, emission leakage)
- Systems and protocols for the equivalent conversion of green certificates from other registries to the instruments managed by them
- Payment receipt system for the collection of shares and fees associated with certain procedures within the registry

For both listing and registering projects, certificate holders or administrators must submit information requested by the registry to proceed with the registry in the database. Table 4 summarizes the generic information requested to list or register projects, based on common information from different registries, mainly from Verra.

Table 4. Generic Information Requested by the Registry

List of project portfolio	Project registry and issuance of instruments
<p>1. <i>For projects under development</i></p> <ul style="list-style-type: none"> <li>• Descriptive draft with the following aspects:               <ul style="list-style-type: none"> <li>○ Project description</li> <li>○ Scope and type</li> <li>○ Bidder(s)</li> <li>○ Start date</li> <li>○ Scale and estimated emission reductions (or environmental benefits)</li> <li>○ Description of the activity</li> <li>○ Location</li> <li>○ Pre-start conditions</li> <li>○ Compliance with statutes, laws and other regulations</li> <li>○ Property</li> <li>○ Relevant information about other programs</li> <li>○ Additional information</li> <li>○ Base emissions</li> <li>○ Project emissions</li> <li>○ Leakage</li> <li>○ Net reductions and removals</li> </ul> </li> <li>• Legal document that includes the list of project bidders, entities that have been assigned the rights to the instruments generated and entities authorized to list the project in the registry.</li> </ul>	<ul style="list-style-type: none"> <li>• Description</li> <li>• Validation report</li> <li>• List of validators</li> <li>• Legal document that asserts the fulfillment of the project with the regulations of a certain standard or norm</li> <li>• Tracking report</li> <li>• Verification Report</li> <li>• Legal document that asserts that the project was verified with integrity and in compliance with the respective regulation</li> <li>• Legal document in which the ownership of the instruments generated is proven</li> </ul>

List of project portfolio	Project registry and issuance of instruments
<p>2. <i>For projects under the validation process</i></p> <ul style="list-style-type: none"> <li>• Full description:             <ul style="list-style-type: none"> <li>○ Summary description</li> <li>○ Scope and type</li> <li>○ Bidder(s)</li> <li>○ Other related entities</li> <li>○ Start date</li> <li>○ Crediting period</li> <li>○ Estimated scale and emission reductions (or environmental benefits)</li> <li>○ Description of the activity</li> <li>○ Location</li> <li>○ Pre-start conditions</li> <li>○ Compliance with statutes, laws and other regulations</li> <li>○ Property</li> <li>○ Emissions trading systems and other binding projects</li> <li>○ Alternative environmental commodities</li> <li>○ Participation in other greenhouse gas projects</li> <li>○ Additional information</li> <li>○ Base emissions</li> <li>○ Project emissions</li> <li>○ Leakage</li> <li>○ Net reductions and removals</li> <li>○ Title and reference of the methodology</li> <li>○ Applicability of the methodology</li> <li>○ Project limits</li> <li>○ Base scenario</li> <li>○ Additionality</li> <li>○ Methodology deviation</li> <li>○ Quantification of GHG reductions or other environmental benefits</li> <li>○ Tracking</li> <li>○ Information and parameters for validation</li> <li>○ Information and parameters for tracking</li> <li>○ Tracking plan</li> <li>○ Safeguards</li> <li>○ Net damage</li> <li>○ Environmental impact</li> <li>○ Consult to local stakeholders</li> <li>○ Public comments</li> </ul> </li> </ul>	

List of project portfolio	Project registry and issuance of instruments
<ul style="list-style-type: none"> <li>• Document proving the contractual agreement with the validating entity.</li> <li>• Legal document that includes the list of project bidders, entities that have been granted rights over the instruments generated from the projects and entities authorized to list the project in the registry.</li> </ul>	

By confirming that the projects have adhered to the relevant procedures and regulations and that they effectively generate emission reductions (or other benefits), finally the registry may proceed to issue the serial numbers corresponding to each instrument or certificate derived from the reductions/benefits. Once the issuance is carried out and the certificate holders pay the respective process fees (if any), the registry deposits the instruments in the account of the green certificate holders.

#### 4.4.7. Transaction Mechanisms

##### 4.4.7.1. Spot Price

The spot market, or "cash market", is the one where it is bought or sold in a short period of time with immediate or almost immediate issuance. It is also known as "current market". The price in this market is mainly determined by supply and demand, whose consequence is that prices suffer some volatility. There is an important difference with future markets, in which the price is also influenced by other aspects such as storage costs or future price movements.

This trading mechanism is usually used in markets where green certificates are sold in voluntary markets. In the sections "Green Certificate Trading Platforms", as well as in "Background Analysis", the trading mechanisms of several international platforms are made explicit.

##### 4.4.7.2. Auction

The consideration of including auction systems for the green certificate trading is based on various experiences worldwide that belong to jurisdictions in which ETSs have been established. In addition, it is possible that depending on the national context, auctions may be held to meet obligations, for example, of the Green Tax as a mechanism of flexibility.

In an auction of green certificates, a buyer can submit more than one offer to the extent that each fully complies with the minimum price, the amount covered by the bidder's financial guarantee, the bidder's purchase limit and the retention limit. The offer price refers to the price offered by an issuing unit.

#### **4.4.7.3. Case Study: Pilot Auction Facility (PAF)**

This was a joint initiative of the World Bank and Climate and Clean Air Coalition for the development of a performance offset mechanism to encourage investment in GHG emission reduction projects of the CDM, seeking to maximize public funds and the use of private sector financing. In order to achieve its objectives, the PAF aimed at a guaranteed base price and organized three auctions of put options backed by funds from Germany, Sweden, Switzerland and the United States.

The first two auctions held in July 2015 and May 2016 respectively, focused on the reduction of methane emissions through animal waste projects, sanitary landfills and wastewater treatment plants.

Under the PAF framework, the sale options or puts are derivative financial instruments that grant its buyer the right (not the obligation) to sell their emission reductions at a pre-agreed minimum price. Thus, if market prices fall in the future, the holder is exempt from losses as it has the right to sell at the pre-established price, even if it is higher than market prices. On the contrary, if the market presents an upward trend, the holder will have the alternative of not exercising the put and selling the emission reductions independently at higher prices. The options could be traded by the holders, which allows them to transfer ownership rights.

Auctions were selected as the most effective mechanism for the placement of the instruments, as it facilitates that the resources achieve their maximum impact by selecting the winners following the criteria of the minimum expected cost per reduced ton of CO<sub>2</sub> equivalent. PAF defined specific budgets to pay for emission reductions in case option buyers decided to exercise their right to sell. Likewise, the criteria for the eligibility of carbon credits were established: only new emission reductions were allowed, leaving out all emission reductions previously traded in the market.

On the other hand, PAF tested different schemes for auctions. First, a Dutch auction scheme that determined a starting price for carbon credits and that was decreasing in each round; the bidders announced positions in which they established the maximum amount of options they were willing to buy at a certain price for the reductions; then, an English auction scheme with a premium price that rose in each round.

The PAF results from the first auction were that the liquidation price per ton of carbon equivalent was \$2.40 dollars and the volume of sales options placed amounted to 8.7 million tCO<sub>2</sub>e; in the second auction, the liquidation price was \$3.50 dollars and the total volume of sales options placed reached 5.7 million tCO<sub>2</sub>e; the third auction held in January 2017 was aimed at reducing nitrous oxide emissions from nitric acid production. The agreed price per ton was \$2.19 dollars and the placement volume was 6.2 million tCO<sub>2</sub>.

#### **4.4.7.4. Transaction Types**

There are different transaction types through which it is possible to trade environmental commodities and they can be divided based on their execution inside and outside the stock market (the latter are known as Over the Counter or OTC operations), as well as in the participation of intermediaries, as illustrated in Table 5.

Table 5 Transaction Types in the Trading of Environmental Commodities

Transaction Types				
Transactions within the stock exchange	Transactions outside the stock exchange (bilateral or OTC)			
	Settled in the stock exchange		Not settled	
	Intermediated	Non- intermediated	Intermediated	Non- intermediated

## 5. Background Analysis

At this stage, the identification and analysis of international experiences for the creation of trading platforms for domestic emission reductions are considered through the creation of a benchmark between the different platforms worldwide.

In order to obtain a broad perspective on platforms that trade emission reductions under different regulatory frameworks, a broad search of all types of instruments was carried out. This was the first approach to determine what kind of platform would be convenient to analyze in depth. Once the results were obtained, three of them were selected with similar characteristics (and even convenient) in view of the objective of this consulting service.

The platforms studied have three different trading mechanisms: by spot price, auctions and mixed. Among the platforms, the most recognized in America, Asia, Europe and Oceania were analyzed.

### 5.1. Green Certificate Platforms

Once the background of the trading of green certificates is known, it is important to emphasize the web platform where the corresponding exchange and transactions take place. Table 6 shows some of the most important platforms worldwide, some of which are listed in “Sources of emission permit prices and exchange rates” on the ICAP website. In addition, it specifies the program or market in which they operate.

Table 6 Web Platforms Analyzed for Emission Reductions Trading

Platform	Program/Market
<b>European Energy Exchange</b>	<i>European Union Emissions Trading System (EU-ETS)</i>
<b>CommeTrade Carbon</b>	<i>New Zealand Emissions Trading System (NZ ETS)</i>
<b>China Beijing Environmental Exchange (CBEEEX)</b>	<i>Beijing Emissions Trading System</i>
<b>GHG Allowances Auction &amp; Reserve Sale Platform</b>	<i>Québec Cap and Trade Program</i>
<b>Ontario's Government Cap and Trade Program Website</b>	<i>Ontario Cap and Trade Program</i>
<b>Shanghai Environmental Energy Exchange (SEEE)</b>	<i>Shanghai Emissions Trading System</i>
<b>Tianjin Climate Exchange (TCX)</b>	<i>Tianjin Emissions Trading System</i>
<b>Carbon Trade Exchange (CTX)</b>	<i>Voluntary Market for Global Emission Reductions</i>



Platform	Program/Market
<b>BVRio Platform</b>	<i>Voluntary Market and Simulation of ETS in Brazil</i>
<b>MMV Colombia</b>	<i>Voluntary Mitigation Market of Colombia</i>
<b>Fujian Haixia Equity Exchange</b>	<i>Fujian Emissions Trading System</i>
<b>Carbon Offset Platform - UN</b>	<i>United Nations Global Voluntary Carbon Offset Market</i>

Below there is a brief description of each of the above platforms, as a preamble to the comparative analysis that is further developed.

### 5.1.1. European Energy Exchange

Access Link: <http://www.eex.com/en/products/environmental-markets>

*European Energy Exchange* (EEX), is part of the EEX Group (group of specialized companies that offer trading platforms for financial products) and the main intermediary for the European spot exchange of emission, electricity and natural gas permits and reductions.

It also organizes the auctions of several EU countries, which follow the European Union Auction Regulation. In general terms, the auction platform is a web-based system, where members of the emissions spot market that meet the requirements of being eligible to bid according to EU standards can access through their username and password provided to members admitted by the EEX market supervision department.

### 5.1.2. CommTrade Carbon Platform

Access Link: <https://www.commtrade.co.nz/>

*CommTrade* is a platform where the parties wishing to buy and sell carbon credits converge to use them in the ETS of New Zealand. It is owned by OM Financial Limited, the most active carbon broker in the country and a member of NZX, and is not available to be used in any jurisdiction where it is not legally accessible or where some authorization is required, or take any action to allow its use.

Regarding the operation of the platform, the following stand out:

- Buyers and sellers can log in and place orders to buy or sell when the market is open, during normal business hours from 8 a.m. to 5 p.m. New Zealand time, only during business days. Despite the above, it is considered that the registered user who placed the order can cancel it at any time before closing the operation, even after business hours.
- The prices are anonymous. Once a match has been made regarding an operation, price and counterparty details are reported electronically.
- Access to CommTrade can be requested by anyone; however, acceptance as a registered user is at the discretion of the administrator.
- Registry is available for people over 18, who should contact the administrators of the CommTrade Platform to request registry (which is not immediate). If the person

requesting registry is not a New Zealand resident or is not present in the country, they must notify their residence and location.

- An order must be at a price with respect to a complete unit of the relevant product in New Zealand currency and without penny fractions for a minimum of 5.000 units in multiples of 1.000 units.
- When an offer and an order match, OM Financial Limited sends a term sheet to the email address of each of the counterparties confirming the terms and proposing options for the settlement method of the transaction. This coincidence does not create a binding contract; the binding contract will not exist until a buyer and a seller conclude a separate contract in relation to the proposed transaction.

### 5.1.3. China Beijing Environment Exchange Platform

Access Link: <http://www.cbeex.com.cn/>

*China Beijing Environment Exchange* (CBEEEX) was founded in August 2008 with the approval of the Beijing municipal government, currently establishing a professional trading platform for the trade of environmental commodities that functions as a public platform.

The exchange has focused on reductions in energy efficiency and renewable energy emissions, which come from CDM projects approved by the central government to be used in the Beijing regional ETS in operation since 2013. Much of the transactional information is not public: participants, volumes, current prices, etc.

### 5.1.4. Environment et Lutte Contre les Changements Climatiques Québec Platform

Access Link: <http://www.environnement.gouv.qc.ca/changements/carbone/Ventes-encheres-en.htm>

In 2013, Quebec established an ETS with the possibility of using offset credits to combat climate change and with the main objective of encouraging companies to change their behavior to reduce GHG emissions.

Regarding the operation, it is possible to highlight the following aspects of this government auction platform:

- GHG issuers must obtain an emission allocation (a term that refers to both the emission units and the offset credits) for each ton of GHG they emit into the atmosphere and remit to the government at the end of each compliance period, for a period of three years.
- The government sets annual maximum limits for GHG emission units (maximum emission limit). These limits gradually decrease over the years to generate GHG emission reductions.
- The government puts on sale, four times a year, emission units at auctions. Only issuers and market participants can participate in these sales.
- Issuers that manage to reduce their GHG emissions below the number of emission units allocated for free can sell these permits to other issuers.
- The government also allows issuers to offset a portion of their GHG emissions through the use of offset credits. These credits must comply with the requirements established by the regulation and protocols of the Western Climate Initiative (WCI), a mechanism that brings together the markets of California, British Columbia, Nova Scotia and Quebec (formerly also Ontario).

- Offset credits are in a register administered by the Quebec government.  
(<http://www.environnement.gouv.qc.ca/changements/carbone/credits-compensatoires/index-en.htm>)
- Transaction data - basically the results of the auctions - are made public at the end of each of them through an electronic newsletter.

#### 5.1.5. Shanghai Environment and Energy Exchange Platform

Access Link: <http://www.cneeeex.com/>

In 2013, the Shanghai platform was approved by the National Development and Reform Commission of China to respond to the Climate Change Division and became the country's most important voluntary national greenhouse gas emission reduction platform, providing related services for China Certified Emission Reduction (CCER) transactions, CDM projects approved by the central authority.

National certified voluntary emission reductions refer to the emission reductions of voluntary emission reduction projects that are included in the national registry system in accordance with the provisions of the provisional measures for the administration of voluntary emission reduction trade of GHG by the National Development and Reform Department. The platform has little information regarding its spot and auction markets for the Shanghai regional ETS.

#### 5.1.6. Tianjin Climate Exchange

Access Link: <http://www.chinatcx.com.cn>

The Tianjin platform was the first in trading instruments derived from public environmental policies in China. It emerged as a collaboration between the Chicago Climate Exchange, the Tianjin government and the PetroChina asset management unit.

It is a site for the exchange of emissions and emission reduction (CCERs), which responds to the Tianjin domestic carbon ETS launched in 2013. The entities participating in the system emit about 50% of the total emissions in the city. This system includes the participation of companies that carry out activities in the sectors of electricity and heat generation, steel, petrochemical, chemical and oil and gas exploration. Among the sections found on the website, the carbon emissions registry system of this jurisdiction, the carbon emissions trading system (accessed with an account enabled by administrators) and a guide for creating accounts are highlighted, as well as another to notify the status of the participants' accounts after they have been requested. The platform allows the use of emission reductions up to 10% of total emission permits as a flexibility mechanism. The CCERs used must be issued through local projects, which are not related to hydraulic energy.

#### 5.1.7. Carbon Trade Exchange Platform

Access Link: <https://ctxglobal.com/carbon-tradeexchange/>

*Carbon Trade Exchange* (CTX) is an electronic exchange platform that operates in the United Kingdom and Australia, and was founded in 2009 after 2 years of Research and Development, launched operationally in London and then in Sydney in 2010. The same year, CTX negotiated with Westpac to create an electronic interface with CTX. This platform allows buyers and sellers to exchange cash for carbon offsets (or credits) in real time, 24/7, 365 days a year.

Today CTX is operated by Environmental Markets Services (EMS), a subsidiary of Global Environmental Markets (GEM) based in the United Kingdom. Under the CTX brand, EMS trades carbon credits certified by Gold Standard, Verified Carbon Standard and CDM. They are also offered as: carbon offset, neutral carbon certification, development of carbon projects, and carbon footprint.

CTX works with two registry suppliers: The United Nations and the Gold Standard.

Regarding the associated process, it should be noted that to buy United Nations emission reductions for voluntary cancellation, a registry account is not necessary and that the CTX banking interface is provided by Westpac.

#### 5.1.8. BVRio Platform

Access Link: <https://www.bvrrio.org/contribuicoes/plataforma/prepara.do>

The BVRio Institute and the BVRio Platform, which form the BVRio Group, are designed to act in a complementary manner to create the necessary conditions and demonstrate the viability of developing an environmental economy in the sectors in which they operate. While originally focused on promoting compliance with environmental trading mechanisms in Brazil, more recently BVRio expanded its reach and activities to address international and global challenges.

BVRio supports the promotion of effective means of negotiation of environmental assets to help convert trading mechanisms into real instruments for the implementation of environmental policies. To this end, the BVRio Platform was created, an impact company whose objective is to leverage private sector capital to implement and scale the pre-operational activities developed by the BVRio Institute.

#### 5.1.9. Natura Foundation – MMV Colombia

Access Link: <http://www.natura.org.co/mvc-mecanismo-de-mitigacion-voluntaria-de-gases-efecto-inverna-ero-en-colombia>

The Natura Foundation integrated this technology and institutional platform initiative that would ideally serve as a basis for adopting a Voluntary Emission Reductions (VERs) trading mechanism with the objective of facilitating voluntary GHG emission reduction activities in Colombia.

The project develops a mechanism to promote voluntary mitigation of GHG emissions in Colombia, supporting the establishment and development of a program to facilitate the adoption of protocols and strategies that guarantee the permanent mitigation of GHG emissions at the corporate and institutional level through the implementation of reliable, consistent and transparent protocols, as well as providing a reliable and transparent scheme for the generation of VER reduction units.

#### 5.1.10. Hong Kong Emission Exchange Platform

Access Link: [http://www.hex.com.hk/en/data\\_detail.asp?id=271](http://www.hex.com.hk/en/data_detail.asp?id=271)

*Hong Kong Emission Exchange* was founded in May 2012. It is the leading and sole operator of commodity exchange of environmental resources in Hong Kong and the surrounding area, including Fujian ETS.

The Hong Kong Emission Exchange operates a broad market of derivative environmental products and financial products. Its main services include different trading, offset, settlement and custody services, and related and energy saving consulting and information services.

*Hong Kong Emission Exchange* establishes strategic cooperation economic relations with China's experimental carbon trading units, actively promotes the internationalization of China's carbon trading market and gives global investors the opportunity to get involved in the world's largest carbon exchange market in the future.

Among the exclusive patent technology solutions, the following stand out:

- Emissions Report System

The Emissions Report System is developed in accordance with the report on greenhouse gas emissions and removals, the ISO-14064 standard and the calculation methods of developed countries, and is combined with the actual situation and characteristics of National companies of China.

- Voluntary system of emission reduction certification and registry

The users of the voluntary system of emission reduction certification and registry are mainly carbon sellers, carbon buyers (individuals or organizations), financial institutions, project accreditation institutions, transaction tracking institutions, etc.

- E-commerce system of carbon emissions

Membership management, carbon brokers, carbon emissions exchange, emission rights settlement, etc. In later sections, the e-commerce system that is generally used in markets with spot prices is discussed.

#### 5.1.11. Carbon Offset Platform

Access Link: <https://offset.climateutralnow.org/howtooffset>

The platform is a channel to offer CERs to the general public, which are the only reductions allowed in the system, although it may well be made explicit that projects can also be standardized by other mechanisms. The UNFCCC Secretariat designed the platform given the interest of different parties derived from the initiative called Climate Neutral Now, exposing their CERs to a wider group of potential buyers.

In this platform, a carbon footprint calculator is available, through which it is possible to make estimates on the impact in terms of carbon dioxide emissions equivalent, that carry out the daily activities of individuals.

The platform is available 24 hours a day, 365 days a year, and has payment systems that facilitate CERs transactions for an international audience.

#### 5.2. Benchmark

In order to review international experiences of other trading platforms for emission reductions, certain common characteristics were considered in most of them. Table 7 shows the parameters that were analyzed with a brief conceptual description, which are divided into two sections: characteristics of the platform and those related to the operation.

Table 7 Web Platform Parameters and Operations for Evaluation

Characteristics	Description
	Web Platform
<b>Look &amp; feel</b>	Set of properties and characteristics that give it a unique visual identity and can be perceived differently according to each user
<b>Web Friendly</b>	Ability to use the website from multiple browsers keeping all instruments working properly
<b>Intuitive</b>	Users can focus their attention on a task without interrupting it. In addition, they are able to understand and use the platform immediately.
<b>Response Time</b>	Time interval in which the website opens and loads new items. It depends on the amount of material that each website contains and the type of instruments used.
<b>Accessibility</b>	Effective use of digital resources for different users.
<b>Reliability</b>	Use of multimedia resources, social networks and high quality photographs. Make evident the involvement of entities with excellent reputation.
<b>Social Networks</b>	Use of social networks to disseminate activities and/or relevant news about the operation of the platform.
<b>Historic Information</b>	Data referring to the price per ton of carbon dioxide traded by different projects and/or at different time periods.
<b>FAQ Section</b>	Most relevant information on the use and operation of the platform, which addresses the most recurring questions by users.
<b>Contact Information</b>	Contact information that responds to user requests, generally found accessible within the website.
<b>News Section</b>	Generally present in a box or widget that expresses the latest developments of the platform and current issues related to trade reductions or emissions on the site or market.
<b>External Links</b>	Additional information that shows concepts on which the ETS are based, issues related to climate change to justify the meaning of the system and potentials associated with the dissemination platform.
<b>Information Available to the Public</b>	Access to information for all types of public regardless of whether it is a registered user.

<b>Multi Platform</b>	Ability to use the platform from different types of electronic devices.
<b>Language</b>	Languages available to view the content of the platform, international accessibility.
<b>Operations</b>	
<b>Operation Hours</b>	Hours in which the platform is active for trading.
<b>Scheduled Auctions</b>	Determination of the number of auctions that will be held annually (if applicable).
<b>Registry</b>	Identity requirement to access platform information.
<b>Information on Agreements</b>	Details of the considerations maintained to determine the agreement of a buying and selling process.
<b>Minimum Volume</b>	Minimum number of tons of carbon dioxide sold by a participant.
<b>Information on Market Rules</b>	Section in which the guidelines for the correct operation of the system are stated and what are the provisions by which it is possible to make a good trading exercise.
<b>Admission Rules</b>	Information available on the clear rules to be a participant within the system.
<b>Transaction Collection Information</b>	Document in which the payment scheme per transaction carried out is manifested.
<b>Price Type</b>	Form in which the trading system is based; it can be by spot, auction or mixed price.
<b>List of Participants</b>	Information about the participants.

Figure 2 shows a comparative matrix of the platforms in Table 6. The objective of the matrix is to evaluate the operational aspects, general characteristics and different parameters of Table 7. In addition to the above elements, information can be found about the market in which it operates, a brief description and finally the link from which each one can be accessed. It is possible to access the original matrix file - a spreadsheet - in this link:

[https://drive.google.com/open?id=1BQf8ilHIU8uTI\\_0nTHchr\\_kU-WKMdgc](https://drive.google.com/open?id=1BQf8ilHIU8uTI_0nTHchr_kU-WKMdgc).



