

<Final Report>

“Online Carbon Emission Trading System (OCETS)”

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1. Introduction

This section gives a scope description and overview of everything included in this SRS (Software Requirements Specification) document. It also include background of domain, objective of project, related works that is needed to understand of this project.

1.1. Background

1.1.1. Current state of climate change

Since the 18th century, greenhouse gas (GHG) has increased significantly because of the burning of fossil fuels. During the 20th century, the Earth's surface temperature has increased 0.6 degrees and sea level has increased up to 20cm.

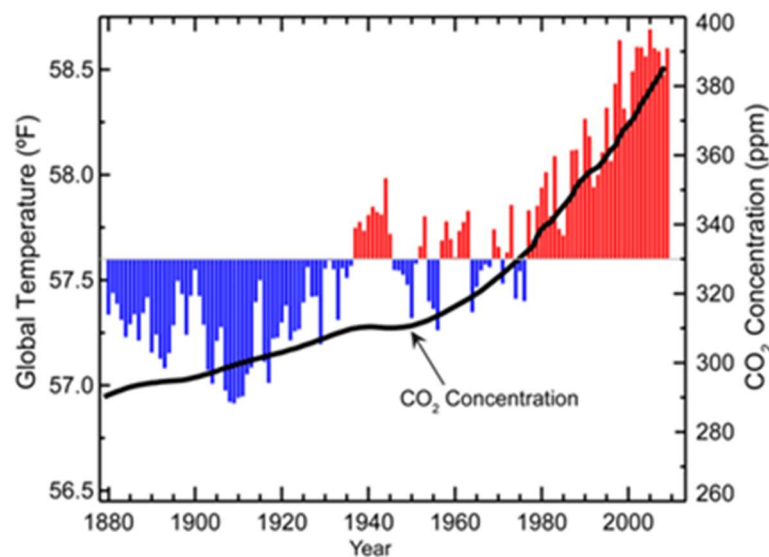


Figure 1. Global Temperature and Carbon Dioxide

Back in 1997, 37 industrialized countries and the European Community committed themselves to reducing emissions of carbon dioxide and other greenhouse gases as part of the Kyoto Protocol, the public debate focused largely on how to design a single global market for trading carbon permits as “the” vehicle to address global climate change. In Kyoto Protocol add up to an average five percent emissions reduction compared to 1990 levels over the five-year period 2008 to 2012.

1.1.2. Kyoto Protocol

The Kyoto Protocol is an international treaty, which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gases emissions, based on the premise that global warming exists and man-made CO2 emissions have caused it.

1.1.3. Carbon emissions trading market

Carbon emissions trading is a form of emissions trading that specifically targets carbon dioxide and it currently constitutes the bulk of emissions trading. This form of permit trading is a common method countries utilize in order to meet their obligations specified by the Kyoto

Protocol; namely the reduction of carbon emissions in an attempt to reduce future climate change.

Under Carbon trading, a country having more emissions of carbon is able to purchase the right to emit more and the country having less emission trades the right to emit carbon to other countries. More carbon emitting countries, by this way try to keep the limit of carbon emission specified to them.

Approaches to emissions trading

Two approaches to emissions trading are cap^[1]-and-trade, in which an aggregate cap on emissions is distributed in the form of allowance permits, and baseline-and-credit, in which firms earn emission reduction credits for emissions below their baselines.

Kinds of emission trading market

Carbon markets exist both under compliance schemes and as voluntary programs. Compliance markets are created and regulated by mandatory national, regional or international carbon reduction regimes.

The voluntary carbon markets function outside of the compliance market. They enable businesses, governments, NGOs, and individuals to offset their emissions by purchasing offsets that were created either through the CDM or in the voluntary market.

1.2. Motivation

We are concerned about global warming and reducing GHGs. Surveying related researches, we have known about carbon emission trade. In foreign countries, like EU, they have carbon emission trade market. And also online-carbon market has been existed. But it is not successfully operated. It's because there are few successful model to follow and this system users cannot make decision whether to buy or to sell carbon emission credit to make profit for users.