Figure 2 Benchmarking of Green Certificate Trading Platforms

Characteristics	Platforms					
	European Energy Exchange (EEX)	CommeTrade Carbon	China Beijing Environmental Exchange (CBEEX)	Québec GHG Allowances Auction & Reserve Sale Platform	Ontario's Government Cap and Trade Program Website	Shanghai Environmental Energy Exchange (SEEE)
Market in which they participate	European Union Emissions Trading System	New Zealand Emissions Trading System	Beijing Pilot Emissions Trading System	California/Québec Emissions Trading System	Ontario Emissions Trading System vinculado al de California/Québec	Shanghai Pilot Emissions Trading System
Description	Main platform for EU ETS emissions trading	NZ's most active carbon broker member of NZX	Beijing public platform to solve environmental problems	Québec/California ETS auction platform	Former Ontario SCE platform linked to Québec/California ETS	Shanghai Environmental Exchange Platform
Web Address	<a href="https://www.eex.com/en/products/environmental-markets">https://www.eex.com/en/products/environmental-markets</a>	<a href="https://www.comtrade.co.nz/">https://www.comtrade.co.nz/</a>	<a href="http://www.cbeex.com.cn/">http://www.cbeex.com.cn/</a>	<a href="http://www.environnement.gouv.qc.ca/chaengements/carbone/Ventes-encheres-en.htm">http://www.environnement.gouv.qc.ca/chaengements/carbone/Ventes-encheres-en.htm</a>	<a href="https://www.ontario.ca/page/cap-and-trade">https://www.ontario.ca/page/cap-and-trade</a>	<a href="http://www.cneee.com">http://www.cneee.com</a>
Operator	EEX Group	OM Financial	CBEX/BlueNext	Western Climate Initiative	Ontario Gvmt	CBEEEX
Web Platform Characteristics						
Look & feel	Good	Regular	Good	Bad	Regular	Regular
Web Friendly	Yes	Yes	Yes	Yes	Yes	Yes
Intuitive	Yes	Yes	No	No	Yes	No
Response time	Fast	Fast	Fast	Fast	Fast	Fast
Accessibility	Good	Good	Regular	Regular	Good	Good
Reliability	High	High	High	Medium	Medium	High
Social networks on the website	Yes	Yes	Yes	No	No	No
Historic information	Yes	Yes	Yes	No	No	No
FAQ section	Yes	Yes	No	Yes	Yes	Yes
Contact information	Yes	Yes	Yes	Yes	Yes	Yes
News section	Yes	Yes	Yes	No	No	Yes
External links	Yes	Yes	Yes	Yes	Yes	Yes
Information available to the public	Yes	No	Yes	Yes	Yes	Yes
Multi-platform	Yes	No	Yes	No	No	No
Language	English/German	English	inese/Limited English	English/French	English/French	Chinese
Operation Characteristics						
Hours of operation	07:45 - 18:00 Monday to Friday	8:00 - 17:00 Working Days	09:30 - 11:00 and 13:00 - 15:00	-	-	15:00 - 17:00 (Auction)
Scheduled auctions	Yes	Yes	-	4 auctions/year	4 auctions/year	-
Registration process	Yes	Yes	Yes	Yes	Yes	Yes
Information on agreements (matching)	Yes	Yes	-	Yes	Yes	-
Minimum volume (CO2ton)	1,000,00	5,000,00	-	1,000,00	1,000,00	1,00
Information on market rules	Yes	Yes	-	Yes	Yes	Yes
System admission	Registered users	Registered users	Public use	Registered users	Registered users	Public use
Transaction collection information	Yes	-	-	-	-	-
Sales mechanism	Spot Price/Auctions	Spot Price	Spot Price	Auctions	Auctions	Spot Price
Participant information	Yes	No	-	-	Yes	-
Information on emission reduction projects	No	No	Yes	No	No	Yes
Additional information	Training material	Feed from Twitter	Low Carbon Mobile Game / Carbon Calculator / WeCha Service / Account Management Charge	Min 15 CAD Reserved Auction Price / Past Auction Examples	User Guide for Auctions / Allocation of 14.53 CAD	Download trading system / WeChat QR code / Membership payment
Traded Instrument	Emission reductions, emission permits, gas, energy	Emission reductions and emission permits (NZUs, AAUs, CERs and ERUs)	Green certificates, emission permits and certified emission reductions.	Emission reductions, emission permits and early reduction credits.	Emission reductions and emission permits	Emission reductions (CCERs) and emission permits.
Form of Payment	Bank transfer from the settlement bank through the European Commodity Clearing (Delivery vs. Payment)	Bank transfer from the user account through OMF Financial Limited.	Information not available	Bank transfer through Deutsche Bank	Cash and bank transfer through the administrator of financial services.	Bank transfer from the user bank fund account through the negotiation system provided by the settlement bank.
Rating	Excellent	Good	Good	Regular	Regular	Good



Characteristics	Platforms					
	Tianjin Climate Exchange (TCX)	Carbon Trade Exchange (CTX)	BVRio	Fujian Haixia Equity Exchange	GHG Voluntary Mitigation Mechanism in Colombia	Carbon Offset Platform
Market in which they participate	China National Emissions Trading System	International Voluntary Market	Voluntary Market (not properly voluntary carbon market)	Fujian Emissions Trading System	Colombia Voluntary Market	International Voluntary Market
Description	Tianjin emissions trading platform	Web platform of basic product exchanges for the environment in multiple world markets	Portal for voluntary contributions to climate and carbon market simulation	Fujian Province Emissions Exchange Platform	VERs transaction mechanism project in Colombia	UN platform to buy voluntary cancellations of emission reductions
Web Address	<a href="https://icarbonaction.com/en/?option=com_etsmap&amp;task=export&amp;format=pdf&amp;layout=list&amp;systems[]=65">https://icarbonaction.com/en/?option=com_etsmap&amp;task=export&amp;format=pdf&amp;layout=list&amp;systems[]=65</a>	<a href="https://ctxglobal.com/carbon-tradeexchange/">https://ctxglobal.com/carbon-tradeexchange/</a>	<a href="https://www.bvrio.org/en/climate">https://www.bvrio.org/en/climate</a>	<a href="http://www.hex.com.hk/en/data_detail.asp?id=271">http://www.hex.com.hk/en/data_detail.asp?id=271</a>	<a href="http://www.natura.org.co/mvc-mecanismo-de-mitigacion-voluntaria-de-gases-efecto-invernadero-en-colombia/">http://www.natura.org.co/mvc-mecanismo-de-mitigacion-voluntaria-de-gases-efecto-invernadero-en-colombia/</a>	<a href="https://offset.climatecentralnow.org/howtooffset">https://offset.climatecentralnow.org/howtooffset</a>
Operator	CCX/Government of Tianjin/PetroChina	CTX Exchange	BVRio Institute	Fujian DRC	Natura	Climate Neutral Now
Web Platform Characteristics						
Look & feel	Good	Good	Good	Good	Good	Good
Web Friendly	Yes	Yes	Yes	Yes	Yes	Yes
Intuitive	Yes	Yes	Yes	Yes	No	Yes
Response time	Fast	Fast	Fast	Fast	Fast	Fast
Accessibility	Good	Good	Good	Good	Good	Good
Reliability	High	High	High	High	High	High
Social networks on the website	No	No	No	No	Yes	Yes
Historic information	Yes	-	Yes	Yes	-	Yes
FAQ section	Yes	Yes	Yes	No	No	Yes
Contact information	Yes	Yes	Yes	Yes	Yes	Yes
News section	Yes	Yes	Yes	Yes	Yes	Yes
External links	Yes	Yes	Yes	No	Yes	Yes
Information available to the public	Yes	Yes	Yes	No	Yes	Yes
Multi-platform	Yes	No	Yes	Yes	-	No
Language	Chinese	English	Portuguese/English	Chinese/English	Spanish	English
Operation Characteristics						
Hours of operation	09:30-11:30 and 13:00-15:00	Always available	Always available	09:30 - 12:00 and 13:00 - 16:00	-	Always available
Scheduled auctions	-	-	-	-	-	-
Registration process	Yes	Yes	Yes	Yes	-	Yes
Information on agreements (matching)	-	-	-	Yes	-	Yes
Minimum volume (CO2ton)	1,00	1,00	-	1,00	-	1,00
Information on market rules	Yes	Yes	Yes	Yes	No	Yes
System admission	Public use	Registered users	Yes	Public use	-	Yes
Transaction collection information	-	Yes	-	-	-	Yes
Sales mechanism	Spot Price	Spot Price	Spot Price	Spot Price	-	Spot Price
Participant information	Yes	Yes	Yes	Yes	-	Yes
Information on emission reduction projects	Yes	Yes	Yes	No	Yes	Yes
Additional information	Minimum 0.01 CNY	WebPlatform Voluntary Market	Development of carbon market simulation (Hair companies / Exchange of other merchandise)	Linked to the Hong Kong Emissions Exchange Platform	The platform does not exist yet	Simple purchase process (use of paypal / credit card / bank transfer)
Traded Instrument	Emission reductions (CCERs) and emission permits.	Emission reductions (CDM and Gold Standard)	Forest quotas	Emission reductions (CERs, CCERs and VERs)	Verified emission reductions (VERs)	Emission reductions (CERs)
Form of Payment	Information not available	Cash and bank transfer from funds to the platform from which the acquired emission reductions are discounted.	Information not available	Information not available	Information not available	PayPal account, payment with credit or debit card and bank transfer
Rating	Regular	Good	Excellent	Regular	Regular	Excellent

The way in which the final grade was obtained, found in the last row of the comparative matrix, was through the evaluation of the parameters described above. The positive parameters were counted (in green). The platforms that had 20 or more positive responses of the 23 total were rated as *Excellent*. Between 17 and 20 parameters evaluated with a good rating were considered *Good*. If the parameters evaluated as positive were less than 17, the rating assigned was *Regular*. Figure 3 shows the selected colors that represent the evaluation of the parameters or indicators.

Figure 3 Color Representation of the Indicators Evaluated on the Platforms

Indicator	Color
Good/Fast/Yes/Public Use/Bilingual	-
Regular/Medium	-
No/Registered Users/One Language	-
Without Information/ Schedule/Price/Description	-

After the rating of the platforms, the best evaluated were selected to deepen their analysis, which includes the most relevant and useful information on the characteristics identified for possible implementation in the development of a new platform for the purpose of this consulting service. It is important to mention that due to the functionality of the Carbon TradeXchange platform, and the similarity in the objectives with those raised in this work, it was decided to include detailed information despite the fact that the final rating of said platform was *Good*.

In the next section, there is a complete description of those chosen as reference platforms.

### 5.3. Reference Trading Platforms

The choice of emissions trading platforms was based on the criteria mentioned in the previous section. As stated, it has been a trend in the more developed markets to start a voluntary carbon market and then move towards the construction of an ETS at national or jurisdictional level, and subsequently link to international markets, although the existence of an ETS for a voluntary system is not necessary. Trading platforms have also followed this path.

According to the best ratings obtained with the application of the criteria from Table 7 and the aforementioned paragraph, four platforms were determined to make an exhaustive analysis, starting with the CTX analysis, given its similarity with the objectives of the platform to be developed from this work. Following this description are the corresponding Carbon Offset Platform, BVRio platform and finally EEX platform. These descriptions contain the most relevant characteristics, as well as fundamental aspects to consider in the development of the green certificate platform for Chile.

Additionally, a more extensive analysis of each of the platforms is found in Annex 5. Finally, there is a table that includes aspects related to their strengths, weaknesses, opportunities for improvement, and possible threats.

### **5.3.1. Carbon Trade Exchange**

CTX works under the spot price trading mechanism for different environmental assets. Carbon reductions, renewable energy and water certificates are among the instruments traded. In addition, this platform allows the exchange of voluntary credits, as well as CDM.

As mentioned in the previous section, CTX is operated by Environmental Markets Services (EMS) based in the United Kingdom. EMS trades carbon credits certified by Gold Standard and CDM. Carbon services are also offered, which include: carbon offsetting, neutral carbon certification, development of carbon projects, and carbon footprint.

In order to join CTX, it is necessary to acquire an annual membership that corresponds to a 12-month contract. This membership is free for the projects that join. CTX includes a 20% tax payment scheme for sales within the United Kingdom.

For projects that wish to sell emission reduction certificates, the procedure consists of an online application for further evaluation by CTX. An official identification copy will be requested, as well as a statement that reflects the bank details. Accepted projects receive a signed copy of the CTX Trade Agreement and a welcome letter that includes an access code.

In order to list VERs in CTX, VERs must be transferred to the GSF CTX account. In addition, it is necessary to send the following information by email: project link with registry number, number of credits, partial or total sale, sale price, currency, registered mail in CTX. It is necessary to have an account in a Registry to use CTX. The following subsection details information about connection with registries.

The prices in which the offsets offered on the platform oscillate vary between 20 cents and 20 USD. The CTX banking interface is operated by Westpac. All members have a cash account for deposits issued or funds obtained in escrow (deposit contract that leaves the amount bonded in reserve for a third party) until the moment in which a member issues a purchase/sale request to withdraw funds.

#### **5.3.1.1. Connection with Registries**

The CTX platform has established strategic alliances with different institutions, which has made it possible to connect with registries of environmental commodities such as APX, Climate Action Reserve, American Carbon Registry, Gold Standard and Australian REC Registry.

In the document of rules and regulations governing CTX, the existence of registry interfaces is mentioned, whose function is to allow the trading platform to communicate and send messages to an approved registry.

Those platform members who in advance are holders of an approved account in one of the registries, must provide CTX with the details of the registry and references with the respective allocation account. In addition, members authorize registries to share with the platform any information related to due diligence to comply with laws against money laundering and terrorist financing. On the other hand, those members of the platform who do not have an approved account in any of the registries must open an assignment account or have access to CTX to make this opening on their behalf. Members must also accept that CTX, the settlement agent and the registry exchange information on due diligence.

In order to offset GHG emissions, CTX members must withdraw or cancel credits acquired through the platform. To this end, they must access through their accounts to the registries and make such withdrawals and cancellations, in addition to paying the respective fees due to the change in status of the instruments.

In the specific case of CERs, voluntary cancellation will take effect upon receipt of payment of cancellation fees. Once the rates are covered, the members receive a written confirmation issued by CTX within the next 48 hours that proves the cancellation.

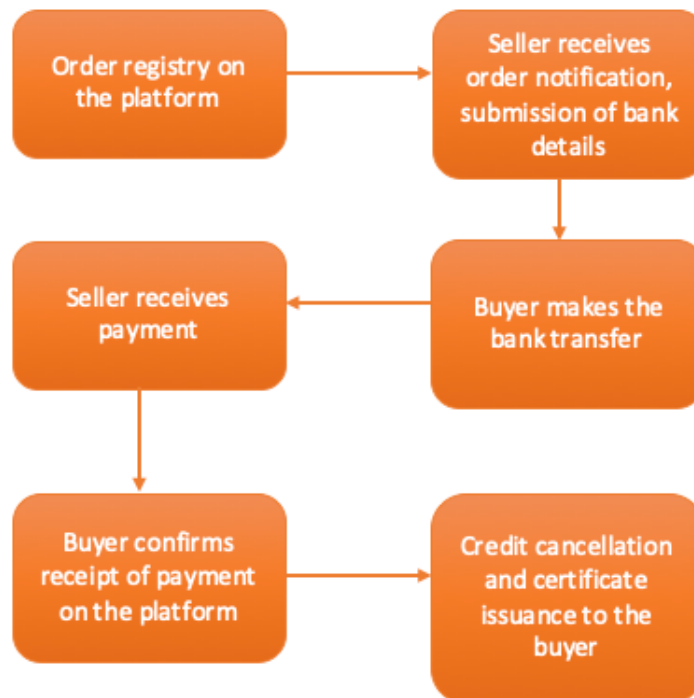
### 5.3.2. Carbon Offset Platform

The United Nations Carbon Offset Platform allows both natural and legal persons to acquire emission reductions through an electronic commerce system. Among its main features are the easy accessibility for users, the incorporation of simple payment methods, integration of a carbon footprint calculator within the platform, the incorporation of filters for specialized searches and linking with social networks.

*Carbon Offset Platform* includes certified projects that reduce, avoid or eliminate GHG from the atmosphere only registered in the CDM, although it also informs if they are registered under another standard. It is a platform dedicated to the voluntary carbon market with global reach, in which users located anywhere can contribute to the reduction.

**Payment system:** One of the most outstanding features of this platform is the ease of making payments. Account with electronic payment, card or bank transfer. When the payment is made by electronic payment or credit card, the financial transaction is made following PayPal's own procedures. However, when a bank transfer is made, the procedure to be followed is executed as shown in the simplified Diagram 1.

Diagram 1 Stages for Making Payment by Bank Transfer



### 5.3.3. BVRio Platform

BVRio is an initiative born by the collaboration of the private sector, the academic sector and non-governmental organizations whose objective is to promote the use of trading mechanisms to facilitate compliance with environmental laws and support green economies. Although it is a pilot platform, so it does not operate in a real way, some of its characteristics were analyzed by proposing the combination of several markets (some unconventional and developed from Brazil's own characteristics) on the same website.

Among the main features of BVRio is the incorporation of an intelligent interface that automatically responds to some of the characteristics of users (such as geographical location), easy accessibility for users, the possibility of translating the supply and demand needs of users with different variables, the inclusion of informative material on the context in which the platform arises (and would operate tentatively), the incorporation of multiple dynamic icons and texts, etc.

#### 5.3.3.1. BVRio Markets

BVRio operates with two different markets. The Forest Legal Reserve Market operates environmental reserve quotas, which are assets created to facilitate compliance with the Brazilian Forest Code.

Each quota represents one hectare of natural vegetation preserved in rural properties for the protection of biodiversity and water resources, thus contributing to the conservation of forests and rural ecosystems in accordance with the National System of Nature Conservation Units of Brazil.

On the other hand, there is the Reverse Packaging Logistics Credit Market that operates with reverse logistics credits, which are assets designed to facilitate the objectives of the National Solid Waste Policy and remunerate the work of recyclable waste collectors in Brazil.

It should be noted that BVRio does not have an operational trading platform for carbon market assets. However, it participated in the Simulation of Carbon Markets with the Getúlio Vargas Foundation and created a dedicated trading platform with an auction system, a registry of the differentiated instruments and interfaces for each type of market participant.

Given the need to analyze the transactional process through the platforms, the transactional platform of the Forest Legal Reserve Market is explored, although it is very clear that the instruments with which it operates are not even similar to offset credits.

### 5.3.4. EEX Platform

*European Energy Exchange* (EEX) is the largest exchange platform in Europe, which develops, operates and connects in a safe, liquid and transparent way the energy markets and environmental commodities, among others.

This platform facilitates the exchange of trading instruments for more than 30 countries. Among its distinctive features are that it supports the trading of many instruments and values, the protocols for access authorization are extremely rigorous, it incorporates processes and systems that guarantee high transparency in operations, the responsiveness of its trading systems to the market variables (supply/demand) and interactions between users occur in real time and incorporates a strategy of capitalization of resources as subscriptions for monthly or annual fees.

Another feature of EEX is that in addition to being the trading platform, through auction and spot sales mechanisms, the role of the settlement agent is fulfilled, ensuring that carbon credits and the amounts corresponding to the transactions are directed to the final destination.

## 6. Best Practices

In an analysis of the parameters found in Table 7, it was possible to identify that there are recurring characteristics in several of the platforms. The fact that they are similar lies mainly in the type of market for which each one was designed. However, some favorable aspects that are mentioned below were generally collected.

Within the group of auction or auction and spot price platforms, the following elements and characteristics could be noted:

- **Training material/user guides:** the provision of training material or user guides for the execution of operations are necessary so that the system can match the price offered and offsets found. This provides the opportunity to make good use of both the graphical interface and the conditions and operations on which the auction mechanism is based.
- **Use of social networks:** Most of the platforms analyzed have this aspect in common. However, the way in which information shared on networks is presented differs; in some cases, the feed of a certain social network was on the same website of the platform, in other cases it was necessary to access through the applications or websites of social networks. The information shared was mainly related to the hours of operation of the platforms, indicators of price changes, auction results, important changes in the platform, and less frequently information related to issues related to climate change and current news.
- **Frequently asked questions section:** It is usual to find in this section specific doubts about the operation, information about the nature of the platform, requirements for access and registry in the system, how carbon emissions trading (or reductions) works, and questions about what to do when participating in an auction and if there are difficulties in the procedure.
- **Information on the price and minimum quantity:** In some cases, the establishment of the minimum price by the entities that regulate the ETSSs, as well as the amount of minimum tons to participate in an auction or purchases in the spot market, are presented.
- **Accessibility, design and response time:** Generally, the design of the platforms was simple with the most representative and necessary elements to carry out the different operations. However, it is noteworthy that some platforms have the ability to guide users in a highly intuitive manner with the aim that the design is not an obstacle to fulfill the wishes of the participants. Most of the platforms evaluated had a good rating in terms of the possibility of navigating them with different web browsers. However, there was a case detected in which the response time considerably increased if a certain web browser was used. Finally, given that the design of most platforms was quite simple with visual elements that do not take long to load, the response time was fast enough.
- **Responsibility and contact information:** In order to give security to users, most of the platforms display information and the logos of the entities that were involved in the planning and operation. In addition, it was recurring to find easily available contact information. In the best cases, the name of the person in charge, address, telephone number and email address are detailed. On some platforms, the way in which contact is established between the user and the entity that operates the platform is carried out by means of the contact button and the



user's pre-established email application is directly executed on its computer. In other platforms, the way to contact is by filling out an online form that requires entering personal data and a text box to send the user's request.

- **Trust:** This parameter is related to the registry process and the perception of the users that they have about the handling and use of their data. There is a direct relationship with the data encryption (such as SSL certification), the presence and application of security and privacy policies that are explicitly found on the website, the process of registering new users, the user's concern about the place of storage of their information, how fast it would be to obtain the funds in a transaction, among other aspects.
- **User registry:** In order for interested parties to access the trading platform, a registry is usually required where personal information, or from the participating entity, bank account data and references are provided. In some cases, such as the CTX platform, where emissions trading systems are directly linked to emission registry systems, it is required to have an account in the emission registry system.
- **Additional information:** Both the platforms with a spot price mechanism and those of auctions have a section where additional information is provided that mainly addresses relevant issues such as climate change, carbon markets, how the purchase of emission reduction works, projects that participate in the platforms and in which users can relate to. The main difference between auction and spot price platforms is the way to provide the information. For the first one, a number of links are usually offered that direct to other websites of entities specialized in each of the topics; meanwhile, for the latter, the information is directly found in some section of the website, which facilitates the access to the information.

On the other hand, the aspects commonly found in the platforms dedicated to the voluntary emission market are:

- **Interactive material:** In order to provide greater tangibility to emission reductions, some platforms make use of interactive resources so that users can easily become familiar. Among the resources found in these types of platforms, some widgets were found in which the reduction of emissions is simulated through the purchase of green certificates. Another resource that besides being interactive provides a quantitative sense of the emissions generated is the carbon footprint calculator. In short, the operation consists in introducing some data referring to the daily activities of the users and, based on this information, an estimate of the number of tons of carbon dioxide equivalent emitted into the atmosphere due to their actions is estimated. An advantage of using this last instrument is that users have the possibility to proceed with the purchase of emission reductions based on the calculation made previously.
- **Easy registry:** Given the common barrier in all voluntary carbon markets represented by the absence of sufficient transaction liquidity, it was common to find that registering on the platforms working on this market is relatively straightforward when compared to auction or compliance platforms. In general, a form must be completed with the essential information of the buyer. On most platforms, information on projects that generate green certificates is publicly



available, as well as the seller's registry can be found on the website or through other sources.

- **Payment method:** With the same objective mentioned in the previous point regarding liquidity, it was found that some of the platforms have a way to make the payment of emission reductions very convenient. On some platforms, payment can be made directly with credit or debit cards, and it is even possible to use online payment systems, very common on websites dedicated to product sales. Payment is usually made directly to the certificate seller, when there is a sufficiently automated platform such as Carbon Offset Platform or CTX, through the corresponding payment systems. However, it is possible that the payment will be temporarily held by the platform itself, and in a short time, the funds will be directed to the certificate supplier or seller.
- **QR codes:** The use of QR codes is to facilitate access to platform information. In addition, it is possible to contact the platform managers by scanning a QR code, which redirects to the use of a messaging application. In some platforms, QR codes are used to make direct downloads of content on climate change, emission reductions, sustainability, among others.
- **Schedule:** One of the advantages of voluntary carbon trading platforms with a spot-type trading mechanism is the accessibility to purchase green certificates at almost any time. The platforms that are international and follow this market scheme generally have 24-hour service, 365 days a year. Among the platforms that offer permanent trading hours are: BVRio Platform, Carbon Offset Platform and Carbon Trade Exchange. In the mechanisms for trading green certificates through auctions, the number of annual auctions, the dates and the time at which they will be held are determined in advance. This information is previously communicated through social networks, emails or on platforms that have a relevant news section.
- **Development of carbon market simulation:** In order to establish an ETS, some governments have developed simulations of carbon markets. For the formation of the exercise, the participating sectors must be established, the greenhouse gases that will be considered, flexibility mechanisms, among other characteristics. The objective of this carbon market exercise is that once the relevant legislation has been entered, the operation and management system is ready and can be activated immediately when it is decided to adopt at regional or national level. On some platforms, there is a section where market simulations are established.
- **User tracking:** Once the registry on the platform is ready, a constant tracking is usually carried out on the actions executed. It is common that when there is an intention to make a purchase or register a new action, the system sends emails with the confirmation of the corresponding actions, for example, when there is a purchase cancellation, or the process is not completed. This allows users to be certain that the purchase process is being monitored and that the requests are constantly attended, providing reliability to the purchase process and the platform.

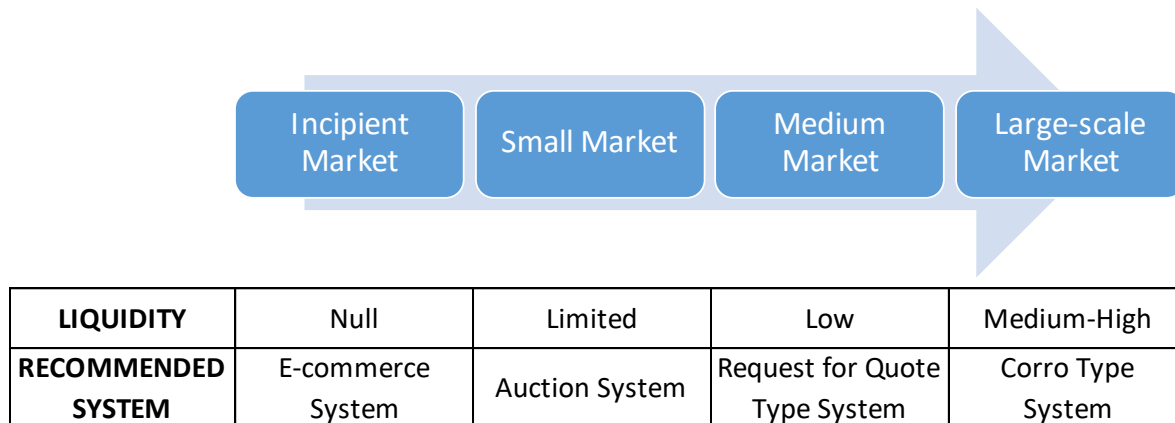
For countries and jurisdictions in which the market is in more developed states due to the implementation of ETS, it is convenient to incorporate trading platforms in which brokerage activities can be carried out operating through Request for Quote (RFQ) type computer systems, which support the conduct of small auctions, consider a time restriction for

operations and require the thrust of transactions through voice carried out by brokers. In this type of markets, it is also possible to implement Corro-type systems, through which firm quotes are disseminated, relying on the assistance of trained personnel, allowing financial intermediaries to arrange operations.

These requirements are necessary to boost the dynamism and liquidity of the market. However, in the case of Chile - where the market is incipient - the incorporation of systems of this type could be counterproductive, since their degree of complexity can act as an obstacle to the development and growth of the market. Therefore, considering the current conditions of Chile, the most convenient option for the creation of an environmental commodity marketing system is the development of a platform that works under an electronic commerce system scheme in which the different types of users can access without hourly restrictions to buy emission reductions according to their needs. Figure 4 shows an approximation of how the trading system used evolves with market liquidity as its main variable.

Despite being a simpler system than an RFQ, the design of the e-commerce system, such as the one used in Carbon Offset Platform, should contemplate a programming language capable of communicating properly with external systems, for example, registries (RAMSE) and financial intermediaries or payment methods. Likewise, it must automate and make processes more efficient, reduce time, deploy the most appropriate information to the user, guarantee the security of buyers and be easy to use and access, always ensuring the environmental integrity of the instruments.

Figure 4 Evolution of the Market System with respect to Liquidity



## 7. Interviews with International Experts

The selection of the entities to be interviewed was based on their experience derived from the management and operation of various international platforms or their specific expertise, as well as two entities responsible for managing, creating and canceling green certificates, that is, registries.

Two of the representatives consulted are involved in the platforms analyzed in this work, one is Carbon Offset Platform from the Carbon Neutral Now program, and the second is BVRio Platform. The third interviewee is the vice president and head of carbon markets at BCG Environmental Brokerage Services.

On the other hand, two entities that function as registries (and auction suppliers) for different markets and whose representatives are part of APX and IHS Markit were interviewed. These entities are closely related to standards accepted by different green certificate trading systems such as the VCS and Gold Standard.

### 7.1. Green Certificate Trading Platforms

#### 7.1.1. Carbon Offset Platform

On behalf of the Climate Neutral Now initiative of the UNFCCC, Miguel Naranjo González, Program Officer, leads the team that implemented the Carbon Offset Platform and other activities related to the promotion and recognition of solutions to climate change. Within the most relevant information obtained through an interview conducted via email, relevant information on the development and implementation of the platform was obtained. This information is presented immediately.

According to the activities carried out by the United Nations in the implementation of the Climate Neutral Now initiative since 2015, the main challenge they faced in the development of the Carbon Offset Platform was to obtain a thorough understanding of the legal basis that allowed to consolidate and operate the platform, as well as getting the required financing. In addition, another of the actions chosen to ensure the correct design was a deep search on the existing technological options since the development of computer systems for commerce is not one of the common tasks of the UN entities. One of the resolutions derived from the analysis of the possible instruments for development was that it was decided to use the open source solution for electronic commerce, called nopCommerce, which mainly serves small and medium enterprises.

In order to promote the use of the platform and after a couple of years of operation, a consultancy was hired to conduct a study on the user experience in the system. This allowed to propose a new design form with the results obtained, which turned out to be more attractive and easier to use. The result of this is the platform as can be seen today.

Regarding the choice of transactions, and because Climate Neutral Now cannot participate in commercial transactions because it is a UN initiative, a solution was sought so that payments were made directly between the seller and the buyer. Thus, it was chosen to use a PayPal plug-in to facilitate the payment method. The use of credit or debit cards is made possible by said supplement. According to experience, some companies could not make payments through this system, so later payment by bank transfer had to be developed, enabling greater accessibility for users who had problems to use cards in certain parts of the world.

In order for the platform to have an international reach, the developers considered three compelling aspects to ensure its global implementation. The first one was the language, so the platform is now available in English, Spanish and French. The other aspect was to offer more than one payment method, as described above. And the last one was to do strategic marketing because there was a very limited budget.

In relation to the registry, the Carbon Offset Platform operates directly with the CDM Registry, which contains the certified emission reductions known as CERs. The platform is linked to the CDM Registry, so it is always possible to know the number of credits available at all times, since the amount is always up to date. When payment for a credit cancellation is confirmed, the cancellation is made immediately in the CDM Registry.

The steps for platform implementation can be categorized as listed below:

- Identification and documentation of the legal basis to be able to develop and operate.
- Analysis of available technologies for its development and options to connect it with the CDM Registry.
- Process for receiving proposals from potential developers.
- Developer selection and contract.
- Development and tests.
- Launch of trial version with limited number of projects, only in English and without bank transfer. In addition, the cancellation of the credits did not occur automatically: each transaction was manually verified in case there was a problem with the new platform.
- Expansion with more projects, more languages and activation of the transfer option.
- Credit cancellation automation.

### 7.1.2. BVRio Platform

Márcio Barros, Director of Information Technology at the BVRio platform, is in charge of the information technology team and determines how market-related activities and software development should be routed. According to a series of questions, part of the lessons learned in the development of the system found on the BVRio website was obtained. Next, the information obtained is detailed.

One of the main obstacles was to establish a link with the participants, that is, between buyers and suppliers, due to the lack of obligation to acquire environmental commodities. This is due to the alignment to a voluntary market system. However, a series of advertising campaigns were developed with the objective of increasing the volume of the number of transactions. One of the premises on which these campaigns were based was the increase in the sense of environmental responsibility, and particularly on the importance of reducing emissions. Despite the efforts made, the transaction volumes continued to be small considering the case in which the market responded to public policies that provided certain obligations to various entities in matters of emissions, as exists in developed countries. The number of transactions achieved weekly is approximately less than a dozen.

There is a system of forest quotas, for which a system administered by the government of Rio de Janeiro is expected to be formed. There are expectations about the system so that quotas that can be credible and verifiable are managed. Currently, the transactions are not effective, but as soon as a certain regulation enters into force, the system will be provided with certain arrangements so that it is fully available and can comply with the needs for future trading. The payment for the number of credits obtained is managed by an entity external to the platform.

Importantly, the platform is a simulation of an environmental commodity market for educational purposes. It is not a real carbon market. It is part of a program to prepare Brazilian companies for a real market, if it develops. The companies had good acceptance of the initiative and have committed themselves to the trading experience, although to date there is no tangible horizon for the development of a real carbon market and its respective regulations.

### **7.1.3. BCG Environmental Brokerage Services**

John Battaglia is vice president and carbon trade leader at BCG Partners (where he provides services for energy and new carbon offset markets). This firm provides a wide range of services, including commodity marketing, brokerage services, information settlement and processing, as well as other secondary processes. John Battaglia is in charge of the promotion and management of carbon emissions trading businesses in North America. Below are relevant aspects that are part of the lessons learned from BCG Environmental Brokerage Services' participation in the carbon market established in California.

Regarding the way in which transactions are carried out in environmental markets, in BCG they are carried out through brokerage, which implies promoting voice transactions.

For the operation and development of a platform to be convenient, it is suggested to comply with a critical number of approximately 20 to 25 participants. In California, the number of market members is just over 100, while the annual transaction volume is close to 10 million tons of carbon. Because the number of transactions is limited, no auctions are held since a massive market is required in which transactions of considerable volumes can be made.

Some of the indications to increase the volume of transactions are: consider liquidity matters within regulations, establish that the free distribution of emission permits does not encourage buying and selling activities in the market (reducing trade possibilities), expand commercial activities to other sectors such as electricity, transport and industry, considering that the allocation of emission permits is an obstacle to trading.

It is possible to establish compatibility between different environmental instruments or commodities; however, it is a complex process. The way in which the standards are adapted would be similar to how the Intercontinental Exchange platform is managed in the standardization for emissions permit trading.

According to experience in California, during the early stages of market development, operations should be carried out close to the places of origin of the projects rather than the link with international markets. That is why in California, there is no interaction with international markets, due to low liquidity.

## **7.2. Interview with Registry Suppliers**

### **7.2.1. Lars Kvale, APX**

APX is a company that provides registries and services for managing environmental commodities that serves carbon, energy and other markets. Through its services, the necessary infrastructure for environmental markets can be established.

The registry system serves as an information repository for all registered projects. APX monitors the generation, withdrawal and cancellation of green certificates, mainly resulting from renewable energy and afforestation projects.

APX developed the Verified Carbon Standard program registry, focused mainly on voluntary carbon markets. It also monitors national GHG emission mitigation programs, for example, in activities related to the forest sector.

Through the APX VCS registry website, certificate holders are allowed to initiate the registry process, provide documents to verify the validity of the emission reductions generated and request the issuance of Verified Carbon Units (VCUs), which will be saleable certificates. Once VCUs are issued, they can be immediately transferred to any holder of an APX VCS registry account or to another VCS approved registry.

The APX VCS registry has been responsible for managing environmental commodities in Colombia and responds to the need to manage certificates from forest projects in the voluntary carbon market. In 2018, APX issued around 3 million credits.

This registry is linked to CBL Markets, an entity that facilitates transactions in environmental markets worldwide and manages the issuance of Climate Forward certificates, the first market of environmental futures developed by CAR.

Among the activities performed by APX, there is also the management of certificates for emissions mitigation according to the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Together with the International Emissions Trading Association (IETA), CAR and VCS, APX participates in the selection of the most appropriate projects for airlines to acquire GHG emission reductions as part of their sustainability commitments.

In relation to the more technical aspects of the operation of the registry, the APX Voluntary Sustainability Manager, Lars Kvale, has established that the difficulty in establishing a connection between the environmental commodity trading platforms and the registry varies according to the requirements and functional characteristics of the platform, for example, the number of users admitted, the level of automation required, the degree of complexity that exists between the way in which payments are made, etc. Kvale points out that an efficient payment system ensures a high level of automation, although this generally implies an increase in the cost of construction and operation of the system.

It also emphasizes that the size of the markets significantly influences the development time of the system. For the specific case of Chile, it would be possible to develop a registry linked to a trading platform in a matter of months (less than one year). In addition, communication between the trading platform and registry must be agile, which is possible through the selective and effective exchange of information between both parties.

The costs for registry and management services depend largely on the payment scheme selected. For example, fees can be set for certain transactions and these can be covered directly by the registry users (buyers, project developers, certificate holders etc.) or they can be subsidized by the platform.

An important consideration is that to ensure the exchange of certificates worldwide, the registries must comply with minimum requirements attached to international standards and practices to ensure connection with other registries. Otherwise, mistakes could be made as the case of European markets, where different jurisdictions used different registries that were not compatible with each other, which made it difficult to exchange certificates. In certain cases, such exchange became impossible due to the lack of similarity in the certificate information.



### *Linking with the California ETS*

The California ETS delegates responsibility for approving emission reduction project registries to the California Air Resources Board (ARB). The credits of the registries approved by the ARB Offset Compliance Protocol may not be eligible for the fulfillment of obligations under the ETS program unless they are converted to offset credits of the ARB registry. GHG emission reduction projects must be listed in an ARB approved registry. The three possible registries to perform such actions are: American Carbon Registry, Climate Action Reserve and Verra.

#### **7.2.2. Kathy Benini, IHS Markit**

IHS Markit is a firm responsible for generating registries adapted to the needs of customers and managing different types of commodities. In the framework of voluntary carbon markets, the standards with which it is linked are Gold Standard and VCS.

This company has the ability to create registries that support the simultaneous participation of several jurisdictions. It is responsible for operating the necessary software, acting as administrator and updating notifications, according to the indications of the clients. It also has the capacity to develop instrument trading platforms, since previously they have created platforms for the trading of environmental commodities through auctions. Among the activities they carry out to manage these platforms, the structuring of the auctions and their administration during the time allocated to execute them, in accordance with the indications and parameters established by the regulatory entities, stand out. They also have the ability to manage participants' questions, by adhering to pre-established protocols as to streamline procedures and response times.

IHS Markit provides marketing management systems appropriate to the indications of regulatory entities. In order to establish the required communication between both parties, the regulatory entity is provided with a version of the platform for its exclusive use through which unavoidable notices are issued at auctions.

Kathy Benini, manager and director of environmental business of IHS Markit, considers that those countries that wish to implement registries to their voluntary or mandatory trading systems in environmental commodities, should consider that the security protocols of the trading systems and registries are key factors to enable future connection with other systems, given the emergence of international trading schemes. It has been observed that when security vulnerabilities or lack of robustness in systems are detected, opportunities are closed to establish communication and exchange with other trading systems, which are not willing to compromise their own security and integrity. The case of a jurisdiction (name is omitted for confidentiality) that decided to create its own registry, which was prepared without due rigor, without the advice of authorities in the matter and unlike international parameters can be highlighted. Consequently, when trying to link such registration to registries and trading systems in other jurisdictions, this was impossible due to the lack of clear and specific information about the commodities housed in the registry itself. Consequently, consulting services provided by IHS Markit were contracted to solve compatibility problems, which raised costs considerably.

The way of linking the registry with the platform is relatively simple and, for this purpose, the development of communication interfaces is essential. Buyers of environmental commodities and certificate holders must create an account both in the IHS Markit registry, as well as on the platform. Likewise, in order to enable the registry to load the credits to the system and to transfer the securities from the account of the sellers to that of the buyers, it

will be necessary for the users to establish two separate contracts: one with the platform and the other with the registry.

When a transaction is made, the changes that must be manifested both in the registry and platform take a few seconds to appear in case the degree of automation of communication systems between the platform, the liquidator and the registry is high. However, this may be delayed if the liquidator takes time to issue the sale and settlement signal. IHS Markit does not provide settlement services, so a third party must be used in that case.

If it wishes to accept credits from different registries (for example, the CDM registry), it is possible to convert them, as long as they are canceled in the original registry. Only after the cancellation has been made, credits can be issued in the new registry in which they will be allocated.



## 8. Lessons Learned

Based on the analysis carried out in the comparative matrix, and also considering the aspects mentioned in the previous section, which addresses the best practices found in the platforms, a series of lessons learned were obtained that will help to design a web platform with the characteristics required to meet the objectives of this work.

In the case of jurisdictions, whose intention is to implement sophisticated carbon pricing instruments and for emerging economies, it is advisable to initially promote the voluntary offset of carbon dioxide emissions. This is a first step that can be made towards the transition of more complex carbon pricing instruments.

Voluntary trading systems are based on the use of emission reductions, which can be acquired to meet the objectives of companies or organizations to neutralize their carbon footprint. In the case where there is an emissions trading, these reductions are also used as a mechanism that gives the system versatility. However, in an emissions trading system the main instrument exchanged is the emission permits. Table 8 describes the difference between these instruments and the market to which they belong.

Table 8 Emission Reductions and Permits

Instrument	Description	Market
<b>Certified emission reductions</b>	The emission reductions are used for offsetting emissions, being able to mitigate (offset part) or neutralize (offset all) the carbon footprint.	Voluntary carbon market Flexibility mechanism in the framework of a regulated market, such as ETS and/or Carbon Taxes
<b>Emission permits</b>	Permits are the certificates issued by a regulatory body, which are intended for certain sectors/entities and that are within the limit defined by the regulator.	Emissions Trading System

Voluntary offset begins with the estimation of the carbon footprint generated by activities of individuals or entities. Then a project that issues green certificates is chosen. These green certificates are acquired by the interested party and represent the reduction of number of tons of CO<sub>2</sub> equivalent, which were initially estimated. By canceling the credits in the registry, a neutralization of the environmental impact in terms of GHG emissions is ensured. It is a common practice to issue a certificate given to the person or entity specifying the number of tons of GHG offset and the reason.

The objectives of the projects that generate carbon offsets are:

1. Collection of tons of CO<sub>2</sub> equivalent in different activities, through the purchase of certified emission reductions to projects that serve as GHG sumps, for example, the care of ecosystem services.

2. Avoid the emission of GHG through support for sustainable projects that are within the most polluting sectors, such as those involved in power generation and that can be reduced through energy efficiency and clean energy use.
3. Conversion of high impact GHG to CO<sub>2</sub> emissions to reduce the potential contribution to the increase in the average temperature, for example in sanitary landfill projects where, in addition to collecting the methane produced, it is used leaving a carbon footprint significantly lower.

Among the projects that are listed in the different platforms of voluntary carbon markets, it is a common practice that the projects are certified by international standards such as Gold Standard, Voluntary Carbon Standard, Clean Development Mechanism or Live Plan, among others.

In the comparative matrix of platforms, those that operate under a voluntary market scheme have a spot price trading mechanism. Take into consideration that the spot price or current price is the one awarded to a product or service, which has been agreed for transactions immediately.

Addressing economic issues, it is crucial that the election and determination of the amount charged as commission for purchasing emission reductions are low, so that the liquidity of the system is not compromised, in addition to the payment process being simple and intuitive. From a couple of voluntary trading platforms, it was observed that the payment method is another important factor that influences users' decision to neutralize emissions. For example, by using online payment systems that allow bank transfers between a bank account and the system, or by using credit or debit cards. There are differences between the information requested for legal and natural persons. This information is duly detailed in the "Buyers" section.

On the other hand, because the public to whom the emission offsetting system is directed is an audience that seeks a fast and effective service, it has been noted that in most platforms there is a synthetic and pleasant way, in which the rules and the mode of operation are communicated. There are even operation manuals presented in infographics or flowcharts, which allow a timely description of how the voluntary market works and/or the instructions for purchasing emission reductions from listed projects.

Another feature that was frequently registered for the update of the information is the implementation of a panel or a section located on the main page of the platform where the most relevant news are announced, and also on the projects listed. One of the reasons for placing this section on the homepage is that users do not have the need to open new windows or tabs in internet browsers, so as to facilitate the dissemination of information.

Most of the platforms studied had a good rating in terms of their use from different browsers. Except for an exception in which the response time was increased when it was changed from one browser to another, that is why the importance of the response time should not be minimized considering the average download and upload speed of data in Chile.

Regarding the multiplatform parameter that was studied in the comparative matrix, a small percentage of the websites analyzed were capable of running optimally from different devices besides computers, such as electronic tablets or smartphones. Given the frequency in the use of these devices and the diversity of the public to whom the platform is intended to be directed, it would be very convenient to allow their use from all types of devices.

Regarding the intention of linking the platform to international markets, it would be appropriate to develop two versions of the system: one in the native language and one in English, for interested users outside the country who do not speak Spanish. In some

situations, the translations of the platforms are not complete, that is, once the option to change the language and display the content in English is selected, the information is altered exclusively for informational purposes. However, it is recommended that a complete translation be performed so as not to limit potential users who have full access to the platform from different regions.

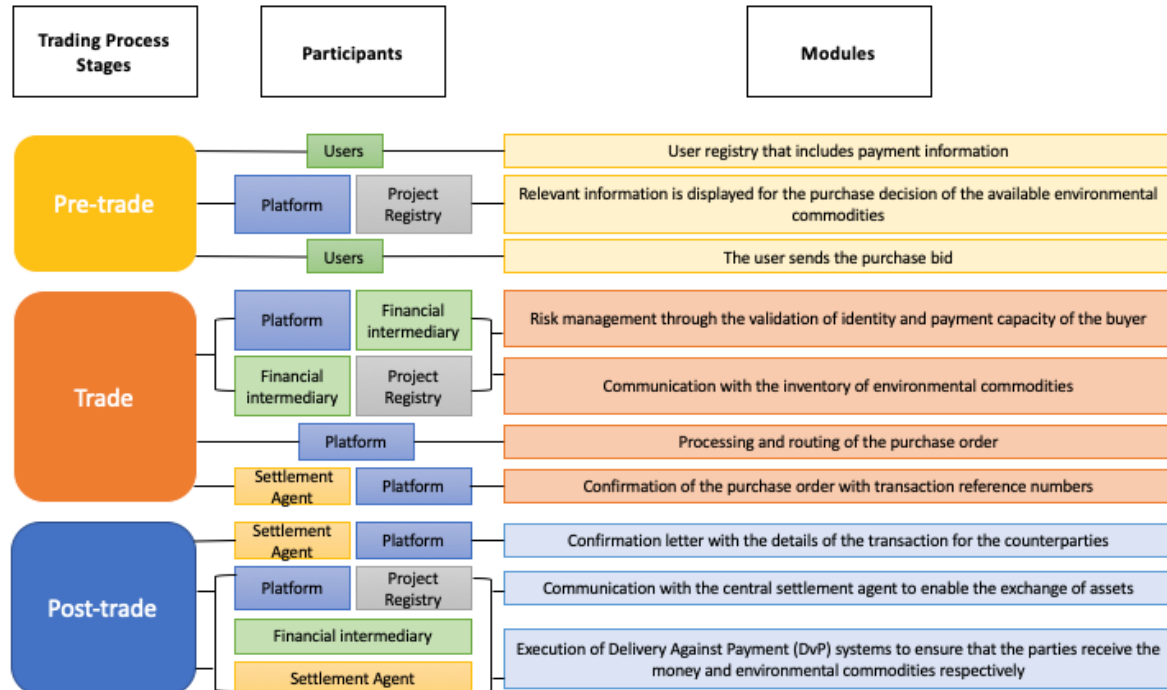
One possibility to facilitate the search for projects within the platform is the use of filters to make a selection of specific characteristics, which can be searched by users. These filters could be located at the top of the set of projects, and can be used to identify, for example, those that are in a price range, specific sectors, geographic location, standard, etc.

In addition to the previous points, if the users of the platform are individuals that are little related to the offsetting and/or neutralization of emissions, it would be convenient to generate a more tangible feeling about the effects of carrying out such actions in order to encourage the use of the system. This could be achieved through the use of infographics, videos or interactive sections, in which it is possible to visualize the number of tons of emissions to offset, and relate them to illustrative equivalences of real situations such as fuel savings in means of transport or the reduction of energy consumption.

## 9. Green Certificate Trading Process

Regardless of the transaction mechanisms chosen (spot price and auction), stages, stakeholders and modules that interact in the trading process and that will carry out different processes in the different stages that comprise it can be distinguished. In Diagram 2, the different stages are shown, as well as the modules that compose them.

Diagram 2 Stages and Modules in the Green Certificate Trading Process



### 9.1. E-commerce System

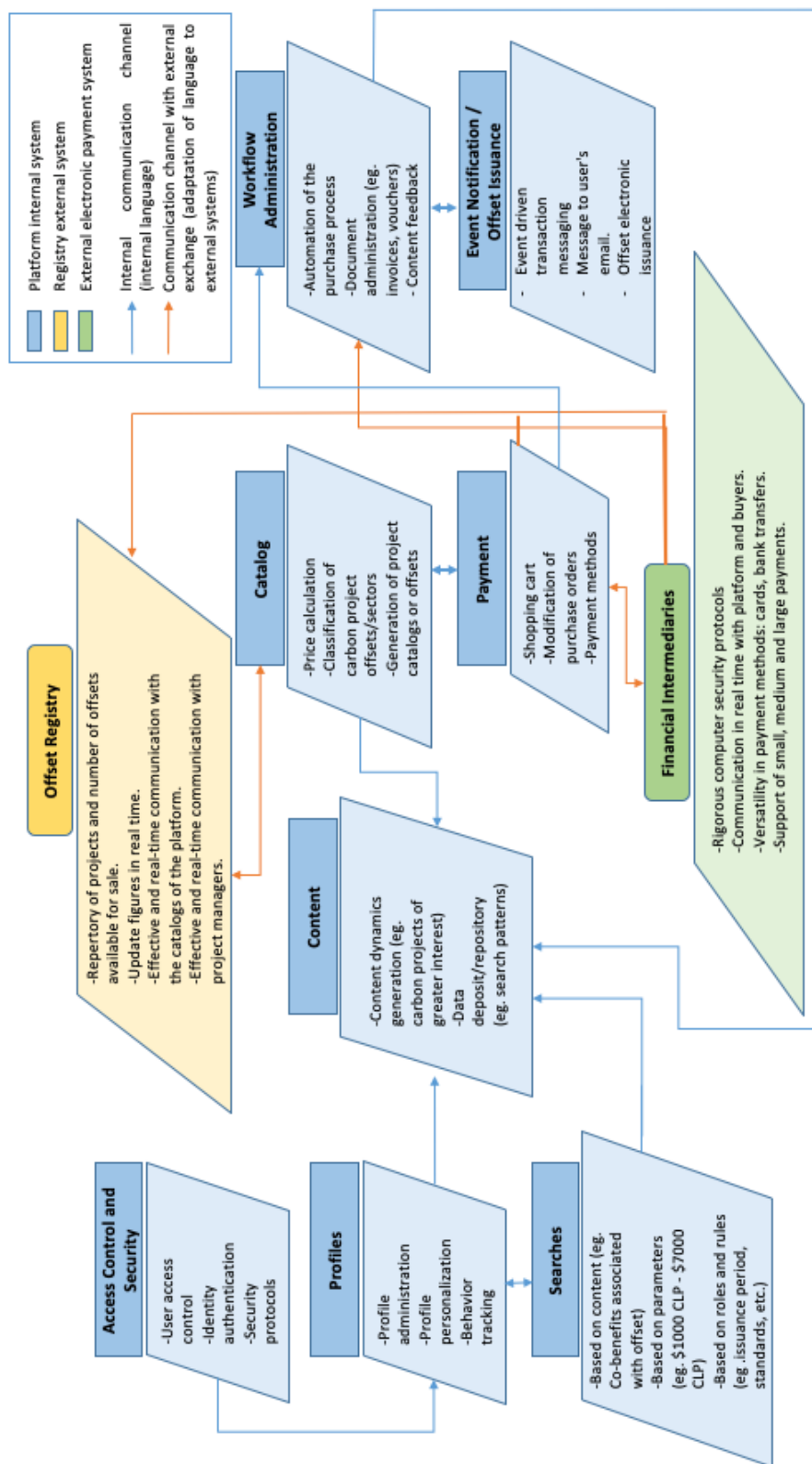
Given the conditions of the current Chilean context, and the analysis derived from the platforms, it is recommended the development of a voluntary spot emission offsetting system in its beginnings, so it would be convenient that the elements that make up the system are those similar to an e-commerce platform. These elements can be classified into three: those related to the internal system of the platform, the external system of the registry and the external system of electronic payment system.

Among the elements related to the internal system of the platform are: access control and security, user profiles, searches (which may be based on content, parameters or roles and rules), content, project catalog, payments, workflow management and transaction consolidation notification.

On the part of the external registry system, there is one of the main parts of the platform that is the offset registry, in which the projects and number of available offsets, the updating of figures in real time, the communication with the catalogs and with the project managers must be included. In relation to financial intermediaries, rigorous computer security protocols, real-time communication with platform and buyers, versatility in payment methods, and support for small, medium and large-scale payments should be considered.

The following diagram presents a concept map where the connection that allows the flow between each stage of electronic commerce, as well as the unidirectional/bidirectional interaction between each of the elements that compose it to ensure the proper functioning of the system can be visualized.

Diagram 3 Concept Map of the Operation of the Platform for an E-commerce System.



## 9.2. Payment Process

In a web platform where projects that have been certified by international standards are listed, the payment method can be made through electronic payment systems or by bank transfer to the managing entity. Next, a detailed description of the main characteristics of two alternatives is made.

### 9.2.1. Electronic Payment System

The exchange of money is done through the transfer between buyers and through an authorized entity that has previously been authorized. There are two main ways to make online payment: electronic money and connection with the user's electronic banking.

#### ELECTRONIC MONEY

There are companies that act as intermediaries between transactions such as SafetyPay or PayPal. They are usually used when the amount that covers the cost of the product is not significantly high. In addition, there are online payment systems that work in trading systems that are useful for auctions. The procedure of these payment systems is as follows:

1. When the buyer wins an auction or purchases a product, the payment is made using the online payment interface.
2. The money is automatically transferred between the bank account and the online payment system. The money stays temporarily in the user's account.
3. The transfer of funds is made from the buyer's account to the seller's account, which can leave the funds in its online payment system account or transfer to its bank account.

Some of the advantages of using online payment systems are:

- Possibility of selling small volumes, since in voluntary markets it is a recurring situation, mainly where projects that emit GHG emission reductions participate.
- Fast electronic payment systems, since the transfer within the system is done immediately and generally the transfer between the bank and the system does not take more than 24 hours.
- Privacy on account of online payment systems. User banking information is not shared with projects that issue green certificates .

However, there are some considerations that should be reviewed before deciding to use electronic payment systems, for example:

- Commissions established by suppliers of electronic payment systems. Usually there are packages that favor the decrease of commissions when the transaction volumes increase.
- User identification and registry of where resources are generated for the purchase of instruments.
- Possibility of requiring a developer to integrate the electronic payment system to the web platform.

## ELECTRONIC BANKING CONNECTION

In this mode, the bank generally allows the use of an interface that is deployed at the time when users make the payment corresponding to the amount of tons of carbon reductions. It is common for banks to generate a periodic collection depending on the agreement established.

Information on the credit or debit card that will be used to transfer funds is requested in the interface. The required data commonly are:

- Cardholder Name
- Card Number
- Security Code
- Expiration
- Address
- Contact Information

This procedure is also used in the electronic money mode, where funds are transferred from the user's bank account to the user's account on the online payment system site.

### 9.2.2. Bank Transfer

This modality is functional when the amount of the transaction to be carried out is significant. The process is completed following the procedure listed below, which must be preceded by the linkage made by the settlement agent.

1. Determination of the number of green certificates (energy efficiency, renewable energy or emission reductions).
2. Total cost calculation by the managing entity of the platform. The total depends on the price set by the developers of the projects (or green certificate holders) that considers the associated costs, including their incursion in the registry.
3. Preparation of invoice voucher to send to users interested in acquiring any of the instruments. This includes three components for the calculation of the total amount:
  - Cost per total number of instruments purchased
  - Commission retained by the managing entity of the platform
  - Transaction taxes
4. Sending fiscal data and bank account to the settlement agent.
5. The user makes the bank transfer by the method that suits it best.
6. The settlement agent issues the payment to projects that issue green certificates for the corresponding amount.
7. If any, the commission of the managing entity is received and retained in its bank account.
8. The project managers assign ownership rights to the users who acquired the instruments.



When the bank transfer system is used, there is a notable advantage: the identification and tracking of users and registry of the activities from which the resources for the purchase of instruments come, for example, if tax identification data or some other document is requested proving identification.

### 9.3. Trading System Elements

The platform is part of a trading system in which different elements and participants are involved, which will be essential to facilitate the process of buying and selling green certificates.

The main participants in a system to trade green certificates interact in different ways allowing the flow of information between each of them. The existing generic interactions, regardless of the payment method chosen, between the participating entities are illustrated in the following diagram. However, it is important to point out that variations can occur both in the communication routes and the exchange capacity in a unidirectional or bidirectional way, depending on the capacities of the participating entities.

Diagram 4 Elements of the Green Certificate Trading System and Fundamental Interactions



The participant elements of the trading system for green certificates are listed below, as well as a brief description of each.

- **Buyers:** They show interest in acquiring instruments. In addition, in a regulated market derived from public policies, they are forced to fulfill certain responsibilities determined in the legislation.
- **Web platform:** It is the point of contact between the buyers and the rest of the participants in the trading system. It will allow users to visualize the available projects and instruments, initiate the purchase order, provide the necessary data to order the transfer of capital for the acquisition of certificates and receive confirmation of purchase and ownership.
- **Settlement agent:** Its functions can be limited to corroborating that the buyers receive the acquired instruments and that the sellers receive the money for said instruments. It can also safeguard the values.
- **Project registry:** Entity in charge of listing the existing projects and corroborating the environmental integrity of the projects with the independent third parties and the developers of the projects to proceed with the registry and issuance of instruments. In addition, it is responsible for canceling certificates and keeping track of the number available and the traceability of those that have been acquired.
- **Certificate holders:** They are the agencies that carry out various activities that respond to objectives of environmental mitigation actions such as, use of renewable energy, energy efficiency and GHG emission reductions through which the traded instruments are generated. Users or entities that acquire green certificates through, for example, auctions and wish to market them in the future are also included.
- **Financial intermediary:** It is the component that allows the connection between users who buy certificates through the web platform and banks. In electronic commerce systems the two main alternatives are banking interfaces (virtual financial entities provided by banking institutions) and electronic money (systems that validate money deposits and organize the transfer to different accounts belonging to the same system).
- **Banking institution:** Entity that protects the money of buyers and ultimately enables and executes the capital transfer.