In Korea, government will adopt carbon trade market system soon. By adopting this system, it could be possible to reduce GHGs and develop carbon-reducing technologies.

In this situation, we are motivated to make particularly Korean Online Carbon Emission Trading System (OCETS). Since it has not been developed yet, we are the first penguin of the online-carbon trade market system developer in Korea. It is meaningful for us to make it very first time.

1.3. Objective

Reduce trial and error

From cases of experienced countries, we can reduce opportunity to fail when we make Online Carbon Emission Trading System (OCETS). Also it could be helpful to make perfect online-system to learn from foreign cases.

Make suited for Korean system

Some foreign online-systems are unfamiliar. We will make online system that could be used easily by Korean.

For enterprises, make profit

Making online carbon trade system is for make profit by trading carbon emission credit. So that users make profit, we will deliver precision information to use.

Develop easy system (easy to see, easy to learn, easy to use)

More charts, less numbers. By using visual methods like charts, images, graphs, etc. user are easily know when to buy or to sell carbon emission credits. By visualization, it could save to time to learn how to use OCETS.

For developing easy-to-use system we will develop web-based (online) system. Everybody who are able to use computers easily access to the internet. Our role is to make what users see is what users can click and get information. Web-based OCETS system will make every users can easily connect and get information.

Make healthy Korea

As we make this online-trade system, we can dedicate to Korean economic activation, make opportunities to work and finally devote to make reduced GHGs clean Korea.

1.4. Related Works

1.4.1. Survey about foreign “carbon market system”.

● China

Problems

1. In comparison to the developed country, emission of carbon in China is increasing. Because of the quota for each country, China will be the biggest buyer of the carbon market.
2. China has regional difference compare to other countries like EU, UK. Chinese specialized economy: according to its own develop law of market in order under macro policy direction.

Methods to solve problems

1. Develop a carbon market system that meets domestic demand and conforms to international rules.
2. Establishment of carbon trading system can't be without policy support. Establish relevant supervision agency and intermediary platform.

● Europe

Problems

1. Carbon emissions Fall, But How Much is Unclear.
2. Tools be needed to Manage Concerns about Costs and Volatility.
3. Online carbon emission trading system has been hacked so that EU lost 5million euros.

Methods to solve problems

1. Market monitoring and oversight should be needed and integrated.
2. The EU ETS provided the flexibility needed to identify and deliver cost-effective emission reductions.

3. Making dependable online carbon trading system that could prevent crimes of crackers.

1.4.2. Research of Online trading platform

Online trading platform, is a computer software program that can be used to place orders for financial products over a network with a financial intermediary. This includes products such as stocks, bonds, currencies, commodities and derivatives with a financial intermediary, such as brokers, market makers, Investment banks or stock exchanges. Such platforms allow online trading to be carried out by users from any location and are in contrast to traditional floor trading using open outcry and telephone based trading.

Electronic trading platforms typically stream live market prices on which users can trade and may provide additional trading tools, such as charting packages, news feeds and account management functions. Some platforms have been specifically designed to allow individuals to gain access to financial markets that could formerly only be accessed by specialist trading firms such as those allowing margin trading on forex and derivatives such as contract for difference. They may also be designed to automatically trade specific strategies based on technical analysis or to do high-frequency trading.

Online trading platform standards

- The National Futures Association (NFA) in the US lists the following general standard requirements for forex electronic trading systems.
- Authentication (Passwords, Authentication Tokens such as secure ID cards; or digital certificates)
- Encryption
- Transactions recording standard
- Pricing and slippage standard

1.5. Purpose

The purpose of this document is to give a detailed description of the requirements for the “Online Carbon Emission Trading System” (OCETS) software. It will illustrate the purpose and complete declaration for the development of system. This document is primarily intended to be proposed to a customer for its approval and a reference for developing the first version of the system for the development team.

1.6. Scope

The OCETS is a web-based application which helps user to transact the carbon credit easily and to make decision for buying carbon credit by using graphical charts (MAC chart). In the system, Buyer and seller may share their carbon credits information, which want to sell or buy. They can request to each other for trading through message and email.

The software needs Internet and web browser. All system information is maintained in a database, which is located on web-server.

1.7. Definitions, acronyms, and abbreviations

Term	Definition
User	Someone who interacts with the web application. User can be people who manage carbon emission in company.
Stakeholder	Any person who has interaction with the system who is not a developer.
OCETS	Online Carbon Emission Trading System
CAP	Legal limit on the quantity of a certain type of chemical an economy can emit each year.
GHG	Greenhouse gas
DESC	Description
RAT	Rational
DEP	Dependency
TECH	Technique for reduction carbon emission. Each user have got a this technique.
COST	Costs for development
VALUE	Value of stakeholder in generally project
MAC	Marginal Abatement Cost
FR	Functional Requirement
QR	Quality Requirement(Non-Functional requirement)

1.8. References

- [1] Chun-hui ZHU, Feng-wen HUANG, Ai-ping JIANG. Study on Construction of Chinese Carbon Trading System in Post-CDM Era
- [2] Richard G. Newell, William A. Pizer, and Daniel Raimi Back other nity. Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges
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- [4] Alexandre Kossoy, Pierre Guigon. State and trends of the carbon market 2012
- [5] RAMESH DARYAPURKAR. EMERGING TRENDS IN ENVIRONMENTAL ENGINEERING
CDM AND CARBON TRADING
- [6] Eduard Niesten, Peter C. Frumhoff, Michelle Manion and Jared J. Hardner. Designing a carbon market that protects forests in developing countries
- [7] Lim, Hoseon, Choi, Eun Kyung, Lee, Min Young and Shin, Seung-chol. An Analysis on Main Issues and Policy Implications of Korean Emission Trading Scheme - Focused on the Semiconductor Industry of Korea
- [8] Nicolas Koch, Sabine Fuss, Godefroy Grosjean, Ottmar Edenhofer. Causes of the EU ETS price drop: Recession, CDM, renewable policies or a bit of everything? — Newevidence or a bit of everything? — Newevidence
- [9] Barbara Paech, Daniel Kerkow, Non-Functional Requirements Engineering - Quality is essential

1.9. Overview

The remainder of this document includes chapters and appendixes. The second one provides an overview of the system functionality and system interaction with other systems. This chapter also introduces different types of stakeholders and their interaction with the system. Further, the chapter also mentions the system constraints and assumptions about the product.

2. Overall description

This section will give an overview of the whole system. The system will introduce the basic functionality of it. It will also describe what type of stakeholders that will use the system and what functionality is available for each type.

2.1. Product perspective

This system is a web-based application. It will be used to trade carbon emission credits and used to identify user state for carbon emission. The users can access to this system through web browser.

The main purpose of this system is carbon emission trading in online. So transaction and user data are so important. It needs somewhere to store the data. For that, a database will be used. Each data of users are managed by each table of the database.