#### 9.4. Interactions between registries and other elements of the trading system

As mentioned in the market elements section, the registry has an outstanding role both in the market and the trading system. Consequently, this subsection discusses its main interactions with the other elements of the system.

The registry will have to constantly interact and exchange information with the other stakeholders of the trading system to enable the buying and selling process. The following diagram shows the main interactions.

The diagram illustrates the architecture of the Project Registry system, showing the flow of information and instruments between various entities:

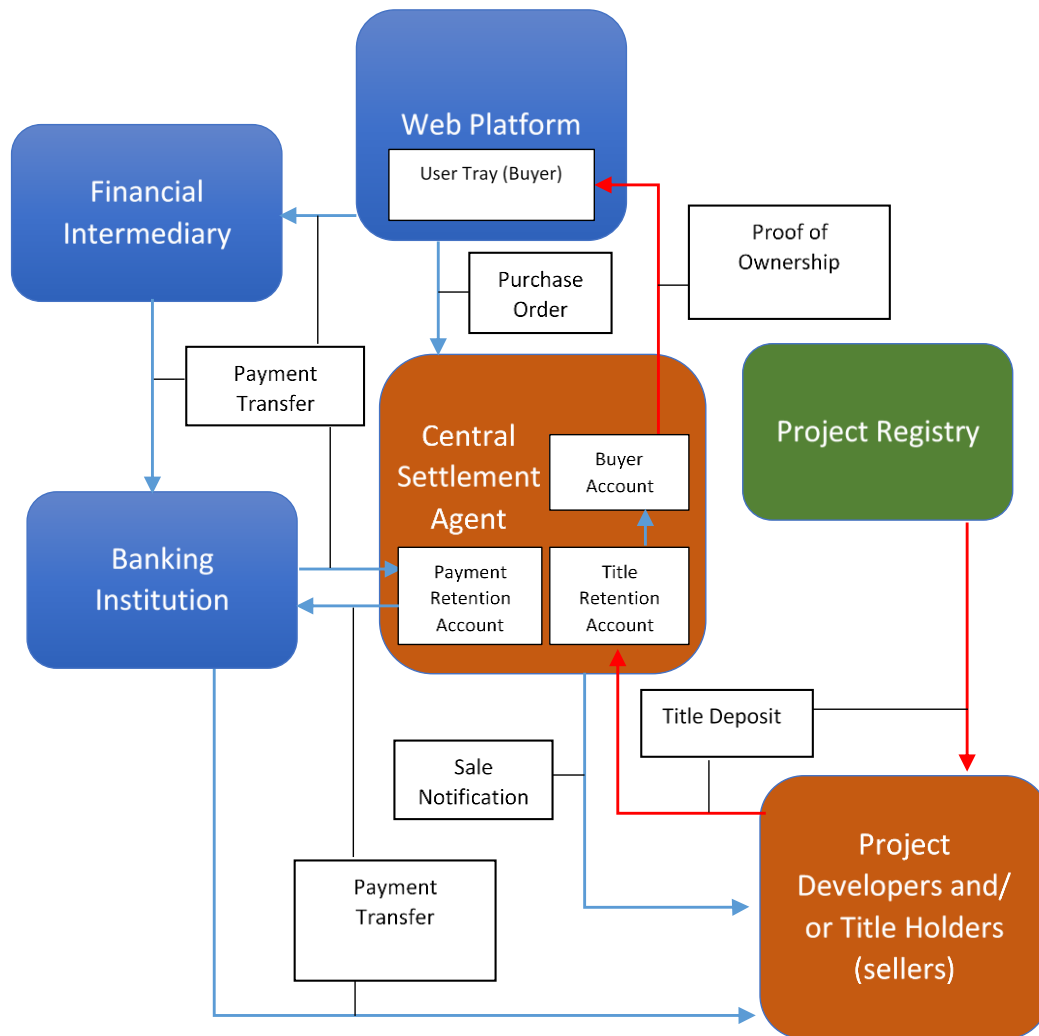
- Information on available projects and the number of instruments for sale** (White box) provides data to the **Web Platform** (Blue rounded rectangle) and the **Project Registry** (Green rounded rectangle).
- The **Web Platform** interacts bidirectionally with the **Central Settlement Agent** (Orange rounded rectangle).
- The **Central Settlement Agent** interacts bidirectionally with the **Project Registry** and the **Project Developers or Instrument Holders (sellers)** (Orange rounded rectangle).
- The **Project Registry** interacts bidirectionally with the **Project Developers or Instrument Holders (sellers)**.
- The **Project Developers or Instrument Holders (sellers)** interact with the **Instrument Deposit** (White box) and the **Banking Institution** (Blue rounded rectangle).
- The **Instrument Deposit** interacts with the **Central Settlement Agent** and the **Project Developers or Instrument Holders (sellers)**.
- The **Banking Institution** facilitates **Income Transfer** (White box) to the **Project Developers or Instrument Holders (sellers)**.
- The **Banking Institution** also interacts with the **Central Settlement Agent**.
- Independent Third Parties (validators/verifiers)** (Blue rounded rectangle) receive information from the **Project Registry** and the **Project Developers or Instrument Holders (sellers)**.
- The **Independent Third Parties (validators/verifiers)** provide an **Information exchange** (White box) for:
  - List projects
  - Register projects
  - Issue instruments
- The **Information exchange** interacts with the **Project Registry** and the **Project Developers or Instrument Holders (sellers)**.
- The **Project Developers or Instrument Holders (sellers)** send **Sale Notification** (White box) to the **Central Settlement Agent**.

Likewise, the registry must maintain a constant and bidirectional interaction with independent third parties (which includes validating and verifying entities of the projects), as well as with the project developers themselves or holders of green certificates to exchange the necessary information to list the projects, continue with the registry process and finally issue instruments (whatever the emission scheme). These interactions do not present alternatives either.

In a first scenario, the transfer of instruments and capital to the liquidator is considered so that it can exchange assets. This scenario can follow two routes.

A first route for the development of the transaction is that after receiving the purchase order of instruments by the platform and the payment of the respective issuance fees, the registry transfers the instruments to an external account to the settlement agent owned by the developers of the projects or any entity that is credited as the owner of the certificates. In this order of ideas, to enable the settlement agent to specify the exchange of assets, it would be necessary for the owners of the instruments to transfer the securities from the account in which the registry previously transferred the commodities, to an account provided by the settlement agent in which this entity could retain them. From that account, the liquidator would have to transfer the proof of ownership to the buyers and send to the developers or previous owners a notification about the sale. Likewise, it would have to receive and retain the capital provided by the buyers and transfer it to the sellers' domain. The described process can be visualized graphically in Diagram 6.

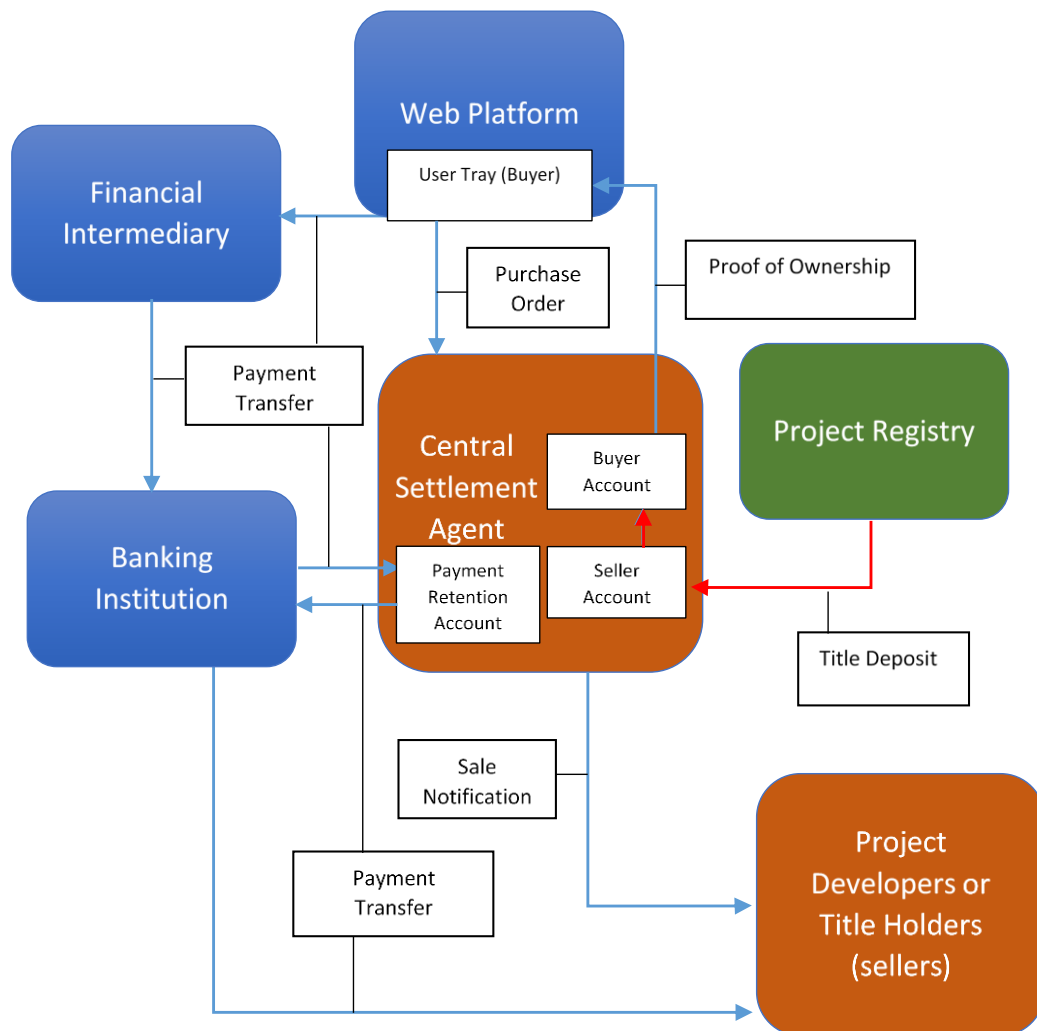
Diagram 6 First possible route of interaction between the registry, the settlement agent and the rest of the elements that make up the system



The second route, which avoids triangulations and therefore is recommended as the most efficient, considers the direct transfer of the instruments issued by the registry (in whole or a portion thereof) to an internal account in the liquidation entity owned by the certificate holder. The settlement agent should have the power to make transfers from the account of the original owners of the securities to another internal account owned by the buyers, once they have received the purchase order and the respective payment.

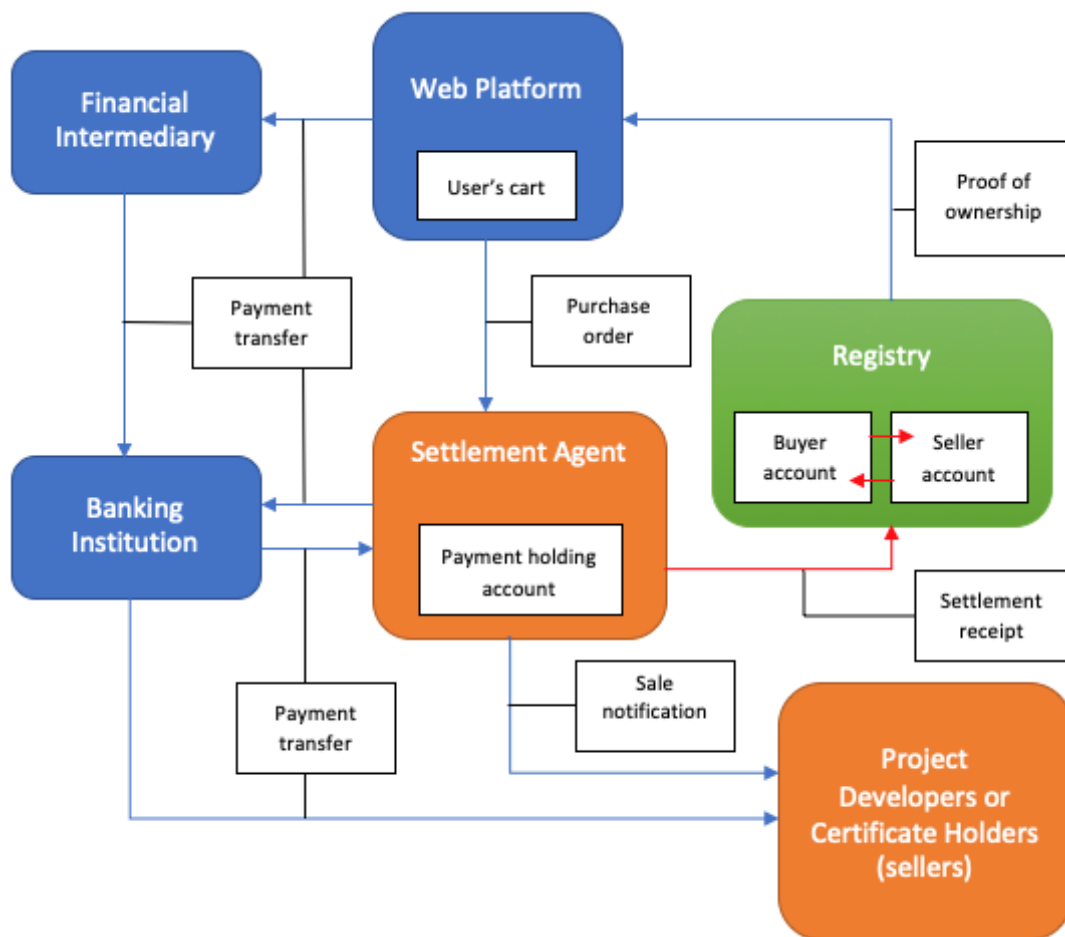
It would also have to make the transfer of money from the payment withholding account to a bank account of the sellers of securities, to send to the buyer, through a communication system with the web platform, the proof of ownership of the instruments acquired and notify the sellers about the sale. This procedure is represented in Diagram 7.

Diagram 7 Second possible route of interaction between the registry, the settlement agent and the rest of the elements that make up the system



The routes concerning the payment and exchange of assets have been described in the event that the settlement agent functions as a depository with the ability to exchange assets. However, it is necessary to consider a third route in which the transfer of assets is made directly in the registry from the seller's account to the buyer's account. The settlement agent is only limited to informing the registry that it has received the capital paid for the commodities through a settlement voucher. Once this voucher has been received, the registry proceeds to transfer assets from one account to the other. In this sense, it would not be necessary for a deposit of the securities to be made from the registry to the settlement agent. This is illustrated in Diagram 8.

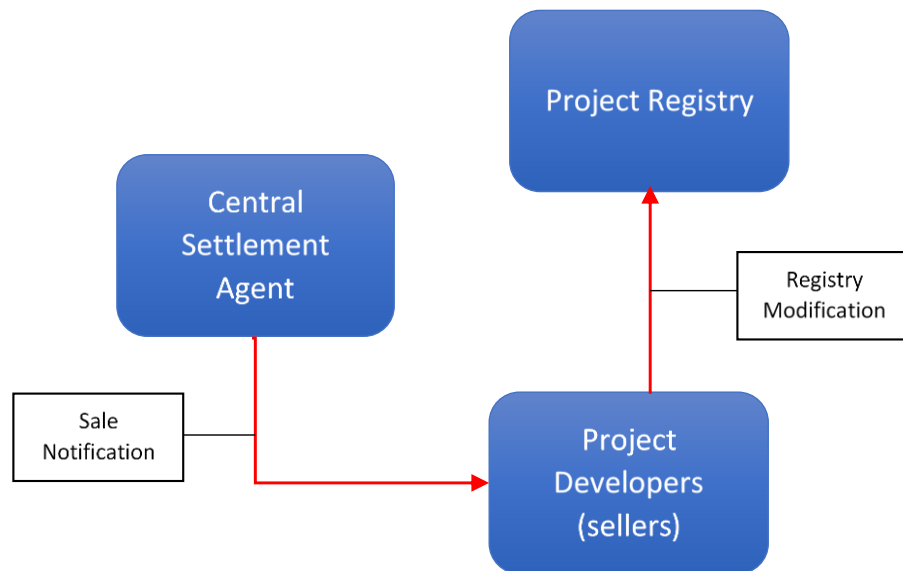
Diagram 8 Third possible route of interaction between the registry, the settlement agent and the rest of the elements that make up the system



On the other hand, there are different routes through which the ownership changes derived from the transactions in the registry will be reflected. Similarly, this process can follow two paths.

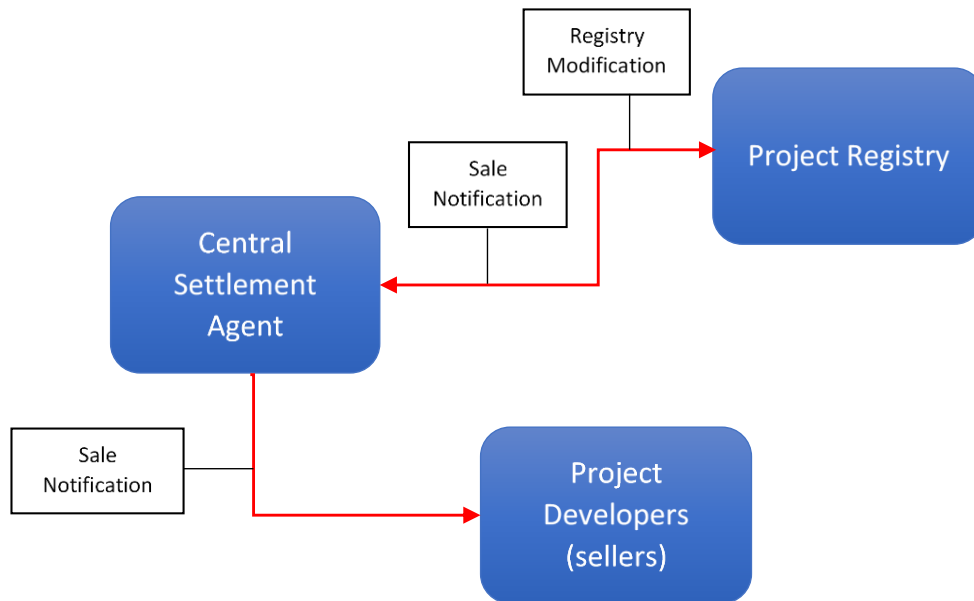
The first route refers to an indirect communication between the liquidator and the registry, using the project owners or certificate holders as an intermediary. Thus, when a sale is finalized, the liquidator must send a notification of sale to the intermediaries and these, by express diligence agreed in advance, must enter directly into the registry to capture the changes derived from the sale. This interaction is illustrated in Diagram 9.

Diagram 9 First possible route of indirect communication between the settlement agent and the registry



The second, more convenient for the reduction of steps, implies a direct communication and incidence of the liquidator to focus on the registry, so that when a sale is made, the liquidator sends a sales notification to the registry (independent of the notification given to developers and/or owners of the project or certificates for informational purposes only) so that it makes the relevant changes without the need for intermediation of the owners. This would imply a high degree of integration between the systems with which the registry operates and the settlement agent's own systems, which in turn is seen as a possible but complex task. This interaction is illustrated in Diagram 10.

Diagram 10 Second possible direct communication route between the settlement agent and the registry





## 10. Platform Requirements Survey

### 10.1. Security Requirements

When designing the security of a web application, a good practice is to follow a security standard such as the one established in Application Security Verification Standard 4.0 (OWASP Foundation, 2019), in which the best practices of authentication, session management, access control, data protection, etc. are defined. It is necessary to mention that, no matter how secure an application is, the responsible use of each user's credentials should be reinforced, since these are the ones that grant access to confidential information and to the performance of restricted actions.

### 10.2. Functional Requirements

Based on the first background check regarding trading platforms and expert opinions, the functional requirements that the platform must meet are divided into three stages, which can be developed incrementally over time as required:

1. Publication of offers and coordination of transactions by a settlement agent.
2. Incorporation of automated transactions (Spot Market).
3. Auction incorporation.

The functional requirements for a first stage are presented below:

Table 9 Functional Requirements, First Stage

Requirement	Description
User Registry	Users can register on the platform, being necessary to establish a registry protocol for each type of user. In this regard, a registry that requests information and supporting documentation should be considered if necessary.
User Management	Administrators can create and deactivate users, in addition to assigning roles.
Project Management	The platform will allow the administration of the different projects whose emission reductions will be available for platform trading.
Bid Management	This will depend on the type of mechanism to consider in the market (auctions, spot or mixed price).
Verification with certificate registry	The bid verification process can be automated for those green certificates that come from green certificate registries (for example.: RAMSE).

Requirement	Description
Setting	The administrators of the platform will have access to a system setting module, in which they will be able to modify some aspects of their operation.
Reports	Reports on the published certificates can be accessed through the platform.

If automated transactions on the platform are considered, the following functional requirements are added to those established above:

Table 10 Functional Requirements, Second Stage

Requirement	Description
Communication with certificate registry	In cases where the platform has a direct connection with a certificate registry, automatic transactions must be notified to the registry, to keep its availability updated. In addition, if the registry is the one that issues the certificate, the platform must send it to the buyer. In addition, the possibility of automatically publishing the certificates that are generated in these registries can be considered.
Purchase and payment management	The platform must provide the means to facilitate a buying user the selection of certificates to buy and the payment associated with each transaction.
Reports	Reports on transactions made through the platform are included.

Finally, when it is considered convenient to incorporate the realization of auctions through the platform, the inclusion of the following functional requirements should be considered:

Table 11 Functional Requirements, Third Stage

Requirement	Description
Auction management	The platform will allow auction programming by an Administrator, at the request of a Seller.
Document and requirements management	For the publication of offers and participation in auctions as a buyer, users must prove compliance with the required requirements (for example, monetary guarantees to ensure the seriousness of the offers made). The platform must require these documents and notify the Administrators of the platform for validation and authorization.

### 10.3. Nonfunctional Requirements

Based on the first background check regarding trading platforms and expert opinions, the first nonfunctional requirements of the trading platform are identified:

Table 12 Nonfunctional Requirements

Requirement	Description
Usability	Easy for the user to use the system and navigate through the web pages and modules considered.
Navigability	Operation of the platform in all modern and most used browsers (Firefox, Chrome, Explorer version 11 or higher and Safari, etc.).
Responsive Design	The information on the platform must be correctly displayed both on mobile devices and on laptops and desktops, from a functional and aesthetic point of view.
Editorial Line Adjustment	The editorial line adjustment must be defined in conjunction with the platform operator.
Payment Gateway Connection	This will depend on the payment alternatives that can be used to carry out the type of transactions that will be performed on this platform.
Logging	Include Event Logging System (Logging), keeping track of all events that occur in the execution of the program (Errors, Warnings, etc.).
User Traceability	Include user traceability, keeping track of user events (time of entry, access, modification, deletion, printing, export).
Connection with Registry Platforms	It will be considered to connect the system to various registry platforms, among them is the RAMSE platform currently managed by the Ministry of Energy. So that the publication of offers of green certificates is more expedited when they are registered and verified. This will depend on the feasibility of coordinating the development of this feature by the different administrators of this type of platforms.
User's Guide	The development of online documentation will be considered.
Frequently Asked Questions	To the extent that the system is tested, and during the period of white march, users' frequent questions regarding the use of the platform should be collected.
Contact Form	The platform must have a contact form so that people can make inquiries to the administration of the platform.

## 10.4. Technological Requirements

The technological requirements of the platform will depend on the infrastructure of the organization in charge of its administration, and its technology use policies. The following aspects must be defined:

Table 13 Technological Requirements

Category	Examples
Operating System	<ul style="list-style-type: none"> <li>• Windows</li> <li>• CentOS</li> <li>• Ubuntu</li> </ul>
Programming Language and Framework	<ul style="list-style-type: none"> <li>• C#: .NET Core 3.0, .NET Framework 4.5, etc.</li> <li>• php: Laravel, Zend, etc.</li> </ul>
Web Server	<ul style="list-style-type: none"> <li>• IIS (Windows Server)</li> <li>• Apache</li> <li>• Nginx</li> </ul>
Database	<ul style="list-style-type: none"> <li>• SQL Server</li> <li>• MySQL</li> <li>• PostgreSQL</li> <li>• MongoDB</li> </ul>
Additional Technologies	<ul style="list-style-type: none"> <li>• RabbitMQ (<i>Message Broker</i>)</li> <li>• Redis (<i>Distributed cache, Database or Message Broker</i>)</li> </ul>
System Architecture	<ul style="list-style-type: none"> <li>• Microservices</li> <li>• Monolithic</li> </ul>

As an example, two common settings are presented below:

Table 14 Common Settings, Example 1

Category	Examples
Operating System	Windows Server 2008 R2
Programming Language and Framework	C# .NET Core 2.2
Web Server	IIS
Database	SQL Server 2012
Additional Technologies	Redis
System Architecture	Monolithic, MVC

Table 15 Common Settings, Example 2

Category	Examples
Operating System	CentOS (Linux Distribution)
Programming Language and Framework	php 7
Web Server	nginx
Database	MySQL 5.7
Additional Technologies	Redis
System Architecture	Monolithic, MVC

In the absence of restrictions that determine the choice of any particular technology for the development of the system, the choice of paid technologies or open source technologies must also be taken into account, since the difference in costs can be significant.

### 10.5. Operational Requirements

In order to ensure the proper functioning of the platform, the organization responsible for its operation must provide and pay for the following resources:

- A server that meets the technological requirements established in section 10.3, and that has the following hardware requirements:
  - Processor: 4 cores, 2 GHz
  - RAM Memory: 8Gb
  - Storage: 80Gb, SSD
- Stable internet connection and fixed IP.

- An SMTP for communicating the platform with its users through email.
- A DNS through which users will access the platform on the internet.
- The license of all libraries and payment software required for the operation of the system.

## 10.6. Platform Design

### 10.6.1. Users, Roles and Permits

Based on the first background check regarding trading platforms, the following users are identified:

Table 16 Platform Users

Role	Entity	Description	Functions/Permits
<b>Administrator</b>	Settlement Agent	Responsible for the administration and operation of the green certificate trading platform.	1. Validate the information of the new projects entered to the platform, when necessary. 2. Update informative content of the platform (news, articles, etc.).
<b>Seller</b>	Green Certificate Holder	This type of users is responsible for managing the offers associated with a project.  They publish the information of projects and their green certificates.	1. Publish projects. 2. Publish green certificate offers.
<b>Buyer</b>	Natural or Legal Persons	Users interested in acquiring the green certificates offered on the platform.  They review the offer of green certificates and request the purchase of green certificates of those projects that are of interest.	1. Review the offer of green certificates on the platform. 2. Contact the sellers regarding the offers in which they are interested.

Role	Entity	Description	Functions/Permits
<b>Anonymous</b>	Natural or Legal Persons	<p>This type of user can view all the public information available on the platform.</p> <p>It corresponds to an unauthenticated user, being able any user, without credentials, to access the web platform through the internet. They can be potential buyers, sellers, or people who want to find out about the operation of the trading platform or the current or historical offer, among others.</p>	<ol style="list-style-type: none"> <li>1. See offer and historical information of the Spot and auction markets.</li> <li>2. See public information of the projects published on the platform.</li> </ol>

## 11. Digital Model

The development of a digital model allows to give graphic support to the requirements of an information system in a general way, facilitating user feedback regarding their design evaluations and usability level. Thus, being a preliminary sketch of what the system interface would be like, a digital model allows to evaluate the navigability and usability status before starting the development stage.