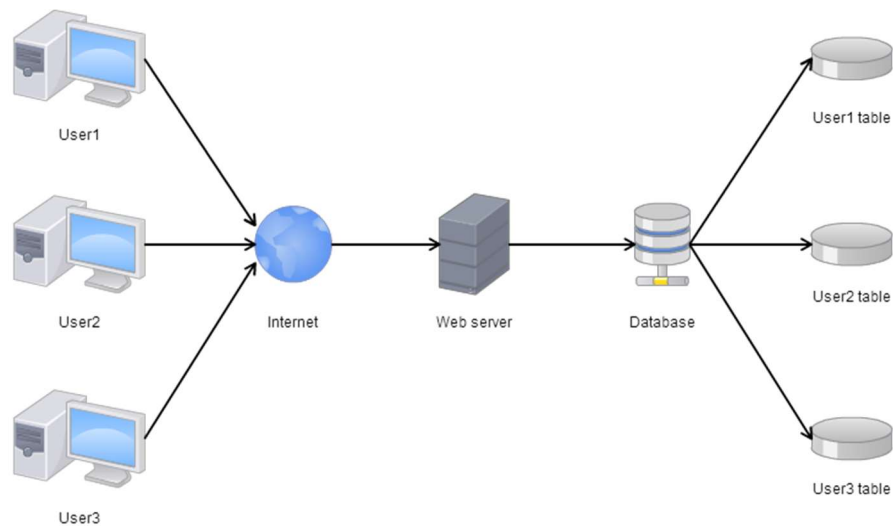


Figure 2. System overview

2.2. Product functions

Using this system, the users will be able to analyze their carbon emission state. As users analyze it, they can make decision for buying or selling carbon emission credits. The system provides graphical chart and UI for those functions.

3. Specific description

3.1. User interface

When users access the web site, they should see the main page, see Figure. If users have not registered, they should be able to register on the log-in page. If user login successfully, they can see the menu. Here the user can use buy, sell and statistics functions.



Figure 3. Login Interface



Figure 4. Logged-in Interface

In the “buy” page, the system will show information, which including company info and carbon emission trading company chart, to user. The user can buy carbon credits using buy button in this page. When the “buy” button is pressed, pop-up page is opened for buying. The user should enter to this form the amount of carbon credit and price. Then the user can request to buy for carbon credits.

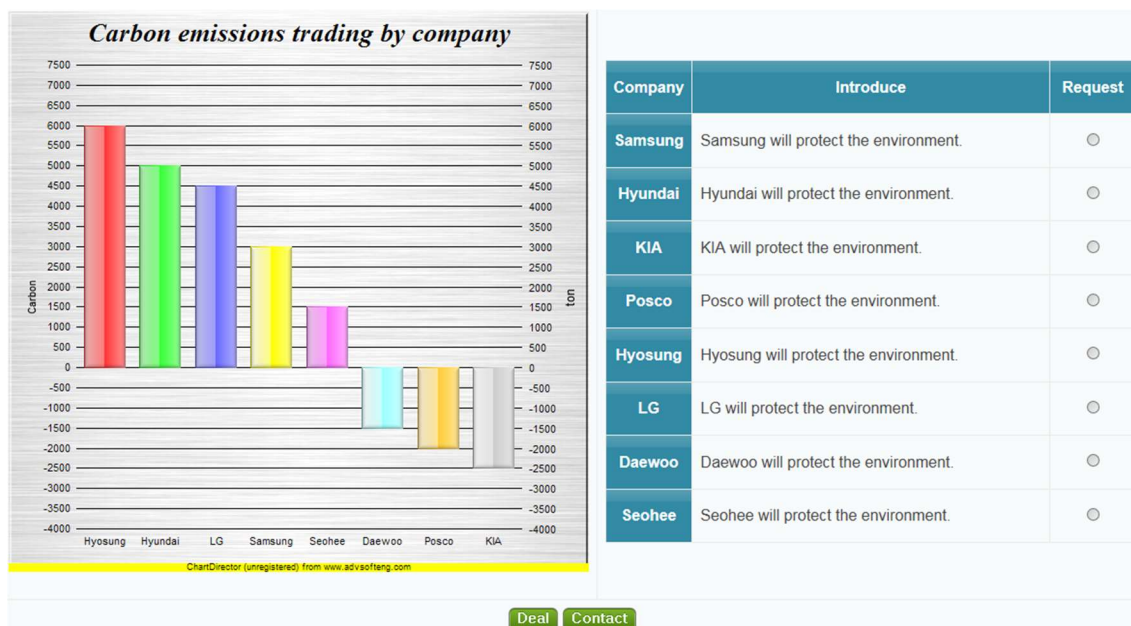


Figure 5. Carbon emission trading by company

The user also can use “statistics” menu in logged-in page. In the “statistics” page, user can check their carbon emissions, expected carbon emissions and payable carbon emissions by using graphical chart. The kind of chart is following:

- Emission Chart: Predict the amount of future's carbon emissions from the amount of the previous emissions
- Rate chart : Expressed the increase or decrease rate of the emission chart
- MAC chart: The MAC chart is the key solution to the enterprise by showing efficiency. It is mathematically calculated environmental techniques of enterprises and then show the efficiency intuitively. In a green area, MAC chart recommend to development of environmental techniques. In a yellow area, MAC chart recommend to buy credits rather than evolution of environmental techniques. In a red area, MAC chart recommend to buy credits directly. Unless users must be get loss.

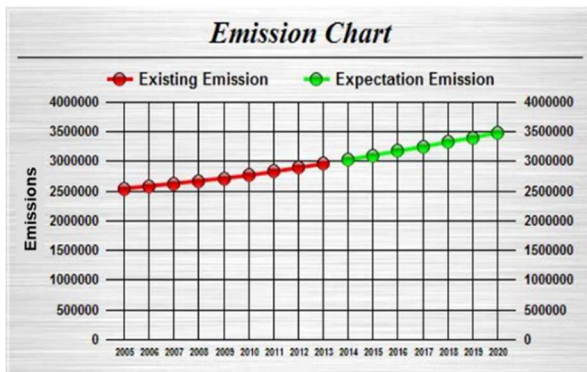


Figure 6. Emission Chart



Figure 7. Rate chart

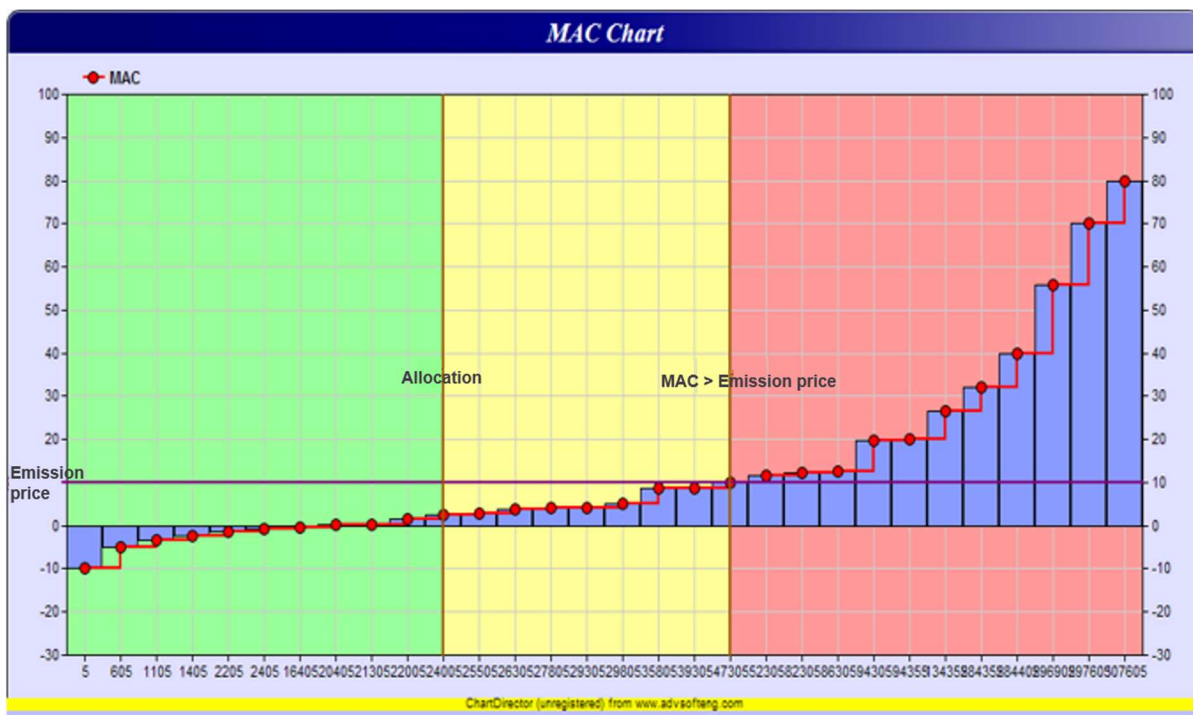


Figure 8. MAC Chart

3.2. Functional requirements

This section includes the requirements that specify all the fundamental actions of the software system.

ID	FR1		
Title	MAC chart: show deduction and display graph		
Author	Park Hyo Seung	Date	23/03/2015
DESC	By using the MAC chart users can easily check the statistical information to analysis efficiency of the data.		

ID	FR2		
Title	Provisioning of accessing information		
Author	Park Joonkap	Date	23/03/2015
DESC	Through a standard form so that the company can keep their information		

ID	FR3		
Title	Reduction technology of each company are entered to DB		
Author	Park Joonkap	Date	23/03/2015
DESC	Reduction techniques should be stored their DB Because they are confidential information of enterprise.		

ID	FR4		
Title	Input a reduction option and reduction goal		
Author	Park Hyo Seung	Date	23/03/2015

DESC	Enterprise should be possible input their reduction option and reduction goal		
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ID	FR5		
Title	Regression analysis		
Author	Kim DaeSoon	Date	23/03/2015
DESC	In order to devised the emissions price		

ID	FR6		
Title	Zoom-in and Zoom-out the MAC chart		
Author	Yang KyeongSeok	Date	23/03/2015
DESC	The MAC to see more detail.		

ID	FR7		
Title	Compute area for each section		
Author	Park Hyo Seung	Date	06/04/2015
DESC	This is used to distinguish each area in the MAC.		

ID	FR8		
Title	Trade request function(sell and buy)		
Author	Kim DaeSoon	Date	06/04/2015

DESC	The basic functionality for trading carbon credits. This is because the enterprise must deal with each other is possible.
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ID	FR9		
Title	Membership join		
Author	Yang KyeongSeok	Date	06/04/2015
DESC	<p>User should be able to register through the web application. The user must provide user-name, password, and e-mail address.</p> <p>In order for a user to register on the web application</p>		
ID	FR10		
Title	Interlocking market price		
Author	Kim DaeSoon	Date	06/04/2015
DESC	The emissions price that the government should devised a standard operating system.		

ID	FR11		
Title	Deduction the analysis data by price		
Author	Park Joonkap	Date	06/04/2015
DESC	Used to display the analysis result obtained by the emissions price.		

ID	FR12		
Title	Predictive analytics		
Author	Park Joonkap	Date	06/04/2015
DESC	Using the old data should be able to forecast the future emissions		

ID	FR13		
Title	Print and output an excel of reduction technology and analysis result		
Author	Park Hyo Seung	Date	20/04/2015
DESC	Through a standard form so that the enterprise can keep their information		

ID	FR14		
Title	Advance the computing way of predictive emission		
Author	Yang KyeongSeok	Date	20/04/2015
DESC	The system predicts emissions using inputted emission data in past. User can see this information as graphical tools.		

ID	FR15		
Title	Up-loading the company information		
Author	Park Joonkap	Date	20/04/2015
DESC			

	User should upload their company information. For this, system provide uploading form like Excel.
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ID	FR16		
Title	Displaying technique on the graph		
Author	Park HyoSeung	Date	20/04/2015
DESC	User should be provide the TECH to the system. The system is displaying this TECH numerical value on the graph.		

ID	FR17		
Title	DB design for ascertaining MAC		
Author	Park Joonkap	Date	04/05/2015
DESC	User can use MAC for decision making. The system should have a database to calculate the MAC numerical value.		

ID	FR18		
Title	Making graph based on surplus emission		
Author	Yang KyeongSeok	Date	04/05/2015
DESC	As a user inputted data, the system calculates the expected emissions for user. This emissions is displayed by graph.		