The digital model and modules of the trading platform are developed based on the functional and nonfunctional requirements identified, the information gathered regarding international experiences and other trading platforms, the users/roles identified (considering that each profile has different levels of access permissions, which determines the information that can be displayed and the actions that each type of user can perform) and the general process identified.

The development of the digital model is mainly based on the use of languages such as HTML and CSS, as well as (open source) frameworks such as Bootstrap 4 and MDBBootstrap.

The proposed digital model is available for viewing in the following link:

- <http://gctrade.sqlms.com/>

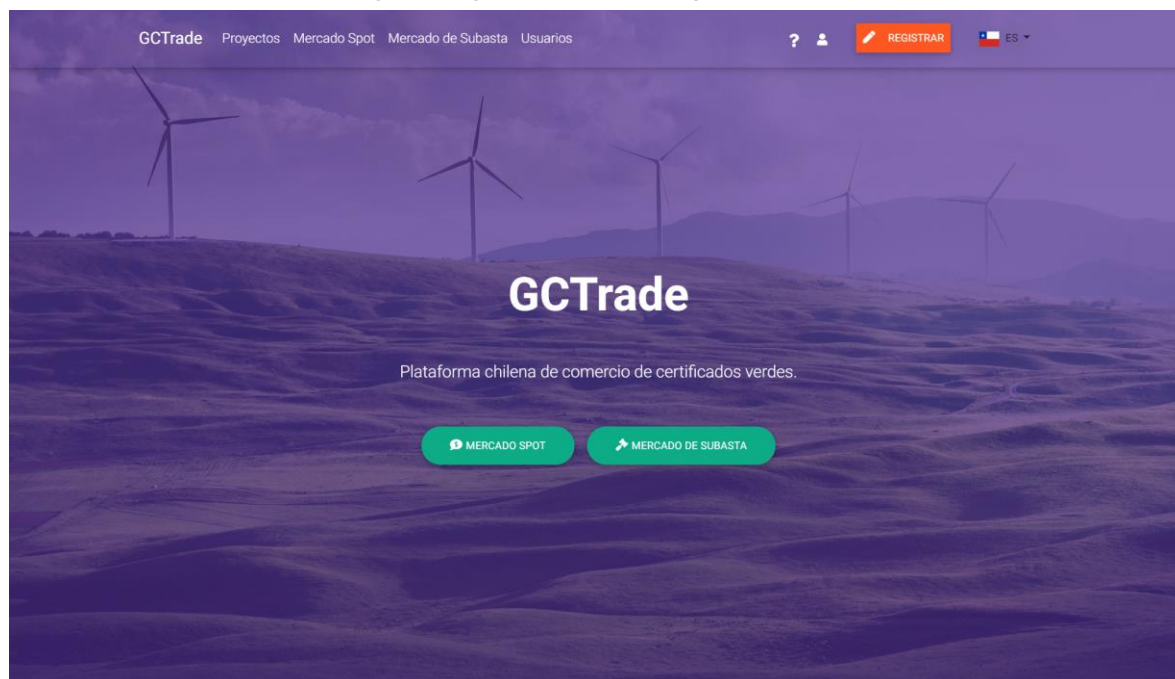
### 11.1. Platform Description

#### 11.1.1. General Description

The proposed digital model is developed with a focus on user experience, aiming to be intuitive and attractive.



Figure 5 Digital Model, Homepage, Initial View

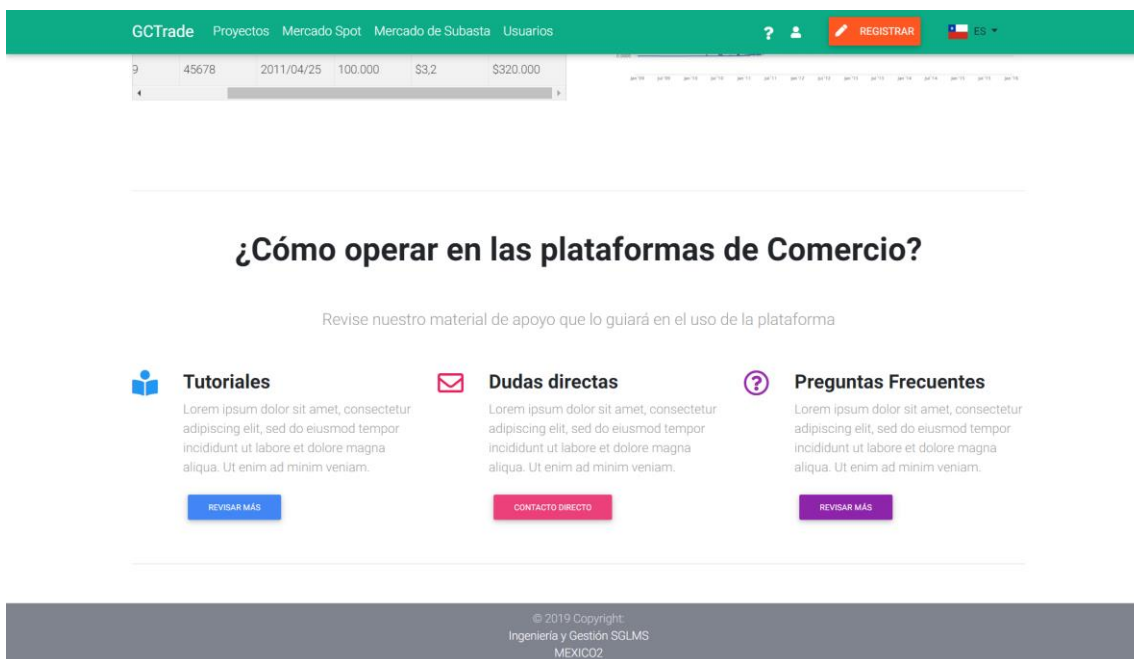


Therefore, the digital model proposed for a trading platform considers a main section that details the main projects under execution, news related to the platform and markets in general, access to help material, among other aspects of general interest of the platform.

Figure 6 Digital Model, Main Page, Recent Projects.



Figure 7 Digital Model, Main Page, Access to User's Guides



The navigation menu allows access to the main modules of the platform, to a view that allows the review of the information and management of the user account, the language change functionality and the new user registry forms, which contains two subsections:

- Buyers.
- Sellers (or certificate holders).

### 11.1.2. Main Modules

The model is designed based on modules that allow managing different key aspects:

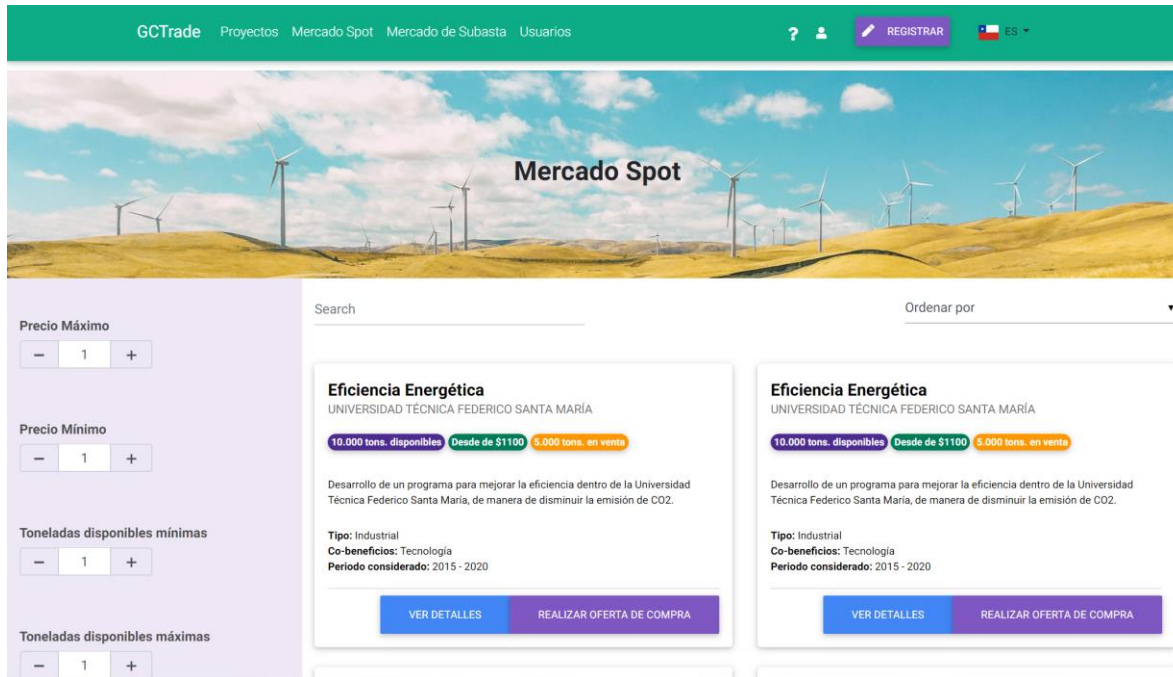
- Spot Market Module
- Project Module
- User and Role Module
- Auction Market Module

The main modules mentioned above are described below:

#### 11.1.2.1. Spot Market Module

In line with the recommendations made, the platform model has a section consisting of the spot market, which allows coordination between bidders and applicants.

Figure 8 Digital Model, Spot Market Module, Main View



#### 11.1.2.2. User Module

The model of the platform has a section in which it details the users and roles that the platform uses. Within the user's subsection, whose visualization is proposed to be restricted according to different views (administrator, users, public), a list is detailed with:

- Users registered on the platform through their email.
- The state in which each user is that may be approved or rejected.
- The role (permission) of the user.
- User data, such as name, surname and date of last access.

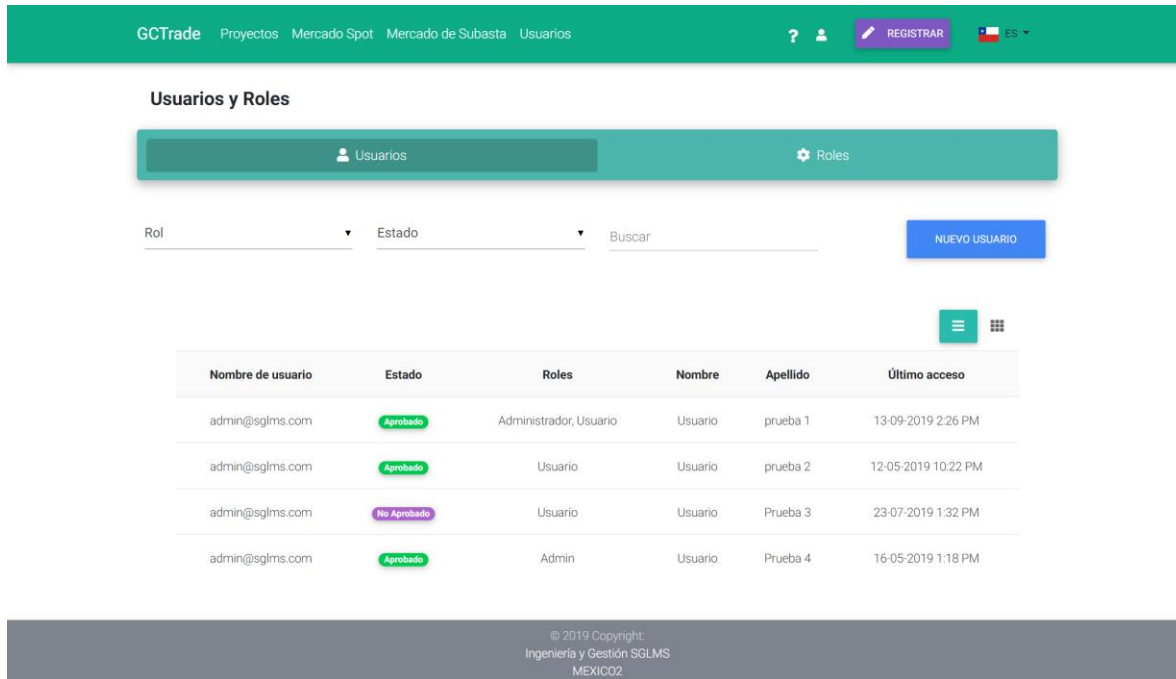
This information, in addition, can be seen through an interface of boxes in order to have a greater clarity of the users, reorganizing their information. In addition, it can perform a personalized search of users, searching through the parameters described above.

In the roles subsection, it is displayed what access permissions the Administrator role and User role have. The permits are constituted by:

- Access Denied: The user cannot access the data.
- Reading: The user can only read the data.
- Writing: The user can read and write data.
- Administration: The user can read, write and modify data.

Each role has 4 unique permits in each type of section: Projects, Auction Market, Spot Market, Users and Roles, being able to assign the type of permission to the roles.

Figure 9 Digital Model, User Module, Main View



**Usuarios y Roles**

Usuarios Roles

Rol Estado Buscar NUEVO USUARIO

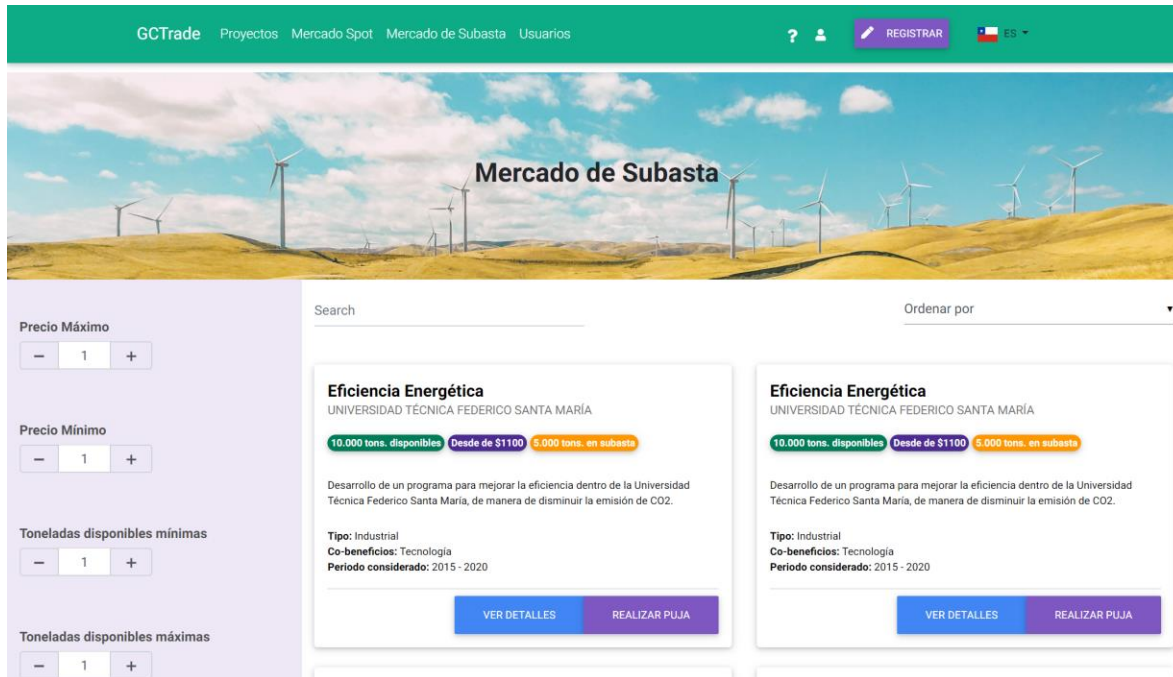
Nombre de usuario	Estado	Roles	Nombre	Apellido	Último acceso
admin@sglms.com	Aprobado	Administrador, Usuario	Usuario	prueba 1	13-09-2019 2:26 PM
admin@sglms.com	Aprobado	Usuario	Usuario	prueba 2	12-05-2019 10:22 PM
admin@sglms.com	No Aprobado	Usuario	Usuario	Prueba 3	23-07-2019 1:32 PM
admin@sglms.com	Aprobado	Admin	Usuario	Prueba 4	16-05-2019 1:18 PM

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### 11.1.2.3. Auction Market Module

As a proposal based on the recommendations delivered in this consulting service, the platform model has a section consisting of the auction market with the available tons to be issued. To do this, a dashboard is used that summarizes the projects, detailing the amount of tons available to be able to trade and the minimum price set by the person performing the auction. In addition, it has a filter to search for projects by default parameters, set by the administrator, or custom parameters set by the user.

Figure 10 Digital Model, Auction Market Module, Main View



#### 11.1.2.4. Project Module

The platform has a section where the projects that will be auctioned can be seen in detail. Within this section, there is:

- A general description, which shows a summary of the project.
- Agents involved in the project with their respective names, number of tons to contribute and country.
- Registry of transactions, detailing the information of the transactions, in effect: name of the stakeholders involved, number of tons traded, the type of transaction (spot and auction) and the date of transaction.
- Transaction showing the image, country of execution and transfer method of project certificates (if this process exists). In addition, the purchase can be made (directly) and/or bid on auction.



Figure 11 Digital Module, Project Module, Main View

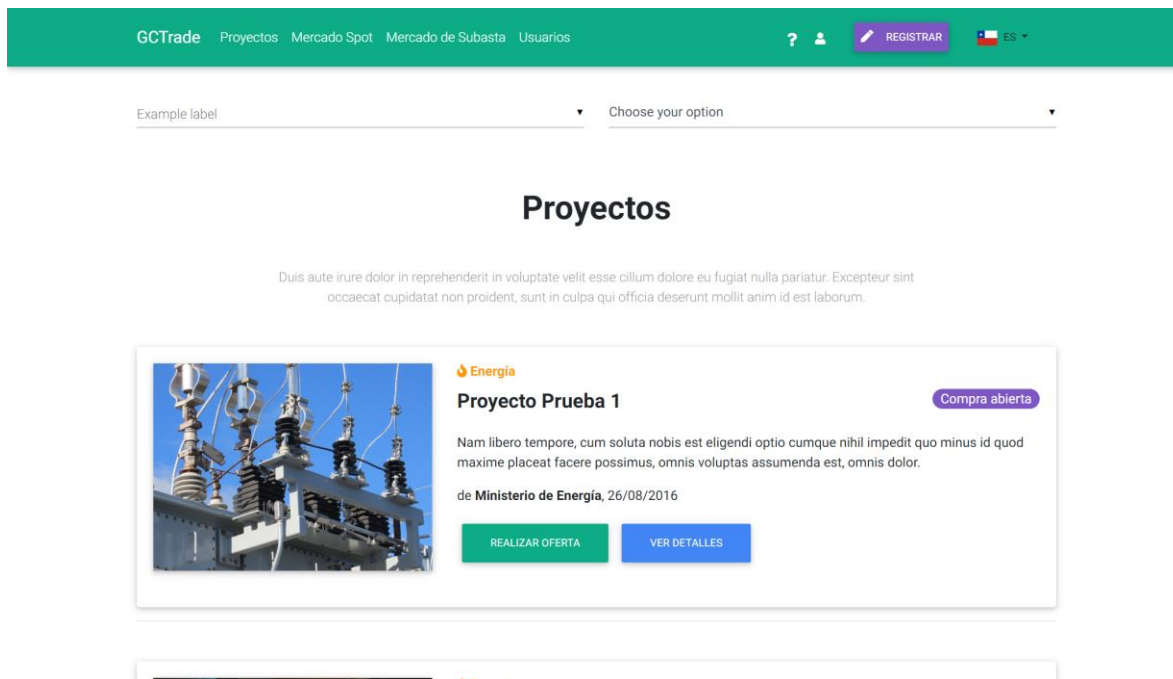
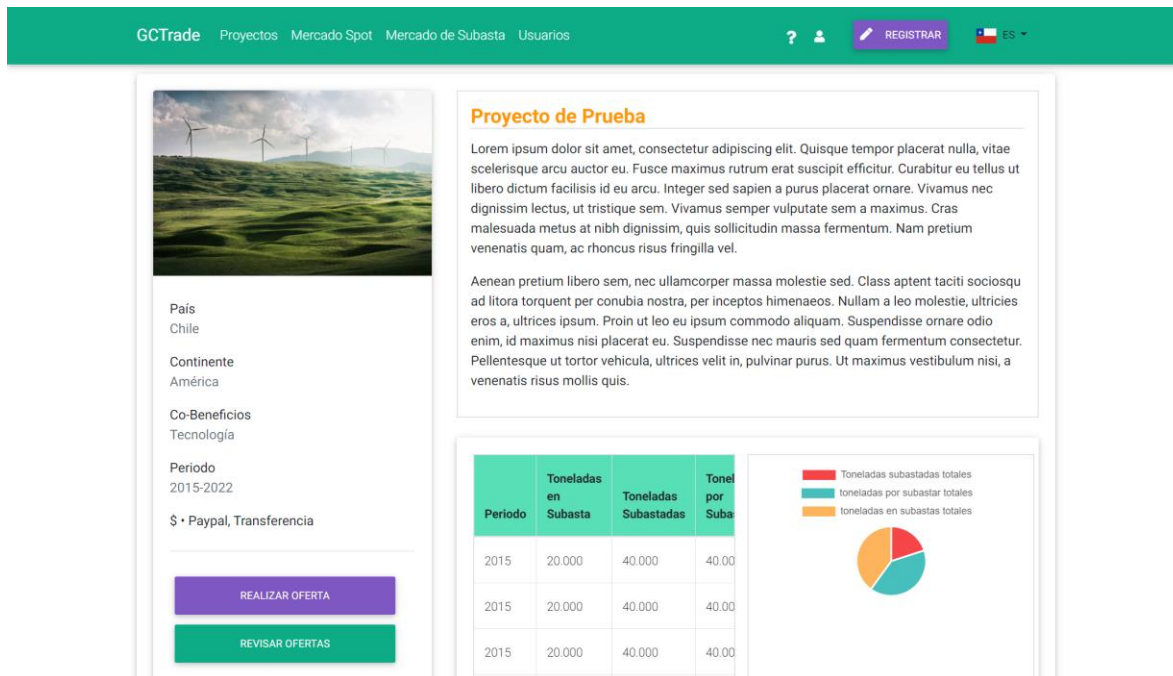


Figure 12 Digital Module, Project Module, Project Detail



## 12. Cost Summary

In order to make a real quotation of the costs implicit in the development of the platform, it is essential to define aspects such as the number of users (buyers and sellers) expected, the number of transactions expected per day, the level of activity of the site, the type and frequency of operations supported and the selected time availability.

However, in general, three main elements can be distinguished with their respective elements that should be considered to consolidate the trading system of environmental commodities and that will generate the costs so that the platform can operate correctly:

1. **Development** of a platform that meets the functional and nonfunctional requirements established in this document. This corresponds to a non-recurring cost that must be incurred at the beginning of the project.

Table 17 Platform development costs, short term stage.

Spot Market Payment Module OTC <sup>1</sup>		
Tasks		Price (UF)
<b>Surveying</b>	<i>Process Surveying</i>	127
	<i>Process Adaptation</i>	105.25
<b>Database Structure</b>	<i>BD Model Design</i>	174
<b>Development</b>	<i>Authentication and Authorization</i>	
	User Management	26.05
	User Registry	21.05
	Permit Management	26.05
	<i>Project Management</i>	
	Project Creation / Edition	21.05
	Project Elimination	15.7
	Information Detail per Project	15.7
	Related Documents (certificates)	11.4
	Project Master	25.7
	<i>Selling User Management</i>	
	Selling User Creation / Edition	21.05
	Selling User Elimination	15.7
	Information Detail per Selling User	15.7

<sup>1</sup> OTC: Over the counter;



Spot Market Payment Module OTC <sup>1</sup>		
Tasks		Price (UF)
	Selling User Master	25.7
	Buying User Management	
	Buying User Creation / Edition	21.05
	Buying User Elimination	15.7
	Information Detail per Buying User	15.7
	Buying User Master	25.7
	Communication Management	
	Notifications	20.7
	Chat	30.7
	System Parameter Management	
	System Parameter Creation / Edition	30.7
	Control Panel and Reports	
	Report Creation	30.7
	Control Panel	30.7
Customization and Graphic Design		
	Responsive Design	41.4
	Panel Construction	60.7
	<b>Total</b>	<b>970.85</b>

Table 18 Platform development costs, medium term stage.

Spot Market Payment Module		
Tasks		Price (UF)
<b>Surveying</b>		
	<i>Process Surveying</i>	121.75
<b>Database Structure</b>		
	<i>BD Model Adjustment</i>	121.75
<b>Development</b>		
	Payment Management	71.75
	Document Management	
	Document Generation	26.75
	Document Master (storage)	26.75
	Collection Management	61.75
	Calculator	41.75
	Control Panel	
	Adjustment	15.7
<b>Customization and Graphic Design</b>		
	Design	20.7
	<i>Panel Construction</i>	45.7
	<b>Total</b>	<b>554.35</b>

Table 19 Platform development costs, long term stage.

Auction Module		Price (UF)
Tasks		
<b>Surveying</b>		
	<i>Process Surveying</i>	121.75
<b>Database Structure</b>		
	<i>BD Model Adjustment</i>	121.75
<b>Development</b>		
	<i>Auction Management</i>	
	<i>Auction Creation</i>	21.75
	<i>Bidding Creation</i>	10.7
	Best Bidding Selection	31.05
	Calendar Management	
	Calendar	21.05
	Event Creation / Edition	16.05
	Event Elimination	10.7
	Document Management	
	Document Generation	16.4
	Document Master (storage)	25.7
	Document Load / Elimination	21.4
	Payment Management	
	Adjustment	16.05
	Collection Management	
	Adjustment	16.05
	Control Panel	
	Adjustment	13.75
<b>Customization and Graphic Design</b>		
	Design	20.7
	<i>Panel Construction</i>	45.7
	<b>Total</b>	<b>530.55</b>

2. **Maintenance and updating** of the platform and its infrastructure in order to ensure its correct operation throughout its useful life. This category includes various periodic costs, which may vary depending on the way of hosting the application:

Table 20 Maintenance and updating costs of the platform.

Alternative	Description	Reference Cost
<b>Own Server</b>	In this case, it is the organization that manages the platform and is responsible for providing and maintaining its server, also ensuring the operational continuity of all the services required for its operation, in accordance with the provisions of section 10.4 (Operational Requirements).	Server purchase: 50 UF
<b>Housing</b>	Similar to the previous case with the difference that the maintenance of the server and the services required for its operation are outsourced. Server administration and maintenance continue to run by the server owner.	3.5 UF/month
<b>Cloud Hosting</b>	The organization does not use its own server, but leases the use of a remote one, being able to be a Dedicated Server, a VPS (Virtual Dedicated Server), or even hiring an application hosting service.	3 UF/month
<b>Saas</b>	The administration of the server and all the resources required for the proper functioning of the platform are outsourced to an organization specialized in this. Reference value: 4 UF/month, scalable according to use or requirements.	4 UF/month

In general, it is advisable to use alternatives such as Housing, Cloud Hosting or Saas mode, since companies that deliver these services specialize in maximizing the availability of servers and applications they host, and maximizing the stability of services and resources required for their operation (electric power, internet connection, file and database backups, etc.).

On the other hand, the costs of the administration of the platform itself must be considered, which allows to carry out all the processes necessary for its services to be provided properly. In the case of this platform, it corresponds to the functions performed by the Administrators. This category of costs constitutes a recurring cost.

### 13. Implementation

Based on the analyzes carried out and considering the local context, a proposal that can be developed in three incremental stages is considered. The above can be visualized in the following table.