ID	FR19		
Title	Buying license		

Author	Yang KyeongSeok	Date	04/05/2015
DESC	To maintain website, license cost is required. Administrator should check for the license expired.		

ID	FR20		
Title	Generating ID of each company and employee		
Author	Kim DaeSoon	Date	04/05/2015
DESC	For accurate identification for user, when a user is registered, the system gives a new generated id(uid) for user.		

ID	FR21		
Title	Login		
Author	Park Joonkap	Date	04/05/2015
DESC	Given that a user has registered, then the user can login in the main page. When user try to login, user id and password is compared to information in database.		

ID	FR22		
Title	Cancelation of applying transaction		
Author	Kim DaeSoon	Date	18/05/2015
DESC	User can cancellation of trade if he/she wants. At that time, the trade should not be passed 7 days.		

ID	FR23		
Title	Concrete method to estimate of marginal cost		

Author	Park HyoSeung	Date	18/05/2015
DESC	The system can calculate estimate of marginal cost depend on user input. The mathematical formula is following. estimate of marginal cost = (technology investment cost - saving cost) / amount of reduction		

ID	FR24		
Title	Display information of company requested for trading		
Author	Park Joonkap	Date	18/05/2015
DESC	When a user is received about trade request, this information is displayed to user message section.		

ID	FR25		
Title	Detail information for each section		
Author	Park Joonkap	Date	18/05/2015
DESC	The system should provide detail information for each section such as, buy/sell, each chart, information of emissions etc. This information is useful to help user understand.		

3.3. Non-Functional requirements

ID	QR1		
Title	To need standard format of document		
Author	Park Joonkap	Date	05/18/2015
DESC			

	Developers easily understand a document. When writing a document, Standard format help process of work.
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ID	QR2		
Title	Restrict data gathering coverage		
Author	KyeongSeok Yang	Date	04/20/2015
DESC	When users register their ID, password, etc. necessary data should be saved, but sensitive information or privacy info never saved in the database, because of their privacy and security reason.		

ID	QR3		
Title	Secured message		
Author	Kim DaeSoon	Date	18/05/2015
DESC	As transfer secure message, protect user information and assure security. There are more one way to secure message.		

ID	QR4		
Title	24-hours connection to web site		
Author	Park Hyo Seung	Date	04/06/2015
DESC	Whenever service should be provided. Which improve the Accessibility and satisfy user's		

ID	QR5		
Title	Make it secret who traded and how much they paid or got others cannot see message. And no loss when sending message directly re-act button		

Author	Yang KyeongSeok	Date	05/04/2015
DESC	Information of users should be kept secret. And it needs to be safely conserved while sending message, even directly after pushed the button.		

ID	QR6		
Title	Short waiting time when connecting, trading ...		
Author	Kim DaeSoon	Date	04/20/2015
DESC	All things should be executed immediately, when customers want to do. It is important factor in online system.		

ID	QR7		
Title	Save information safely		
Author	Kim DaeSoon	Date	04/06/2015
DESC	As safely save information, prevent data loss. Even if the time when the electric service unavailable.		

ID	QR8		
Title	Information not to be exposed to others		
Author	Yang KyeongSeok	Date	03/23/2015
DESC	It is related to the safety, security and privacy. Private information should be keep secret. Therefore if web searching engine (e.g. google) easily fine information, users don't want to use OCETS.		

ID	QR9		
Title	Safely conserve data		

Author	Kim DaeSoon	Date	03/23/2015
DESC	Whenever data be needed, it could be usable. Also It needs to be used, when it goes sudden blackout or drought.		

ID	QR10		
Title	Encryption of user password		
Author	Yang KyeongSeok	Date	04/06/2015
DESC	When users input password, it should be encrypted like hash-code, SHA... When input password, cheating be avoided. So, password will expose just as asterisks (*).		

ID	QR11		
Title	To need certification of user		
Author	Kim DaeSoon	Date	04/20/2015
DESC	When company become a member, We must positively identify. With this certify to trade each other.		