Table 21 Incremental implementation by stages

	Short Term	Medium Term	Long Term
<b>Market Size*</b>	<ul style="list-style-type: none"> <li>Incipient</li> <li>Small</li> </ul>	<ul style="list-style-type: none"> <li>Medium</li> </ul>	<ul style="list-style-type: none"> <li>Big scale</li> </ul>
<b>Corporate Governance</b>	<ul style="list-style-type: none"> <li>Corporate governance may be integrated merely by the private sector.</li> <li>The participation of the regulatory body of the market is given through informal consultations.</li> </ul>	<ul style="list-style-type: none"> <li>Corporate governance must integrate the public sector without excluding the private sector.</li> <li>The participation of the regulatory body of the market is given through specific and formal studies.</li> <li>The government sector must give certainty of the operation of the platform.</li> </ul>	<ul style="list-style-type: none"> <li>Corporate governance must integrate the public sector without excluding the private sector.</li> <li>The participation of the regulatory body of the market is given through specific and formal studies.</li> <li>The government sector must give certainty of the operation of the platform</li> </ul>
<b>Transactions</b>	<ul style="list-style-type: none"> <li>Corresponding to a voluntary market.</li> <li>E-commerce system for sales with OTC spot price</li> </ul>	<ul style="list-style-type: none"> <li>Corresponding to a regulated market under development.</li> <li>Auction system for moderately frequent transactions.</li> </ul>	<ul style="list-style-type: none"> <li>Corresponding to a developed regulated market.</li> <li>Request for Quote type system for frequent transactions.</li> </ul>
<b>Legal-Institutional Context</b>	<ul style="list-style-type: none"> <li>Null regulation. The definition of accepted standards is done internally and is not subject to official provisions.</li> </ul>	<ul style="list-style-type: none"> <li>Need for secondary regulation (at the level of regulations) in which the requirements to use the auction platform and</li> </ul>	<ul style="list-style-type: none"> <li>Need for robust regulation (at the level of law, regulation and norm) for the market.</li> <li>The regulation must accept modifications</li> </ul>

		participate in the purchase and sale of securities are established. <ul style="list-style-type: none"> <li>• The secondary regulation must consider the definition of accepted standards.</li> </ul>	suggested by the regulatory entity without the need to modify the law. <ul style="list-style-type: none"> <li>• Rigorous regulations for the platform (if official).</li> </ul>
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\* This is a hypothetical scenario of market evolution and does not necessarily reflect its real development.

In general terms, the implementation should consider the following activities in each of the stages:

- Identification and documentation (or update) of the legal basis.
- Process for receiving proposals from potential developers and/or suppliers.
- Selection and contract of the developer or supplier.
- Design, development and testing for OTC Spot Market platform if required (this can also be considered for the adaptation of alternatives provided by a supplier):
  - Survey of processes and information
  - Identification of requirements (recommendation of an iterative process).
  - Platform design
  - Platform development
  - Development and execution of test plans.
- Launch of trial version with limited number of projects and without bank transfer.
- Extension of version to a greater number of projects.

The administration of the platform should consider a team that provides general and specific full-time support.

The operation considers a team that acts as a settlement agent, who will be responsible for coordinating the process behind the transactions made in the different markets.

## 14. Strategic Analysis

For the implementation of a voluntary or regulated market in which green certificates can be traded, there are certain characteristics of high importance that influence the development of the web platform. These characteristics are mainly related to the type of users, the size of the market and the connection with other instruments (such as those related to the carbon price).

According to international experience, carrying out information dissemination programs on the benefits of neutralization of emissions derived from personal or business activities allows an active voluntary market to be generated, which would be additional to the contribution of establishments affected by green taxes. Currently, in Chile there are 94 entities that are taxed since they are fixed sources of emissions, which mainly belong to the energy sector.

It is worth mentioning that the size of the voluntary carbon market is tiny compared to a regulated one. Considering the above, it is possible that the potential demand for certified emission reductions originates mainly from the participation of entities that may be subject to the Green Tax in Chile. This, as long as the regulation stipulates a GHG emission limit (as opposed to the current restriction that mainly includes installed thermal capacity) as indicated in the tax reform project for Green Taxes. As a consequence of the above, if any of the taxed subjects exceeds said limit, they may resort to buying emission reductions, which would allow them to fulfill their obligations. One of the advantages of considering this scheme is that in the future sectors that do not have a direct relationship with installed thermal capacity, but that are large GHG emitters, could be included and participate in the acquisition of emission reduction certificates. It is known that the sectors and industries that emit large amounts of GHG, in addition to energy, are mining, steel, cement, paper and fuel production.

On the other hand, the offer of emission reductions registered for projects in Chile through compliance with CDM, VCS and Gold Standard standards total the amount of 125, of which 80% belong to the energy sector. A large part of the credits issued by the project owners have not been used, which is why there is a decrease in their participation.

Considering the total number of emission reductions available in Chile, the carbon tax could be established in the short term with a favorable forecast. This could be favorably fulfilled by taxed subjects, if it is taken into account that there are currently just over 30 million certificates of emission reductions available, according to the CDM, VCS and Gold Standard registries. Approximately only 7% of verified emission reductions have been voluntarily canceled, leaving a large percentage available.

An effect of the approval of the tax reform project of the Green Tax would allow the reductions of current emissions to be used, reactivating the transactions, and additionally certificate holders could issue future credits since there is some potential for issuing annual credits. This possible issuance of additional credits could be useful when there is interaction with international mechanisms to exchange green certificates, such as the World Bank Warehouse.

## 15. Conclusions

The most important factor for the success of the platform will be the mobilization between the supply and demand of green certificates. The offer, projects admitted to the platform and the possible certificate holders must be identified and mobilized to join the website. The demand must be induced to participate through the voluntary market (mobilization by corporate image, social responsibility, requirements in the parent company) or the payment of the carbon tax. On these factors depends the incipient liquids generated in the platform.

Although the platform serves as the space for interaction between buyers and sellers, on the other hand, the elements that make up the trading system as a whole (registries, settlement agent and financial intermediaries), as well as the interactions between them will have a preponderant role in the trading processes, and will be indispensable for this system to function properly. The platform must consider the development of interfaces that allow it to exchange information effectively with these elements.

The linking of the platform with the registries and the figure of the settlement agent is essential and must be carefully developed, together with the structuring of the transactions. In order to achieve short response times and effective communication requires a high level of integration between them. Therefore, it is convenient to have a common language, that is, identification codes that can be read by both parties.

The adequate incorporation of the components of the trading system will allow to migrate relatively easily from a platform that operates with an electronic commerce system to a platform that supports other sales mechanisms (for example, auctions), before a market growth and increase in the liquidity of instruments.

The choice of the registries where the projects will be listed and from which the trading instruments will be issued depends largely on the standards that will be accepted as valid to participate in the market. The establishment of criteria for the selection of standards must be carried out by an entity that acts as a market regulator. This entity should also establish the guidelines and regulations under which both the platform and the rest of the elements of the trading system must operate, once it is migrated from a voluntary scheme to a regulated one. There is also the possibility of developing an own registry; however, the level of implicit complexity and the difficulties in establishing a future link with other systems must be taken into account. This will take relevant importance in the face of the emergence of an international market.

It must be determined which entity will serve as the settlement agent. At a minimum, it must ensure that both buyers and sellers receive the instruments and money in question, so an issuance system against payment must be incorporated. On existing platforms, delivery against payment is a joint competence of the registry and the settlement agent.

In order to achieve maximum and optimal use of the platform, users must have a complete understanding of it. To achieve this, descriptive and easily locatable user guides should be developed. The use of social networks will allow dissemination of what happens on the



platform, and will also serve as an advertising strategy. The information available to the public, design and accessibility of the site are elements that will lead to the increase in the number of transactions that may be carried out.

The development of the platform and systems that enable its internal operation will generate inherent costs. However, it is necessary to consider additional costs arising from communication with other elements of the trading system, such as registries, the settlement agent and financial intermediaries, as well as hosting, administrative and legal costs.

In order to prepare the ground for a platform with international scope, it is essential to standardize the nomenclature of the commercialized instruments. This will facilitate the proper distinction of each type of tradable instrument.

In line with the international context, there has been a growing tendency for public policy instrument structuring agents to rely on accreditation services managed by the private sector. Therefore, as regards the management of the entire trading system (including the platform, the settlement agent, financial intermediaries and the registries) a hybrid scheme could be adopted in which stakeholders from both the governmental and private sectors participate. However, it is essential to clearly define the differentiation of roles and the scope of the activities that each of the participants in the management will carry out.

Finally, it should be taken into account that the platform can be the basis for eventually facilitating the transition to a market with greater liquidity and scope, so it is important that it functions as an efficient, effective, and safe trading space that incorporates flexible systems to enable migration to a more dynamic trading system.

## 16. Recommendations

### SHORT TERM

- Development of a trading platform that uses a system according to the context of the current market in Chile. It is urged to adopt an electronic commerce system for a small-scale voluntary market. Only in the case of market growth (see below for medium and long-term proposals), it is recommended to migrate to more complex systems in which auctions are incorporated as a transactional mechanism.
- Implementation of a flexible commission scheme that follows the evolution of the market.
- Promotion of capacity building that serves the development of the voluntary carbon market through workshops and easily accessible dissemination material.
- Support the development of a voluntary market ecosystem in which support from the public to the private sector is provided for the consolidation of the business model and identification of supply and demand, among other items.
- Accompaniment by the corporate governance for the institutionalization and strengthening of the platform, for example, by supporting it as an official trading space for green certificates.
- Development of compatible computer language among the elements that make up the trading system (registry, platform, financial intermediaries, etc.).
- With respect to supply and demand, it is necessary to:
  - Consider the results of comprehensive mapping of all existing projects, as well as take into account the decision of the Determined National Authority on what type of projects will be accepted.
  - Design together with the platform operator a commercial campaign for the voluntary market among the main emitting companies in the country (energy, mining, cement, transportation, among others).
- Implementation of agile trading systems that promote market liquidity.
- Support for the transaction design from the point of view of capital exchange, considering safeguard protocols to prevent money laundering and terrorist financing.

### MEDIUM TERM

- Develop a free-use calculator for accounting emissions to facilitate the calculation for individuals or small businesses that wish to neutralize their emissions.
- If the implementation of the carbon tax reform is completed, develop a platform that supports an auction system. This must be compatible with both the new market conditions arising from the regulation and with the RAMSE and must be created through the joint work of companies specialized in systems and market experts.
- Prompt definition of admissible standards by the regulatory entity to carry out green certificate auctions and reduce market uncertainty.

## LONG TERM

- Standardization of the nomenclature of the instruments sold on the platform in accordance with international practices. This will facilitate future interaction with international markets.
- Standardization of platform rules in accordance with international best practices to ensure compatibility with other systems.
- Creation of a registry aligned to international practices to ensure future connectivity with other trading systems in the face of the emergence of an international market. This can be done with the support of experts in the field.
- Before the implementation of an ETS or a similar instrument in Chile:
  - Platform reformulation
  - Capacity building through the development of a market simulation exercise
- Development of protocols for incorporating into the market the certificates issued by the program to reduce emissions from deforestation and forest degradation (REDD+), given their possible eligibility to comply with the CORSIA scheme commitments.

## 17. Annexes

### 17.1. Annex 1 Energy Sector Mitigation Actions Registry

The RAMSE platform considers three important threads for the main process, which are detailed below:

**a) Identification of Mitigation Actions:** This thread considers the identification of mitigation actions by the RAMSE user, requiring entering the name and main information of an action to be validated by the system administrator, helping to avoid double registry of mitigation actions. After this, the process continues with the registry of the Mitigation Action.

**b) Registry of Mitigation Actions:** This thread considers the entry of detailed information related to a mitigation action whose identification has been validated in the previous thread. This information is entered by the RAMSE user or the secondary institution RAMSE user involved in the MA, being validated by the System Administrator.

**c) Updating of the Registry of Mitigation Action Reductions:** This process considers the updating of the information of the Mitigation Action (emission reductions) until its completion by the RAMSE user responsible for the Mitigation Action.

#### 17.1.1. General Aspects of the Platform

The RAMSE platform was developed with responsive design that allows its visual adaptability to any mobile device. In addition, the development considered the Spanish and English languages (internationalization).

In order to support the main process, the platform sends notifications via email for the relevant milestones.

#### 17.1.2. Users and Roles of the Platform

Table 22 Platform Users and Roles

User Role	Description	Actions and Responsibilities
Administrator	The Super Administrator profile considers the same RAMSE Administrator accesses, in addition to permission management for different user profiles.	Constant system tracking.

User Role	Description	Actions and Responsibilities
RAMSE Administrator	The RAMSE administrator considers the access defined above for users, in addition to user management and the validation of information related to mitigation actions.	Perform the validation at the different stages of the process: <ul style="list-style-type: none"> <li>- Identification of Mitigation Actions.</li> <li>- Registry of Mitigation Actions.</li> <li>- Updating of the Registry of Mitigation Actions.</li> </ul> Manage users. Manage information parameters for the registry of mitigation actions.
RAMSE User	The RAMSE user profile considers loading permits and updating of information related to the mitigation actions in which it participates (as a member of the responsible institution or an institution involved), in addition to reviewing reports.	Identification of Mitigation Actions. Registry of Mitigation Actions. Updating of the Registry of Mitigation Action Reductions. Make corrections informed by the administrator. If necessary, register information regarding the registry of the Mitigation Action in which it is involved as a Secondary Institution.
RAMSE User Secondary Institution	The RAMSE user may be involved with a two-level mitigation action: belonging to the responsible institution or belonging to an involved institution.	Institution registered as second participant. If necessary, enter comments on the mitigation action in which the institution is involved.
RAMSE Verifier	The RAMSE Verifier user profile considers permissions to verify updated information regarding the green certificates associated with a mitigation action, being able to upload verification documentation.	Verify updated and registered information regarding green certificates of mitigation actions. Upload green certificate verification document.

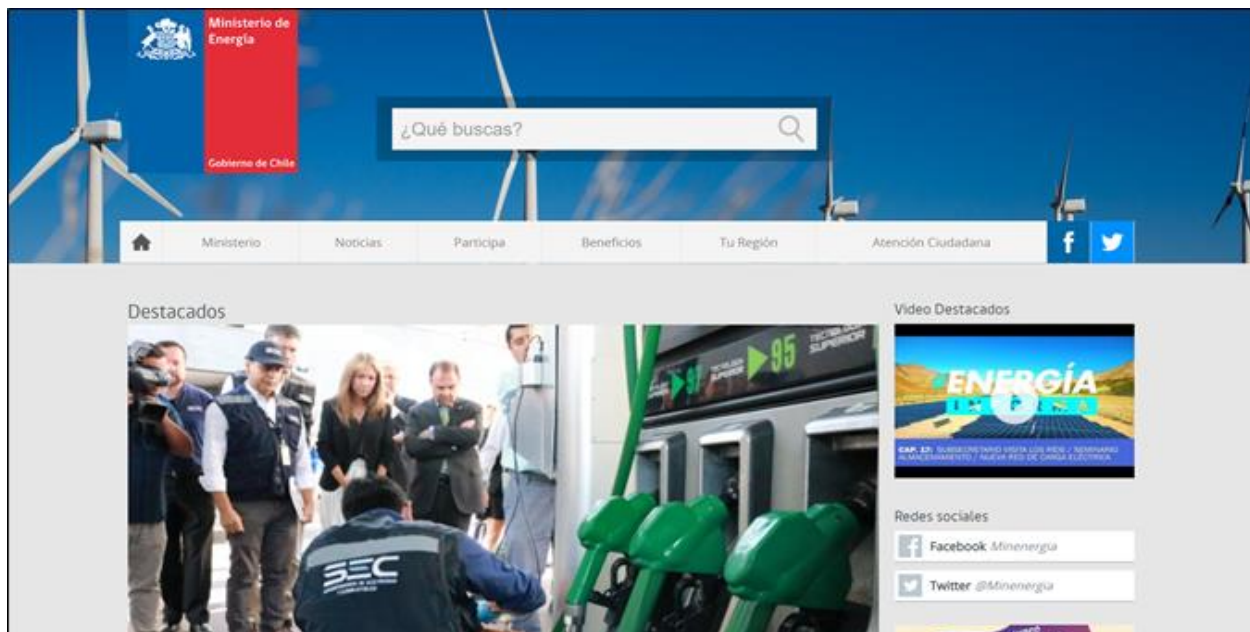
User Role	Description	Actions and Responsibilities
Observer	<p>The RAMSE platform contains public information that can be reviewed without restrictions by guest users (who do not require any authentication or login). These users will not be able to access under this profile information classified as private or register mitigation actions within the platform.</p> <p>Public access considers the review of information related to the system itself, methodologies, mitigation actions and projects, in addition to a contact form.</p>	Consult public information.

## 17.2. Annex 2 Editorial Line of the Ministry of Energy of Chile

With the aim of a potential approach to the design of the online trading platform in the already determined graphic profile of the website of the Ministry of Energy, a review of said site is made (available on link <http://www.energia.gob.cl/>).

First, the beginning of the site's homepage is reviewed:

Figure 13 Ministry of Energy Website, Homepage



A header is identified in the form of a main bar with a background image that incorporates the logo of the Government of Chile, a search engine and a menu of the site. The latter gives

access to sections of the site such as: Home, Ministry, News, Participate, Benefits, Your Region and Citizen Attention. In addition, access to social networks such as Facebook and Twitter are included at the end.

The structure of the body of the site presents a distribution (layout) that mainly considers two columns: the first one of greater width shows recent and outstanding information (such as news or relevant information), while the column of smaller width presents an access to other information less recent or secondary (social networks, annexed programs, among others).

On the other hand, the footer of the main page of the site is reviewed:

Figure 14 Ministry of Energy Website, Homepage End



There is an interactive and animated section that shows links to other public information related to government management, allowing the visitor to review it through the side arrows. In addition, there is a footnote that provides information on the Ministry of Energy (address and contact telephone number), privacy policies and displays; additionally, direct access to social networks is incorporated. This last part of the layout is shared by all sections of the site.

Continuing with the review of the ministerial website, part of the “Participate” section to visualize how to deliver the information:



Figure 15 Ministry of Energy Website, Participate Section



In this section, visitors are shown the activities and public consultations available, in addition to their effective date and status (Closed and Open). This information is presented in the form of blocks. On the other hand, there is access to more information on other aspects of citizen participation in other areas, such as “Prior Consultation to Indigenous Peoples”, “Participatory Public Accounts”, “Civil Society Council” and “Open Government”.

The “News” section presents notes classified by columns in media and news in colors, in addition to a calendar for search by date, a bar for search by keywords and a section of the most viewed to review the news with a greater number of visualizations.

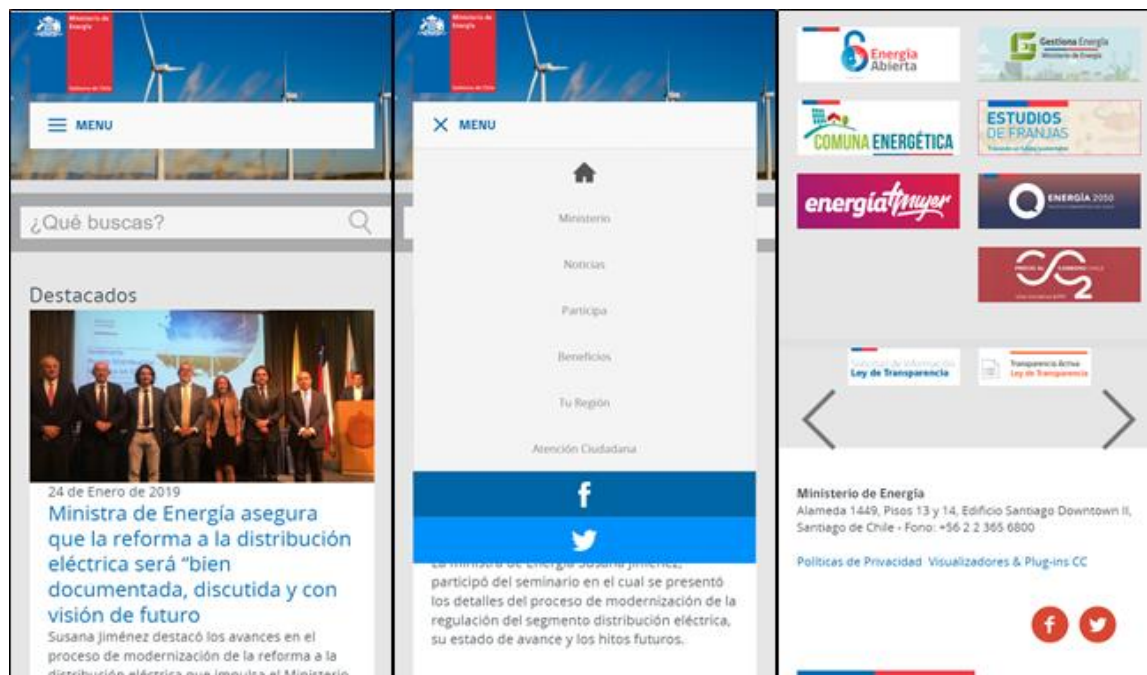
Figure 16 Ministry of Energy Website, News Section



Additionally, the responsive design of the website that seeks to adapt to devices of different sizes is reviewed:



Figure 17 Ministry of Energy Website, Responsive Views



Thus, the site is adjusted depending on the size and resolution of the screen, changing the location and size of its components (for example, the menu is available to scroll down).

From the website review, the color palette used, its RGB code and the use within the site are detailed below:

Table 23 Color palette, Ministry of Energy Website

Code	Color	Use
RGB (255,152,22)		“Participate” section: entry classification
RGB (30,163,147)		“Participate” section: entry classification
RGB (223,224,228)		Navigation bar
RGB (254,199,32)		“Participate” section: entry classification
RGB (219,69,112)		“Participate” section: entry classification
RGB (45,118,183)		Social networks

RGB (218,70,49)		Social networks
RGB (239,240,243)		Site footer
RGB (85,181,41)		"News" section: entry classification
RGB (102,102,102)		"News" section: calendar header
RGB (195,214,228)		"News" section: calendar day mark
RGB (252,156,0)		"News" section: entry classification
RGB (0,142,226)		"News" section: entry classification
RGB (196,196,196)		Site background
RGB (227,46,58)		Government of Chile logo
RGB (0,98,168)		Government of Chile logo
RGB (116,116,116)		Letter color

### 17.3. Annex 3 Clean Energy Certificate Market in Mexico

As of the promulgation of the Energy Industry Law in 2013, Mexico experienced a drastic change in the energy sector: the opening of the electricity market. One of the instruments created for this recent market is the CEC, whose main objective is to accelerate the implementation of electric energy technologies that use clean energy sources, so that the objective of generating 35% of electricity from these sources is met according to the General Law of Climate Change published in 2012.

According to the Clean Energy Progress Report, clean energies are those whose sources and generation process used involve the emission of GHG or waste that does not exceed thresholds established in the regulatory provisions. Thus, thermoelectric gas and nuclear power plants are included in this definition.

The axis of operation of the CEC market is the fulfillment of distribution companies, generators and certain users, ensuring that a certain percentage of electricity consumed has been generated with clean energy. Said regulated percentage is established by the Ministry of Energy during the first three months of each year, effective in a period of three years. The percentage with which the CEC market started was 5% in 2015, increasing to 5.8% in 2019, and reaching 13.9% in 2022.

Since CECs are granted to entities that generate electricity with clean energy, there is a surplus of CEC that can be traded in the future to generate profits. If the generators or distributors do not fulfill their obligation, they must pay the fine imposed by the authority that is directly related to the amount of the maximum price of the certificates, in addition to the recidivism in case of consecutive non-compliance. The payment of the fine does not exempt the participants obliged to comply with the obligations owed.

A direct consequence of the creation of this market is that uncertainty for investors is reduced by directing their funds to clean energy technologies, this is achieved since the return rates of all clean generation plants are increased. In addition, the CEC market has a value that experiences an increase in the extent to which the entire country moves away from meeting the goals of using clean energy. The reason for the above is that market participants will notice that CEC demand exceeds supply, generating an impact on prices, which rise. This promotes competition and inclusion of new participants. According to the Mexican Institute for Competitiveness, a direct consequence is that the creation of the CEC market enables the decrease of externalities and allows diversification of the national energy matrix in a cost-effective way.

The considerations to assign CECs are: that the generation plant has started operations after August 2014 or the generation has increased in the same plant, that the energy is sold in the Mexican power grid, that the guidelines of energy efficiency are followed, established and collated by the Energy Regulatory Commission and that regulations issued by the Ministry of the Environment and Natural Resources are complied with.

The synthetic procedure to grant CEC to generating or distributing entities is as follows:

1. Application for registry to the CEC Administration System
2. Having certification of operation with clean energies by a unit accredited by the Energy Regulatory Commission
3. Payment to register to the CEC Administration System

The CEC trading form is carried out through centralized auctions, which are mandatory, open and long-term. In addition, it is possible to create a spot market to exchange the surplus that may arise from natural disasters or delays in works of the generation plants.

The way in which the estimation of the price of CECs is carried out is based mainly on the following aspects:

- Generation goal to meet
- Difference between marginal costs of energy production between technologies,
- Percentage of variable obligation every three years
- Strategic purchase derived from what is established in the regulation

According to the considerations to promote investment in terms of CEC, the main points to cover that ensure optimum market performance are:

- Certainty in prices: The medium and long-term demand must be considered, as well as an estimation of marginal costs for all technologies. It is necessary to provide security regarding the infrastructure of the electricity network that is required for the implementation of new technologies. In addition, a considered transition from the previous scheme to the new market must be ensured to avoid disruptions that may affect the national electricity system. Finally, it is a good practice to consider the variation of prices in the first years to determine additional measures to ensure certainty for investors.

- **Simplicity:** Have an efficient and easily accessible registry, as well as a database that contains all the information on the CECs that serves to ensure the best decision making.
- **Transparency:** Promote periodic audits whose information obtained is of a public nature.
- **Cost-effectiveness:** Allowing free and broad competition between different technologies allows CECs to be acquired at the lowest available cost, while promoting innovation, despite the existence of goals for each type of technology, since electricity can be more expensive weakening market transactions.

## 17.4. Annex 4 Interviews with International Experts

The selection of the entities to be interviewed was based on their experience derived from the management and operation of various international platforms. Two of the representatives consulted are involved in the platforms discussed above, one by Carbon Offset Platform from the Carbon Neutral Now program, and the second by BVRio Platform. The third interviewee is the vice president and head of carbon markets at BCG Environmental Brokerage Services.

### 17.4.1. Interview: Program Officer, Miguel Naranjo González

1. What were the main challenges for the implementation of the platform?

*In our case, as an organization of the United Nations System, the main challenges were to clarify the legal basis that would allow us to develop and operate the platform, obtain the required financing and learn about the existing technological options to build such a platform, since it is not part of our traditional operations.*

2. Was any recommendation followed to increase the volume of transactions made? If yes, which strategy was better?

*After a couple of years of operation, a consultancy was hired to analyze the user experience on our platform to make it more attractive and easier to use. Based on the results, the platform was modified to the way it looks today.*

*In addition, it is important to highlight the value of carbon credits to contribute to sustainable development and the well-being of the population in general, not only the climate impact.*

3. What is the degree of satisfaction or general experience related to the performance of the platform that the operator has?

*The platform was developed by a German company based on nopCommerce. Our experience has been very satisfactory.*

4. How was the resolution reached regarding that the payment method would be by means of online payment, card or bank transfer? Does it respond to any particular criterion?

*As a United Nations organization, we cannot participate in purely commercial transactions in any way. Therefore, we had to find a solution so that payments were made directly from the buyer to the seller (the owner of the credits, which is not us). We need a system that allows this transfer between two thirds. We choose a plug-in that uses PayPal.*

*The use of credit card or PayPal is facilitated by the plug-in. The bank transfer is implemented later because many large organizations prefer to pay by transfer and not by*

*card, in addition to that in some countries it is not easy to use cards or PayPal and we try to give access to all users in the world.*

5. What are the steps taken to carry out the transaction?

*When the payment is made with a PayPal account or credit card, the entire financial transaction is made by PayPal following its own procedures.*

*When the payment is by bank transfer, the buyer makes the order on the platform. The seller then receives the order notification and sends the bank details directly to the buyer. The buyer makes the transfer. The seller then receives the payment and enters our platform to confirm receipt of the payment. At that time, the cancellation of the credits and the issuance of the certificate to the buyer occurs.*

6. What are the challenges for the platform to have an international reach?

- *Language. The platform is currently available in English, Spanish and French.*
- *Payment methods. Use of credit card or PayPal is not easy in some countries.*
- *Communication. We have a very limited budget to do “marketing”.*

7. How is the operating mechanism in which the registry of certified emissions is linked with the banks and the platform itself, so that the number of tons available is constantly updated?

*As the Climate Change Convention Secretariat and its Kyoto Protocol, we operate the CDM Registry, which generalizes emission reductions (certified emission reductions or CERs). Our platform is linked to the CDM Registry, so we always know how many credits there are at all times and the amount is always up to date on the platform. When payment for a credit cancellation is confirmed, the cancellation is made immediately in the CDM Registry.*

8. What were the stages for the implementation of the platform?

- a. *Identification and documentation of the legal basis so that our organization could develop and operate.*
- b. *Analysis of available technologies for its development and options to connect it with the CDM Registry.*
- c. *Process for receiving proposals from potential developers.*
- d. *Developer selection and contract.*
- e. *Development and testing.*
- f. *Launching the light version with limited number of projects, only in English and without bank transfer. In addition, the cancellation of the credits did not happen automatically: we verified each transaction in case there was a problem with the new platform.*
- g. *Expansion with more projects, more languages and activation of the transfer option. Automation of the cancellation of credits.*

#### **17.4.2. Interview: Information Technology Director, Márcio Barros**

1. What have been the main obstacles to the development, implementation and management of the web platform for a voluntary market?

*I believe that linking with people (voluntary buyers of emission reductions) is the most complicated step in the development of such a market, since there is no obligation to purchase.*

2. Is there any suggestion to increase the volume of transactions?

*Frequent use of advertising campaigns to increase transactions. People are increasingly aware of the importance of reducing emissions, but the number of voluntary buyers remains significantly small in relation to what could be under a mandatory market, such as that in developed nations.*

3. What is Brio's overall experience around the trading of emission reductions?

*Our platform is a simulation of a carbon market for educational purposes. It is not a real carbon market. It is part of a program to prepare Brazilian companies around their participation in a real carbon market, if it develops. The companies have accepted the idea well and are committed to the trading experience, although to date there is no tangible horizon for the development of a real carbon market and its respective regulations, as far as we know.*

4. How large is the volume of transactions with which you operate?

*It is not very big. Usually, we have less than a dozen transactions per week.*

5. How do you corroborate that the offers listed on the forest quota trading platform are really supported and exist for the underlying assets?

*For forest quotas, there will be a system administered by the government in the long run. This is expected to contain credible and verifiable fees. Transactions are not currently effective, but future arrangements will be made when the system (along with its associated regulation) is available.*

6. How is the minimum and maximum price set for fees?

*These prices are established by the market based on supply and demand.*

7. Once an offer is established, how is it possible to make the payment or receive it?

*This procedure is external to the platform.*

### 17.4.3. Interview: Vice President and Leader of BCG Environmental, John Battaglia

John Battaglia is vice president and carbon trade leader at BCG Partners, a firm that provides a wide range of services, including trade execution, brokerage services, information settlement and processing, as well as other secondary office processes. John is in charge of the promotion and management of carbon emissions trading businesses in North America. The main reason for having interviewed him is because BCG Environmental Brokerage Services provides services for energy and new carbon offset markets, so the questions asked were directed in this direction.

1. Regarding the platform: What are the requirements to establish communication between a registry and the platform to ensure that the information displayed is up to date? What are the challenges that arise when connecting the registry to the platform? Is it compatible to market green certificates and offsets on the same platform?

*Buying and selling transactions in environmental markets are not very liquid. Brokerage is used, which involves pushing transactions through voice. Transactions do not run by themselves and do not operate linked to a registry. A massive market is required to introduce auction systems that match large volume transactions. BCG Environmental Brokerage Services does not operate directly with a registry or with a market for green certificates or carbon emissions.*



*Compatibility between one instrument and another can be made; however, it is complex and the way to standardize it would turn out to be something that the Intercontinental Exchange (ICE) platform does about merchandise standardization in emissions permit trading.*

2. When dealing with operations, what is the minimum number of market participants so that it is convenient to develop a trading platform? In California, how big is the market and with what volume of transactions does it operate?

*The market requires a critical number of approximately 20 or 25 participants for the development of a platform to be relevant. In California the number of market participants is just over 100 at this time, while the volume of transactions is close to 10 million tons.*

3. Could you point out any strategy that you consider appropriate to increase the volume of transactions?

*Some of the points that I think are necessary to highlight in order to achieve that purpose are: not to restrict the laws, consider matters related to liquidity in these regulations, establish that the free distribution of emission permits does not encourage buying and selling activities in the market and contrary to this, it reduces its possibilities, expanding commercial activities to other sectors such as electricity, transport and industry, always keeping in mind that gratuity is an obstacle to trading.*

4. In relation to the instruments that facilitate transactions: Could a Request for Quote (RFQ) instrument favor market liquidity? Is there a scheme in the California and RGGI market in which offsets seeking buyers are reflected in a message on the platform to be visualized by users and thus promote liquidity?

*The direct market is very small; therefore, we opt for the use of brokers to push and facilitate transactions through voice, which drives liquidity. A third part, which in our case is BCG Environmental Exchange, serves as a regulator. To foster the market, it is essential to ensure a good design and a solid infrastructure for registries. Likewise, support for intermediaries will promote liquidity if and only if the market is well designed. Neither in RGGI or California, any system similar to RFQ is used since all transactions are made through the direct market driven by brokers.*

5. In relation to the link between local operations and international markets, are there specific challenges to which attention needs to be paid?

*In early stages of market development, rather than linking with international markets, it is recommended to carry out operations near the project's places of origin. In California, there is no interaction in international markets.*

## 17.5. Annex 5 Reference Platform Analysis

### 17.5.1. Carbon Offset Platform

#### 17.5.1.1. Homepage

The United Nations Carbon Offset Platform allows both natural and legal persons to acquire emission reductions through an electronic commerce system. Its main features include easy accessibility for users, the incorporation of simple payment methods, integration of a carbon footprint calculator within the platform, the incorporation of filters to perform specialized searches and the link with social networks.

*Carbon Offset Platform* includes certified projects that reduce, prevent or eliminate GHG from the atmosphere. These projects are in developing countries, and generate Certified Emission Reductions (CERs). It is a platform dedicated to the voluntary carbon market with global reach, in which users located anywhere can contribute to the reduction through projects registered under the Clean Development Mechanism, one of the flexibility mechanisms of the Kyoto Protocol.

A description of the importance of supporting emission reduction projects is displayed on the homepage of the platform, followed by a selection of those available in the system, in addition to a button that redirects the carbon footprint calculator. The next section is a selection of projects separated by region (Africa, Oceania, Asia and Latin America and the Caribbean), impact (environmental, social, economic) and industry (agriculture, energy, fuel transition, waste management, transportation, reforestation, etc.). Next there is interactive material to deal with topics such as: climate change, elements in everyday life that affect the climate, project benefits, etc. The penultimate section contains opinions on the platform issued by external organizations that have neutralized emissions through this system. Finally, the page includes a chart about the contribution by countries to the projects on the platform. Additionally, as a common practice on websites, there are links to the privacy notice, conditions of use and means of contact.

#### 17.5.1.2. Access to the Carbon Offset Platform

There are two routes to access the platform where projects are listed. The first is simpler and serves so that users know the number of tons to offset. The way to access is through the option "See all projects". Within this section, there is a description of each project: name, price per ton of reduced CO<sub>2</sub>, available tons and a brief description. Each description is preceded by a photo alluding to the project, in addition to iconographies that describe which sector it belongs to and which elements of sustainable development it supports.

The second way to enter the platform is through the use of the carbon footprint calculator. This option is viable for users who do not have estimates on the amount of tons of CO<sub>2</sub> to neutralize. When the calculator icon is selected, a panel of three tabs is displayed: the first one is home, under which data referring to the activities and characteristics in the housing must be entered; the second is transport, where the use of different means of transport is detailed; and the third, called lifestyle, gathers information on user habits, for example: food, and consumption of products and wastes. Once the form has been completed, it is possible to finish the procedure by selecting the option "Calculate my footprint". The report derived from the estimate includes the breakdown of the contribution to the user's carbon footprint.



From this point, it is possible to access the platform where the projects are listed, and then select the one that best suits according to the user's interests to offset all (neutralize) or part (mitigate) of its calculated emissions.

#### **17.5.1.3. Emission Reduction Projects**

Once the project of interest to the buyer is selected, the platform displays an entire exclusive section to show specific information about it such as: name of the project, internal codes of the identification platform, photographs alluding to the project, a brief description, sector, geographical location, emission period of emission reductions, co-benefits associated with sustainable development, project serial number (internal to the CDM), hyperlink to the project's own website, the price/ton of the project in USD, the applicable tax rate, the supplier, the availability of credits and finally the shopping cart to enter the desired amount of emission reductions to acquire.

#### **17.5.1.4. Transactional Platform**

When a project is selected, the website redirects to the platform where the transaction is made. It is possible to carry out the transaction as a registered or invited user. The registry process is simple: a form is filled out with the user's name, email and additional information about geographic location.

Once in the "Your order" section, the payment terms are described. Following an image, project information and the number of tons that were introduced in the previous section are shown again with the possibility of modification. Below there is an option whereby the right to publish the certificate on the website is assigned. Subsequently, an option in which the reason for the offset must be selected (for example: contribution to climate action, offset of personal GHG emissions, derived from travel and events, by the operation of companies, etc.). Finally, a table is displayed showing the Subtotal, Tax and Total of the operation, as well as a button through which the order is made and the payment method is chosen (bank transfer/PayPal or credit card) and address to which a hard copy of the United Nations Framework Convention Certificate on Climate Change, in addition to the electronic copy, will be sent physically to the user's email. Below, there is a box that must be selected accepting the terms and conditions of use. Finally, there is a preview of the certificate, a box that again indicates the total of the operation, and also a section in which it is mentioned that the payment is made directly to the certificate holder.

When the order is confirmed, the system redirects to the payment section managed by PayPal. Two vertically divided panels are deployed. The one on the left contains the payment summary where the name of the project supplier is located and the amount in USD. The right side panel has two sections: login with PayPal account and payment by credit or debit card. If the first option is selected, a box opens in which it is required to enter the PayPal account details and the access code. Once the payment has been entered, it proceeds like any other, using this online payment system, and the purchase process ends.

In the second card payment option, the typical form of this payment method is displayed (the required data are: country from which the purchase is made, language, card number, the available payment types, expiration, code, and user data). When selecting the accept button and continuing, the operation is concluded. Before making the payment, the system notifies the order, sending an email to the user where information about the order details, the billing address, the name of the project and the transaction total can be found. In addition, an email is attached to obtain more information in case the payment has not been made successfully.

It is also mentioned that another email will be received from the entity that manages the payments confirming the transaction.

An analysis of the main points in favor, opportunities for improvement, weaknesses and threats in relation to the platform in question was carried out.

#### **17.5.1.5. Points in Favor**

- Very accessible forms of payment (online payments, credit or debit cards and bank transfers) and simple payment procedure.
- Availability of a carbon footprint calculator on the homepage.
- Estimation of the carbon footprint of natural persons following a simple procedure.
- Information available on how the carbon footprint is calculated.
- Incorporation of filters to facilitate the selection of projects depending on the region, impact (environmental, social economic) or industry (renewable energy, agriculture, nitrous oxide, energy efficiency, reforestation, fossil fuel transition, waste management, etc.).
- Adequate level of information about projects to facilitate decision making.
- Permanent availability that allows users to make purchases all the time.
- Availability of information in multiple languages, including English, Spanish and French.
- Linking with social networks to achieve greater reach and penetration.

#### **17.5.1.6. Weak Points**

- Carbon footprint calculator only works for the residential sector, specifically for calculating emissions generated in a house. If it is necessary to neutralize another type of activity, other calculators should be used.
- Null protocols to confirm that the source of the resources with which the instruments are acquired is lawful.

#### **17.5.1.7. Threats**

- First, anyone can access to acquire CERs, so it is difficult to identify where the resources to carry out the transaction come from. This could compromise the reputation of the platform.
- In order to make payment by bank transfer, a minimum amount is required in certain projects (variable/project), so that if users wish to offset for a small amount of issues, the purchase opportunity may be lost.

#### **17.5.1.8. Improvement Opportunities**

- Make a change in the calculator, so that the fields to be filled are descriptive and understandable for all types of users.
- In order to make the emission offset, it would be convenient to have two options: calculate the CO<sub>2</sub> footprint or offset directly if the estimate is known.
- Homogenize the payment method to all projects, because not all accept bank transfer and online payment method or debit/credit cards.

## 17.5.2. BVRio Platform

### 17.5.2.1. Homepage

BVRio is an initiative created by the collaboration of the private sector, academic sector and non-governmental organizations whose objective is to promote the use of market mechanisms to facilitate compliance with environmental laws and support green economies. Although it is a pilot platform, so it does not operate in a real way, some of its characteristics were analyzed by proposing the conjunction of several markets (some unconventional and developed from the contextual characteristics of Brazil) on the same website.

Among the main features of BVRio are the incorporation of an intelligent interface that automatically responds to some of the characteristics of the users (such as geographical location), easy accessibility for users, the possibility of translating the supply and demand needs of users with different variables, the inclusion of informative material on the context in which the platform arises (and would operate tentatively), the incorporation of multiple dynamic icons and texts, etc.

The main domain receives the user with a dynamic main screen through which the BVRio Mission is deployed and automatically and gradually changes displaying ads (images and short messages) of the main sectors with which it works, as well as some of its products and promoted events. At the top of these ads, it is possible to find a bar with the interactive BVRio icon on the far left, which redirects the user to the main screen. On the right side of this icon, it is possible to find four dynamic tabs (About BVRio, Sectors, Library and Contact), which in turn display a series of options. The icon to register or access the platform appears in the upper right corner, as well as to change the language.

When moving vertically towards the lower part of the main screen, it goes from being dynamic to static and the user finds a brief and general description about BVRio, its history and the needs to which it responds, its objective and scope.

Below, there is a section called "Sectors" with a series of icons that correspond to a brief description of the main sectors through which BVRio promotes compliance with Brazilian environmental policies.

By continuing to scroll to the bottom of the page, the user finds a new section called "Initiatives, Instruments and Products", which also consists of several interactive icons and descriptions of the main initiatives, instruments and products offered.

The next section called "Latest News" displays the four most recent news. Both illustrative images, news headings and ellipses at the end of the introductory text to the note are interactive.

The final section called "Awards" contains icons with the logo and the name as text at the bottom of the icons with the main awards that have been awarded to BVRio throughout its existence.

Below the "Awards" section, there is a bar with the interactive icon and the address of the offices on the far left; there are icons and contact details (telephone and email) in the central part, as well as social networks. All the icons included in this bar redirect the user to Google Maps, the user's email application and social networks.

#### **17.5.2.2. Access to the Voluntary Climate Contribution Portal Platform (VCC)**

There are two paths from the main page to the Voluntary Climate Contribution Portal platform. The first is through the Sectors tab, clicking on the Climate option. The second is by scrolling down the main page to Sectors and clicking on the icon corresponding to Climate & Emissions. Both paths will redirect the user to the page called Climate. In this, the user must place the cursor on the interactive text Portal of Voluntary Contributions to the Climate and click, redirecting it to a page dedicated exclusively to explaining the purpose of the VCC portal, a brief description of the instruments with which the platform works, and the most relevant characteristics of these market mechanisms.

An information box is included with the emission reductions achieved through the instruments available at BVRío. Below this box, there is a final text in which the BVRío Platform hyperlink is inserted, which redirects to a second page dedicated to VCC, which again includes a brief description of the objective, significance and characteristics of the assets named Environmental Reserve Quotas and Reserve Logistics Credits. In addition, two tables are included - one for each asset - which includes the Tickers, the volume in tons of carbon dioxide equivalent of the instruments and the price in R\$/tons of carbon dioxide equivalent.

In order to properly enter the BVRío purchasing platform, it is necessary to position the cursor on the yellow box in the upper right segment of the website and click. A pop-up window will open to log in with a Facebook, Google account or to register directly. Using any of the options, it is possible to access the buying and selling platform. Once registered, the page will automatically redirect the user to the page on which it was prior to starting the registry process. The platform access hyperlink is as follows: <https://www.bvrio.org/carbono/plataforma/prepara.do>

Subsequently, the user must position the cursor on the interactive texts in bold with the name of the instruments (Environmental Reserve Quotas and Reserve Logistics Credits) and click to properly access the transactional platform in which all instruments are available with which BVRío operates.

There is a test account for the purpose of knowledge of the system operation. The username and password are shown below:

**User:** [test@consultancy.com](mailto:test@consultancy.com)

**Password:** consultancy1

#### **17.5.2.3. BVRío Markets**

BVRío operates with two different markets. The Forest Legal Reserve Market operates with environmental reserve quotas, which are assets created to facilitate compliance with the Brazilian Forest Code.

Each quota represents one hectare of natural vegetation preserved in rural properties for the protection of biodiversity and water resources, thus contributing to the conservation of the forest and the ecosystem of rural landscapes in accordance with the National System of Conservation Units of the Nature of Brazil.

On the other hand, there is the Reverse Packaging Logistics Credit Market that operates with reverse logistics credits that are assets designed to facilitate the objectives of the National Solid Waste Policy and remunerate the work of recyclable waste collectors in Brazil.

It should be noted that BVRio does not have an operational trading platform for carbon market assets. However, it participated in the Simulation of Carbon Markets with the Getúlio Vargas Foundation and created a dedicated trading platform with an auction system, a registry of the differentiated instruments and interfaces for each type of market participant.

Given the need to analyze the transactional process through the platforms, the transactional platform of the Forest Legal Reserve Market is explored, although it is very clear that the instruments with which it operates are not nor are they assimilated to offset credits.

#### **17.5.2.4. Transactional Platform of the Forest Legal Reserve Market**

The fact that although the rest of BVRio's domain and hyperlinks can be translated into English, this is not possible when entering the transactional platform since although the user selects the British flag, the text of the page will remain in Portuguese language.

The page consists of four sections. The first one called Market Offers consists of two filters in the upper part where it is possible to select the state in which the reserve looking to support is located, as well as the type of biome that is sought to keep. Also, a button is included that allows converting the ratio of the minimum and maximum prices of \$R/ton CO<sub>2</sub> eq to \$R/ha.year or vice versa, depending on the preference of the buyers.

Below these filters, there is a table in which the Ticker symbol of each instrument is displayed, the biome it supports, the state of Brazil in which the reserve to be supported is located, the minimum and maximum price of the instrument, the reason used to consider the minimum and maximum prices, as well as the column that contains the icons that will allow the user to acquire the instruments.

The next section called "Sale Offers" shows a box with the legend "Click here" to register the user's first purchase offer. When pressing the box, a pop-up window opens with dynamic tabs in which it is possible to select the state in which the reservation is located through which the instruments to be offered will be created, the municipality in which the reservation is located and the biome that can be found predominantly in that reserve. Also, there are as many boxes and selection areas to detail the characteristics of the reservation. For example, if it is or not within a conservation area, the total area of the reserve, the area available to generate the marketable instruments from it, the desired price (\$R/ha.year) and establish whether the reservation is registered within the CAR. Once the information is established in these tabs and boxes, the OK and Cancel buttons at the bottom of the pop-up window will give the user the possibility to cancel the sale offer or proceed. At no time during the process to make the sale offer are additional data requested to corroborate the veracity of the reservations offered and it is not clear if this information is requested through another means.

The "Purchase Offer" section is very similar to the one described above, because when you click on its respective box, another pop-up window will open in which, through dynamic tabs and blank boxes, information regarding the state and municipality will be entered where the reserve is located, the biome, the desired area in hectares, the maximum desired price (\$R/ha) and select if the instruments to be acquired are registered within CAR. Then, the purchase offer is made or canceled through the OK and Cancel buttons at the bottom of the pop-up window. At no time during the purchase offer process is information requested, such as bank details, that may serve as a guarantee of the ability to pay.

Both the data related to the desired volume to be offered or purchased in the pop-up windows can be modified if the button is used to convert the price ratio. This gives users the

alternative of planning their purchase or sale both in terms of hectares covered, and in emission reductions, depending on their preference.

Finally, the “Messages” section consists of a header at the far right, where an interactive text with the new legend can be found. Clicking on it opens a new pop-up tab in which a box appears to compose a message.

#### **17.5.2.5. Points in Favor**

- The BVRio website detects the geographical location of users and based on it displays content in Portuguese or English.
- The first thing that the user visualizes when entering the website is the mission of BVRio, which facilitates understanding.
- The design of the main page is visually attractive, informative, and has a large number of interactive elements for the user to access the information.
- The main page includes the awards with which BVRio has been recognized throughout its existence, which gives the institution credibility and prestige.
- There are several ways to access the same sites through the BVRio website, which may favor user accessibility.
- A single site serves as an access vehicle to all the transactional platforms of the different markets in which BVRio participates, which is pragmatic.
- The transactional platform of the Forest Legal Reserve Market offers the user multiple possibilities to register, even without the need to create an exclusive account for the use of the platforms, since it can be accessed using networks such as Google or Facebook.
- The transactional platform offers users a space to make buy-sell offers customized to their needs and demands, through the use of filters, pop-up windows, dynamic tabs and boxes to enter inputs to create offers.
- The platform considers the possibility of translating the supply and demand needs of the users to different variables (tons of CO<sub>2</sub> equivalent or hectares per year) for their better understanding and adaptation to the particular requirements.

#### **17.5.2.6. Weak Points**

- Access to the transactional platform requires prior entry to many intermediate pages, which can be tedious and/or confusing for the user.
- Although the user can access the English language content throughout the BVRio website, when the transactional platform is properly accessed, the text and content automatically appear in Portuguese. Pressing the British flag in the upper right corner of the page does not imply any change in the language.
- There are many intermediate pages before accessing the desired sites, which includes redundant information and could be contained on a single page.
- Although the presence of tables with information related to the instruments stands out, this is outdated, which makes it impossible for users to inform themselves about the behavior of assets in real time.
- It highlights the lack of mechanisms to corroborate the veracity of purchase and sale offers. It is not clear if at any point in the process the existence of forest projects and areas through which the instruments arise and sale offers are made is verified. It is also not clear in which part of the process the payment capacity of the buyers is corroborated.
- Lack of clarity regarding the deadlines for responding to offers made on the platforms.



- The large amount of information contained in the BVRio homepage can cause the user to lose focus on their purpose of entering the platform.
- The coexistence of several services, products and information in the same web space can generate intraspecific competition for the attention of users.
- Given the number of intermediate pages through which users have to travel to access the transactional platform, it is possible that the user is lost on the route before accessing the platform.

#### **17.5.2.7. Threats**

- The lack of liquidity in the market has significantly lowered the activity.
- The lack of notion of a property right of the instruments may be associated with a lack of dynamism in the markets in which BVRio operates.

#### **17.5.2.8. Improvement Opportunities**

- Synthesis of the information contained in the BVRio website.
- Real-time update of the content related to the traded instruments.
- Clear establishment of the guidelines and mechanisms through which the platform operates (response time, transparency, etc.).
- Incorporation of MRV system to provide transparency and legitimacy of traded instruments.
- Incorporation of a transaction mechanism according to the level of activity.
- Incorporation of a transaction mechanism that enables the traceability of income and its transparency.
- Creation of tutorial content regarding the operating mechanism of the platform.
- Incorporation of mechanisms to corroborate the veracity of the offers and the bidders.

### **17.5.3. European Energy Exchange Platform**

*European Energy Exchange* (EEX) is the largest exchange platform in Europe, which develops, operates and connects in a safe, liquid and transparent way the energy markets and environmental commodities, among others. This platform serves as a space for exchanging market instruments for more than 30 countries from different parts of the world. Among its distinctive features, it stands out that supports the trade of many types of instruments and values, the protocols for access authorization are extremely rigorous, incorporates processes and systems that guarantee high transparency in operations, the responsiveness of its trading systems given the market variables (supply/demand), interactions between users occur in real time and incorporates subscriptions for monthly or annual fees.

#### **17.5.3.1. Homepage**

This description will only include information on the section that covers environmental markets, specifically emission permits. These emission permits correspond to a primary market of medium and large scale in a spot trading system. Additionally, in cooperation with Incubex, EEX manages a secondary market to carry out continuous emission permit transactions within the EU ETS (European Emissions Trading System) and emission reductions of CDM projects.

On the homepage of EEX, there is a table in which the relevant news and a presentation of the platform are presented, which consists of an infographic where the markets for power, natural gas, agriculture, global, environmental and environmental goods, and the registry of services are mentioned; there is also a section of data and figures that includes general information about the market participants and the countries to which they belong, as well as the number of auctions held on a certain date and information on the transactions carried out.

The second section of the homepage consists of the presentation of the evolution of power prices and emissions, during the last two weeks. On the right side of this section, there are messages concerning the market that mainly inform about the day on which the auctions are held. Below these sections, there is a box for quick access to the calendar, publications, contract specifications, rules and regulations. On the right side, there is a panel with news, social networks and websites that belong to the EEX Group. At the end of the homepage, there is contact information, and a badge indicating that EEX belongs to a German stock exchange group.

### **17.5.3.2. Environmental Markets**

In order to access the environmental markets section, it is necessary to select the options menu found next to the EEX logo, within which the products tab is located. By selecting this tab, a menu is displayed in which it is possible to find the environmental markets section and also the subsections: emission auctions, spot market, futures and options, Carbon China, news on emissions, meet the emissions equipment and a section with information about the environment.

In order to find the emissions trading section, "Environmental Markets" must be selected, an action by which the user is redirected to the subsections mentioned above. Next, the most relevant sections are described: Emission Primary Auctions or Primary Emission Permit Auctions.

In this section, there is a description made by the sales coordinator, where the auctions are discussed. At the top of the page, it is possible to find a horizontal bar with a series of boxes. By positioning the cursor on them, the user has the possibility of accessing a large amount of information related to environmental markets, rules and regulations that govern them, volume and temporality, requirements and access mechanisms to the auction platform, rates, auction design, auction system, frequently asked questions, news and related files.

When scrolling vertically down, the user will be able to see information about the auctions where it is mentioned, for example, that these are the principle for assigning permits within the EU ETS, which means that companies and organizations must buy a proportion of emission permits tending to increase through auctions. The issuance permit volumes are published in an auction calendar, which is organized between the European Commission, Germany and Poland. The EEX has the responsibility of serving as the platform to auction emission permits for 25 EU states.

After the previous description, and scrolling down, there is a summary of the auctioned products (type of permit, day of delivery, minimum amount to participate and minimum amount per transaction). In addition, there is a box indicating the weekly auction schedules. Below, the user can find a box containing the primary market rates for the European Union auctions, German auctions and Polish auctions.



The next section called list prices includes two bullets with interactive texts. By clicking on them, they redirect the user to another web page that allows the user to download pdf documents describing the transaction fees, annual fees, technical fees, fees for additional services, as well as ECC fees.

Subsequently, the “Auction Report 2019” section includes a descriptive text and an interactive text whose hyperlink activates the download of an Excel document that includes detailed information on prices, volumes and countries participating in the auctions. Below there is a box where the user can download several documents in pdf, xlsx and zip format.

Finally, the final section of this page is the so-called “M7 Auction System Tutorial” that includes a video tutorial of the operation mechanism of the M7 Auction System auction platform. The general public and users who have not undergone the processes required to participate in the auctions have no possibility of accessing this platform.

#### **17.5.3.3. Primary Emission Permit Auctions**

In this section, there is a description made by the sales coordinator, Christian Fleischer, where the auctions are discussed. At the top of the page, it is possible to find a horizontal bar with a series of boxes. By positioning the cursor on them, the user has the possibility of accessing a large amount of information related to environmental markets, the rules and regulations that govern them, their volume and temporality, the requirements and mechanisms for accessing the auction platform, rates, auction design, auction system, frequently asked questions, news and related files.

After the description above, and scrolling down the page, there is a summary of the auctioned products, which specifies the type of permit, the day of delivery, the minimum amount to participate, and the minimum amount per transaction. In addition, there is a box indicating the weekly auction schedules for members participating with emission and aviation permits within the same platform. These auctions are held on Monday, Tuesday and Thursday at 11:00. Similarly, it is pointed out that auctions on behalf of Germany and Poland are held on Fridays once a week and Wednesdays every two weeks, respectively. Below, the user can find a box containing the primary market rates for European Union auctions, German auctions and Polish auctions.

The next section called “List Prices” includes two bullets with interactive texts. By clicking on them, they redirect the user to another web page that gives the user the possibility of downloading PDF documents describing the transaction fees, annual fees, technical fees, fees for additional services, as well as ECC fees.

Subsequently, the “Auction Report 2019” section includes a descriptive text and an interactive text whose hyperlink activates the download of an Excel document that includes detailed information on prices, volumes and countries participating in the auctions. Below there is a box where the user can download several documents in pdf, xlsx and zip format where it can access the calendars of the different auctions in the period 2019-2020.

Finally, the final section of this page is the so-called “M7 Auction System Tutorial” that includes a video tutorial of the operation mechanism of the M7 Auction System auction platform. The general public and users who have not undergone the processes required to participate in the auctions have no possibility of accessing this platform, so the greatest contact they will have with it will be this video explaining its functioning.

When clicking on the video, it will start playing. It consists of a recording of the platform screen with short and emergent texts that describe both its constituent parts and operation. The recording is not accompanied by any audio that guides the user in this learning process.

#### **17.5.3.4. M7 Auction System**

In order to enter the transactional platform, a pop-up window appears in which the username and password must be entered. The user must select the Ok button at the bottom of the window to access the platform.

Once this is done, a screen is displayed in which a series of options appears at the top. In the upper left part, the following options appear: Auctions, Imprint and About. The username and the Change Password and Sign Out options appear in the upper left. The screen displayed by default when entering the platform corresponds to the Auctions option.

Also, the page displays a vertical bar in the left part. At the top of this, there is the EEX logo. Below this, there is a menu with the following sections: All Auctions, Live Auctions, Finished Auctions, My Live Auctions and My Finished Auctions.

By positioning the cursor on the All Auctions option, the user is able to see a table with eight columns in the central part of the page. The first column refers to the number, which is a random number in ascending order. The next column is called Auction ID and contains a figure that serves as a specific identification code by auction. This column is followed by the Name column, which includes the particular nomenclature for each auction, as well as the icon of a flag that refers to the country of origin of the auction. Subsequently, a fourth column is displayed indicating the phase in which each auction is, for example, published, in progress and completed. The fifth and sixth column contains the type of product that is marketed in the auction and the amount of instruments that are auctioned, respectively. Finally, the last two columns contain the opening and closing times for each auction.

In the right part of the page, below the options to close the session and change the password, the user can find a message window through which additional information regarding auctions can be obtained.

When positioning the cursor on any of the auctions of the previously referred table that is active, an additional tab will be opened in which again the user will have the possibility to view the auction information. This tab will also contain:

- A section describing the auction configuration in terms of the algorithm used, smallest unit, initial conditions and minimum bid size.
- A section to configure the parameters, for example, stepped steps in terms of quantities and prices as a mechanism to change the conditions of the offers.

Likewise, a box is displayed in which the initial conditions of the auction can be indicated by setting an initial amount and price. Finally, the Offers box allows the user to view, modify or cancel the offers.

The remaining sections of the sidebar menu previously referred to will function as a filtering instrument. The EEX works under a completely electronic system and it has platforms for the liquidation of products in the spot and derivative markets. Auction participants transfer orders and fees through their respective workstations. Administrators are responsible for allowing the use of other transfer forms. They also control access to EEX for one or more products for technical reasons.

#### **17.5.3.5. Points in Favor**

- Rigorous transactional platform access authorization protocols.
- Large amount of information related to the regulation applicable to both EEX and the markets in which it operates.
- The same page allows the user to access different markets.
- Inclusion of texts and video tutorials to access the platform.
- Inclusion of downloadable documents that allow knowing specific principles through which the transactions specified in the platform are governed.
- Prices respond to the market situation, which may encourage the participation of more buyers and sellers.
- High transparency since it is possible to access documents where previous auctions, participants and market prices have been settled.
- Capitalization of the resources allowing the page to raise funds in exchange for giving users access to certain information, or providing them with advisory services for the use of the platforms.

#### **17.5.3.6. Weak Points**

- Although it is practical that through the same page the user can access different markets, the amount of information contained in the page makes it difficult for the user to distinguish how to proceed to access the page that contains the specific information of interest.
- The information is not presented in a synthetic way, so it implies the destination of a considerable amount of time to synthesize it.
- If you are not familiar with the markets, it is relatively complicated to understand how the platform works.
- The information available is not created for anyone to understand, since the presence of specific technicalities and concepts abounds.
- The tutorial videos are not totally clear because they are limited to containing short and few descriptive texts, without audio material.
- The user has no possibility to understand in a practical way how to use the platform, unless it pays for it.

#### **17.5.3.7. Threats**

- It is possible for the user to perceive the path to the platform confusing or find it difficult to distinguish between the large amount of information available.
- Potential users may consider the large amount of technical information as a deterrent, which could be overwhelming.
- Potential users may consider the non-gratuity of EEX material as a deterrent.
- Users not familiar with the market may not be able to cope with the technical complexity of the material.

#### **17.5.3.8. Improvement Opportunities**

- Synthesis of information and content on the website.
- Inclusion of understandable material for other types of audiences.
- Development of clearer and more complete tutorial material.
- Incorporation of paths to the simplest and most direct platforms.

- Incorporation of trial periods that facilitate the user to make a decision regarding the payment of products and services in their versions and full access.

## 17.6. Annex 6 Process Diagrams

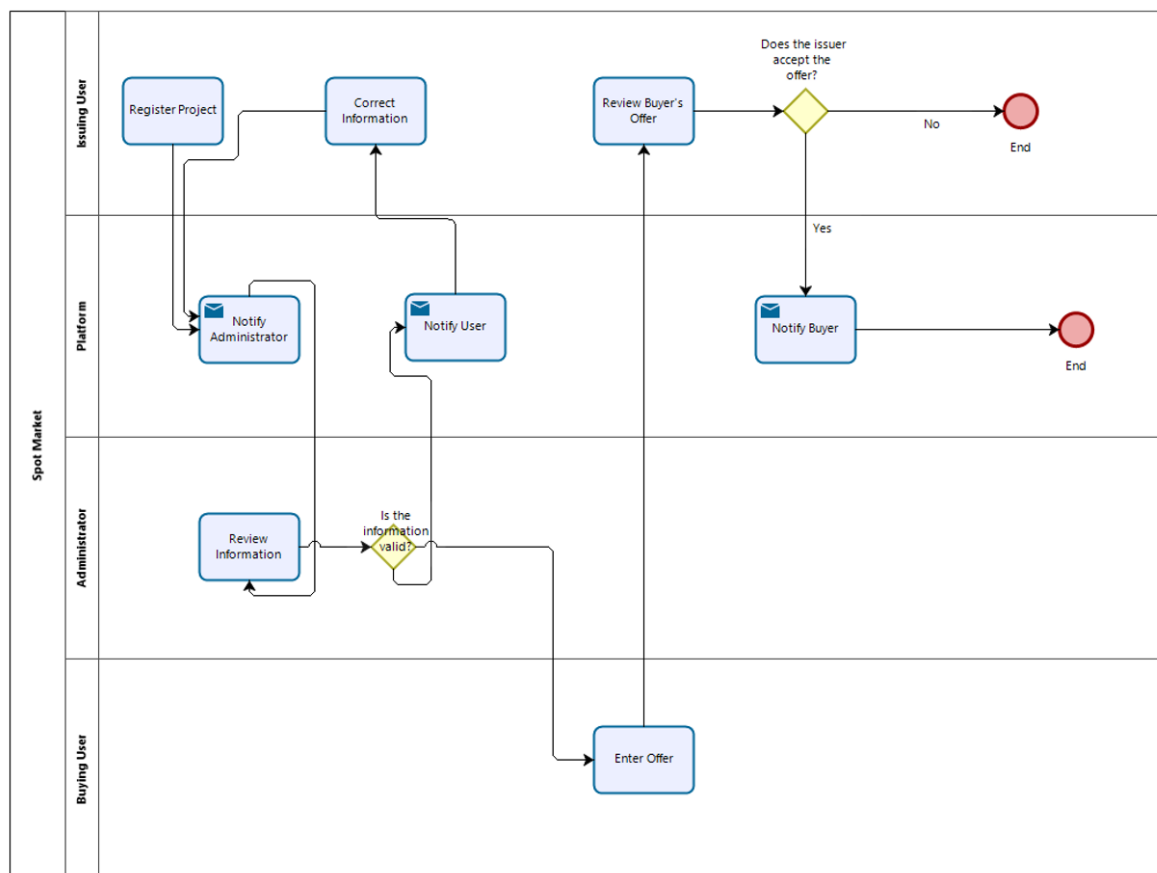
Based on the minimum requirements raised for the trading platform, the diagrams of the main processes were developed in the short, medium and long term.

The diagrams presented are important guidelines for knowing the expected operation of a trading platform; however, they can be modified according to the new requirements that may arise during the execution of the project itself.

### 17.6.1. Spot Market (OTC)

The process involved in a spot market (OTC) implies an interaction of the users with the platform, seeking the coincidence between the selling user and the buying user. In this sense, the platform allows the buying user to enter offers for a specific project registered by a selling user; then, the sales coordination starts.

Diagram 11 Process Diagram of the Spot Market OTC



The above process diagram starts with the registry of the project by a selling user, whose information can be validated by the administrator. If the information is not validated, an

edition by the selling user will be required. This action must be repeated until acceptance of the registry by the administrator.

Once the registry is accepted, one or more buying users may enter offers of interest through the platform. Selling users may review and decide on the beginning of a purchase and sale agreement.

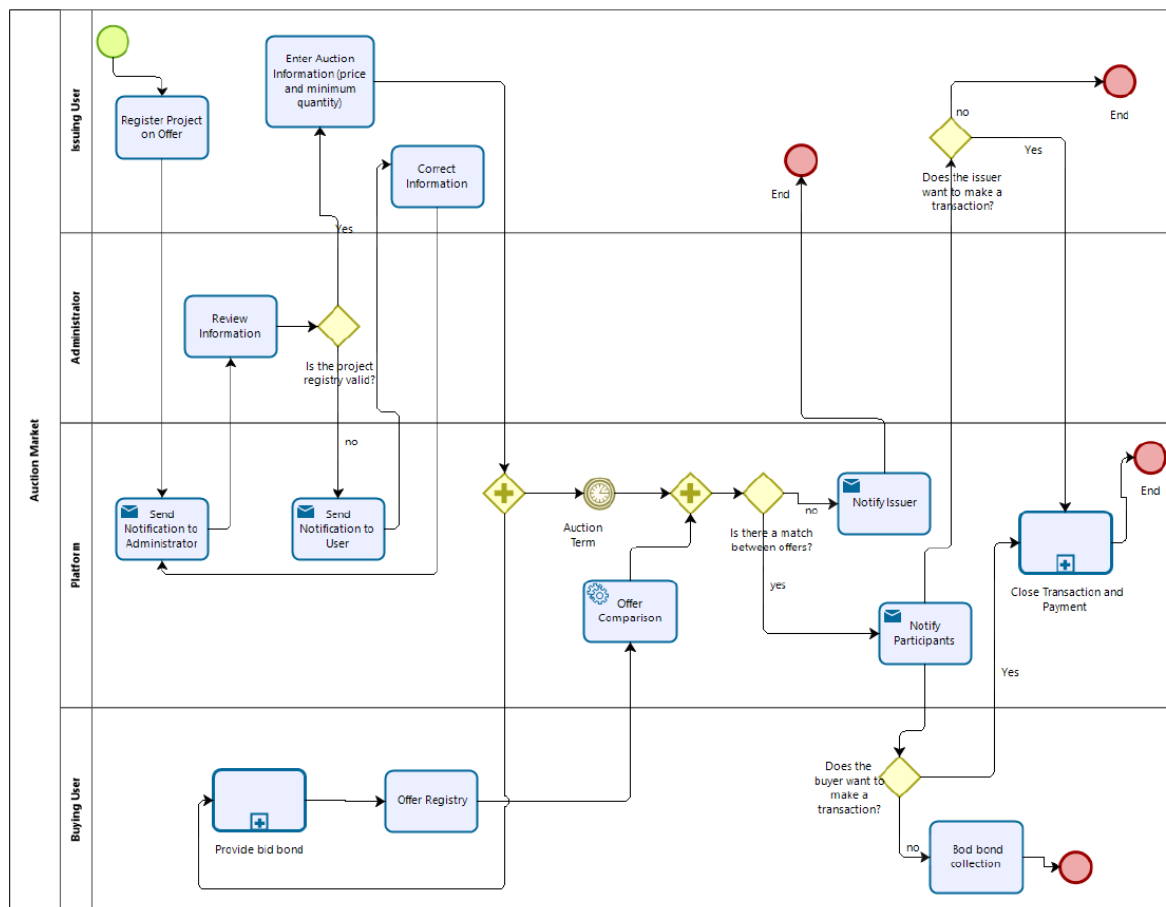
### 17.6.2. Auction Market

The process related to the auction market begins with the registry of a project on offer, which must be validated by an administrator. Once validated, the selling user can enter the project for auction.

Auctions are held within a certain period where the buying users can enter their bids (offers) in the system. To place bids, buyers must, in general, provide guarantees of seriousness of supply. In the event that a selling user retracts from the bid made and selected in the bid adjustment process, the guarantee becomes effective.

If there is an offer and bid adjustment, participants can specify the purchase and sale, which implies that the buyer must execute the payment, generating a certificate proving the purchasing act.

Diagram 12 Process Diagram of the Auction Market



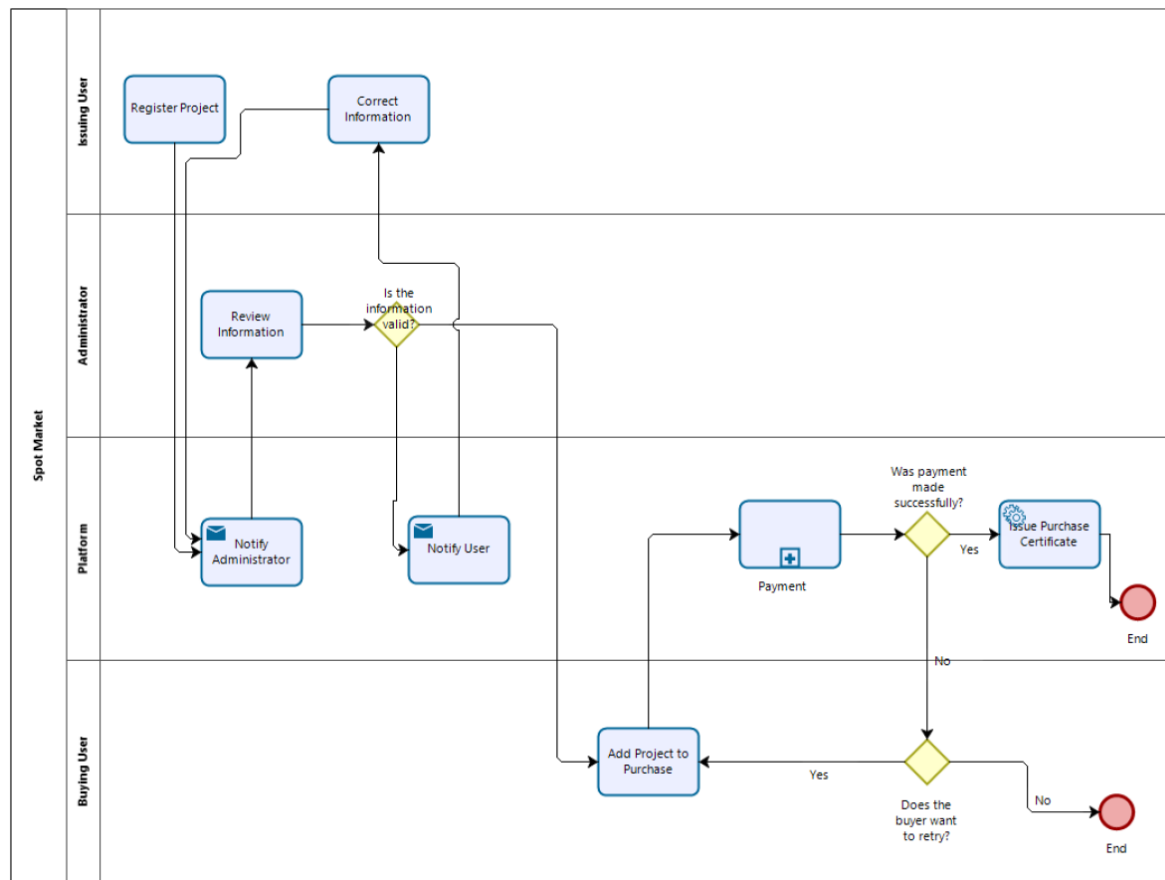
### 17.6.3. Spot Market

Unlike the process diagram for spot market (OTC), in this market the payment is considered to involve the platform.

The process begins with the registry of the project by a selling user, whose information can be validated by the administrator. If the information is not validated, an edition by the selling user will be required. This action must be repeated until the administrator accepts the registry.

Once the registry is accepted, a buying user may purchase a certain amount of reductions at the price registered by the selling user. This purchase considers payment through a valid mechanism (payment gateway).

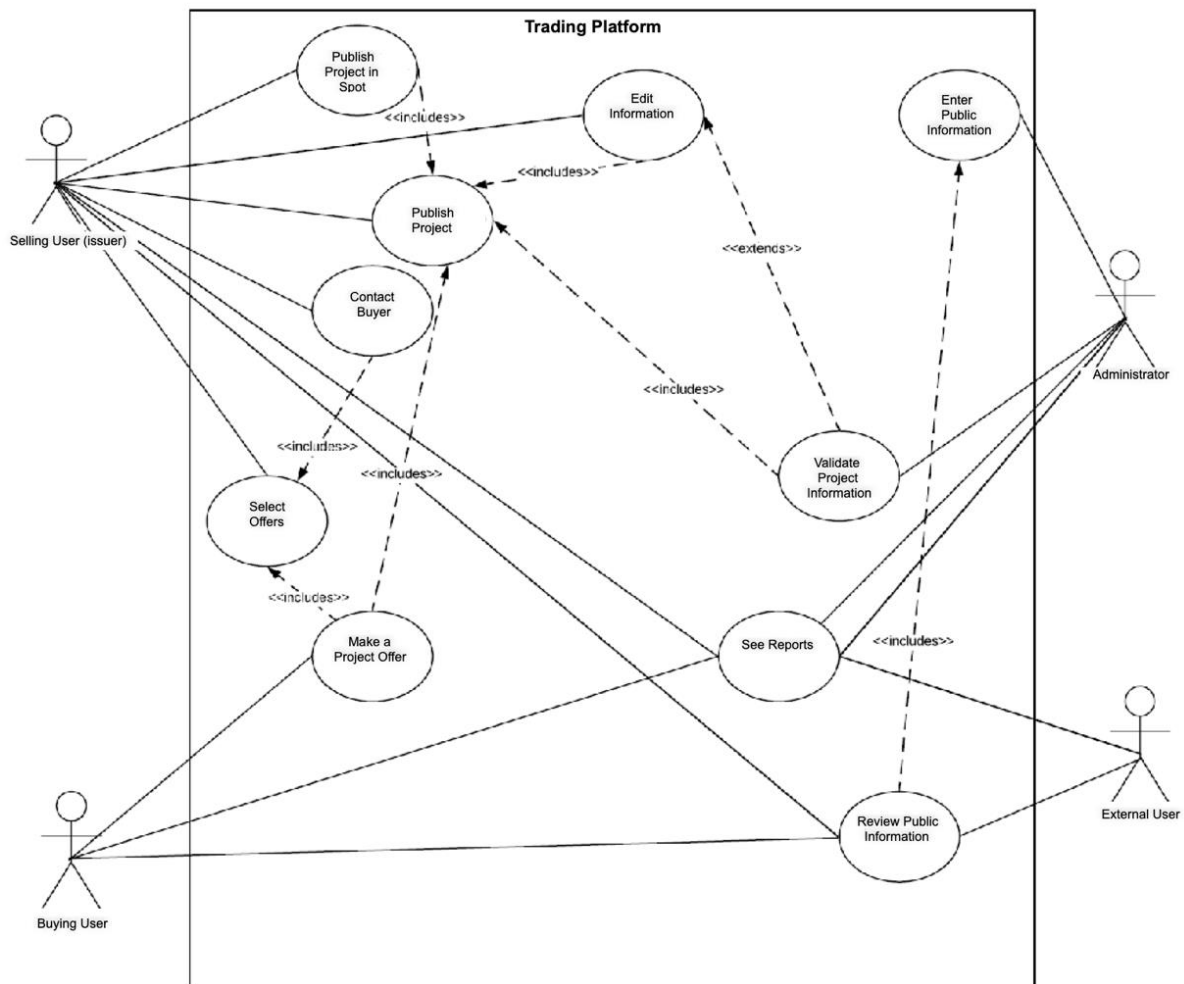
Diagram 13 Process Diagram of the Spot Market



## 17.7. Annex 7 Use Cases

Below, there is a diagram of proposed use cases for the short-term trading platform, as well as a series of tables corresponding to each use.

Diagram 14 Diagram of Use Cases



Print X file

Based on the previous diagram, use cases are detailed:

Table 24 Use Case: Information Editing

<b>Use Case</b>	Information Editing
<b>Stakeholders</b>	Selling User (issuer)
<b>Purposes</b>	Edit registered information regarding a project published on the platform.
<b>Summary</b>	The person enters the project information registry forms and edits the information, such as the price or quantity available for sale (spot or auction).

Table 25 Use Case: Publish Project

<b>Use Case</b>	Publish Project
<b>Stakeholders</b>	Selling User (issuer)
<b>Purposes</b>	Register on the platform the different projects whose reductions will be traded.
<b>Summary</b>	The Person enters the required information of the projects in the form provided for this purpose on the platform.

Table 26 Use Case: Publish Spot Offer

<b>Use Case</b>	Publish Spot Offer
<b>Stakeholders</b>	Selling User (issuer)
<b>Purposes</b>	Publish a project on the platform leaving it available for the purchase of part or all of the reductions associated with it.
<b>Summary</b>	The person selects a published project so that it is available for the purchase of part or all of the emission reductions.

Table 27 Use Case: Validate Project Information

<b>Use Case</b>	Validate Project Information
<b>Stakeholders</b>	Administrator
<b>Purposes</b>	Once the registry of a project on the platform is requested, the administrator validates that request.
<b>Summary</b>	The person reviews the applications for registry of projects on the platform and accepts that request in the case of complying with the established requirements.

Table 28 Use Case: See Reports

<b>Use Case</b>	See Reports
<b>Stakeholders</b>	Selling User (issuer), Buying User, Administrator, External User
<b>Purposes</b>	Display information according to parameters defined when generating the report.
<b>Summary</b>	The person, after selecting the parameters, can see the available information on the screen, according to the required information



Table 29 Use Case: Review Public Information

<b>Use Case</b>	Review Public Information
<b>Stakeholders</b>	Selling User (issuer), Buying User, Administrator, External User
<b>Purposes</b>	Display public information.
<b>Summary</b>	The person can see the available public information on the screen.

Table 30 Use Case: Enter Public Information

<b>Use Case</b>	Enter Public Information
<b>Stakeholders</b>	Administrator
<b>Purposes</b>	Registry of information for public availability.
<b>Summary</b>	The person enters the information to the platform so that it is available for public review.

Table 31 Use Case: Select Offers

<b>Use Case</b>	Select Offers
<b>Stakeholders</b>	Selling User
<b>Purposes</b>	Selection of offers previously entered by a buying user for a specific project of the Selling User.
<b>Summary</b>	The person reviews the offers entered for his project and selects a preferred one.

Table 32 Use Case: Make a Project Offer

<b>Use Case</b>	Make a Project Offer
<b>Stakeholders</b>	Buying User
<b>Purposes</b>	Entering an offer for a given project.
<b>Summary</b>	The person enters the offer information for a project of interest

Table 33 Use Case: Contact the Buyer

<b>Use Case</b>	Contact the Buyer
<b>Stakeholders</b>	Selling User
<b>Purposes</b>	User contacts the buying user to coordinate an agreement.
<b>Summary</b>	The person contacts the buying user to coordinate an agreement

Table 34 Use Cases: Buying User

Person	Process	Pre-Process	Post-Process
Buying User	Make a Project Offer		Select Offers
	See Reports		
	Review Public Information	Enter Public Information	
	Contact the Buyer	Select the Offer	-

Table 35 Use Cases: External User

Person	Process	Pre-Process	Post-Process
External User	See Reports		-
	Review Public Information	Enter Public Information	-

Table 36 Use Cases: Selling User

Person	Process	Pre-Process	Post-Process
Selling User (Issuer)	Publish Project		Validate Information, Edit Information
	Publish Spot Offer	Publish Project	
	Edit Information	Publish Project	Validate Information
	Select Offers	Make a Project Offer	
	See Reports		
	Review Public Information	Enter Public Information	

Table 37 Use Cases: Administrator

Person	Process	Pre-Process	Post-Process
Administrator	Enter Public Information		Review Public Information
	Validate Project Information	Edit Information, Publish Project	
	See Reports		
	Review Public Information	Enter Public Information	

## 17.8. Annex 8 Information Required for User Registry

The profiles of eligible buyers on the platform depend on the protocols established for it. The level of information required to enable the participation of users in the platform is a function of both the type of operations they wish to execute, the type of users that will participate and the market dynamics. The information required to enable transaction processes by natural or legal users is detailed in the table shown below.

Table 38 Information required for registry of natural persons and legal persons.

Natural Persons	Legal Persons
Personal Information <ul style="list-style-type: none"> <li>• Name</li> <li>• Surname</li> <li>• Email Address</li> <li>• Date of Birth</li> <li>• Address (street and number)</li> <li>• Commune</li> <li>• Zip Code</li> <li>• City</li> <li>• Province</li> <li>• Region</li> <li>• Phone Number</li> </ul>	Company Information <ul style="list-style-type: none"> <li>• Commercial Name</li> <li>• Trade Name</li> <li>• Address registered in the Taxpayer Identification Number (RUT)</li> <li>• Commune</li> <li>• Zip Code</li> <li>• City</li> <li>• Province</li> <li>• Region</li> </ul>

It is convenient that regarding the handling of sensitive personal and financial information (for example, the National Identification Number (RUN), identity card, Taxpayer Identification Number, Uniform Bank Code (UBC), credit or debit card number and password) required to institute identity validation and banking security mechanisms, triangulation is avoided as much as possible. Therefore, instead of requesting such information directly through the platform, a more convenient strategy will be to delegate its management to other stakeholders of the proposed system for the green certificate trading. These stakeholders will inevitably request it when required to execute their respective processes and operations. As main applicants for this information, financial intermediaries, project registries and some settlement agent are mainly distinguished.

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