ID	QR12		
Title	Periodically and automatically backup		
Author	Yang KyeongSeok	Date	05/04/2015
DESC	It is related to QR9. When it goes sudden blackout or drought, It is not avoidable because it is a natural disaster. But after that, it needs to be restored. So that it can be possible, periodically and automatically backup is essential.		

ID	QR13		
Title	Security (layer architecture, encryption of data in database)		

Author	Kim DaeSoon	Date	05/04/2015
DESC	There are many way of security. It is one of the security method solution. Sensitive data is suited by inner layer so that when attacker attempt attack, increase number of attack.		

ID	QR14		
Title	Collect essential information(Not collect private/sensitive information)		
Author	Yang KyeongSeok	Date	05/18/2015
DESC	It is related to QR2. When users register their ID, password, etc. necessary data should be saved, but sensitive information or privacy info never saved in the database, because of their privacy and security reason.		

ID	QR15		
Title	The chart should be reliable		
Author	Yang KyeongSeok	Date	04/06/2015
DESC	Users believe that chart show precise information. It is premised as a fact to the users. If it is not reliable, this system never used to the users no longer.		

ID	QR16		
Title	Probability of failure per system down time shall be low		
Author	Kim DaeSoon	Date	04/20/2015
DESC	When user's using trading system, users should be able to use trading system in every day. we are duty to maintain low failure		

ID	QR17		
Title	Prediction be accurate as estimated		

Author	Yang KyeongSeok	Date	05/18/2015
DESC	It is related to QR15. Users believe that chart show precise information. It is premised as a fact to the users. And predicted from this data, If it is not reliable, this system never used to the users no longer.		

ID	QR18		
Title	Easily see the chart		
Author	Yang KyeongSeok	Date	04/06/2015
DESC	As users are not a specialist to analyze the data by themselves. So chart help users to see data easily.		

ID	QR19		
Title	Can see details of the chart		
Author	Kim DaeSoon	Date	04/20/2015
DESC	It is related to QR18. We are a specialist to analyze the data. So we have a many analyzed data and should provide more detail data for users.		

ID	QR20		
Title	Fast loading of the chart		
Author	Yang KyeongSeok	Date	05/04/2015
DESC	Chart shows many information of the data by graphic. Because it contains many information and needs to bring many data from the database. Users want chart contains many information, also load data faster.		

ID	QR21		
Title	Carbon credits' price should be the price, right now		

Author	Yang KyeongSeok	Date	04/06/2015
DESC	As a trading market, price of the carbon emission credits is changing in a short time, in a few minutes or even in a few seconds. So that users can accurately know the most updated information		

ID	QR22		
Title	Easily see the prediction of the future data		
Author	Yang KyeongSeok	Date	05/18/2015
DESC	It is related to QR17, QR18. Estimated future data needs to be seen easily to the users.		

ID	QR23		
Title	ID of company, accessible to sub-ID user		
Author	Yang KyeongSeok	Date	05/04/2015
DESC	Main ID is issued by company name. And Main ID has sub-IDs. It is hierarchical relationship. So main ID should control sub-IDs.		

ID	QR24		
Title	Recently updated information of company		
Author	Yang KyeongSeok	Date	04/06/2015
DESC	Information of company be updated in the latest stats. System message can be sent to the company that update company's information recently updated.		

ID	QR25		
Title	Convenient to communicate with users		

Author	Yang KyeongSeok	Date	03/23/2015
DESC	When trading, there could be lack of information that users want to know. Therefore if users want to know about other users that are interested in, make users can communicate with other users through E-mail, telephone, sms, message etc.		

4. Prioritization and Release Plan

In order to get a view of how to divide the requirements into different releases and what requirements should be included in which release, a prioritization of the requirements is needed. This section discusses the choice of prioritization methods and gives a suggestion of how the release plan for these requirements could look like.

4.1. Choice of prioritization method

When prioritizing the requirements the ten most important ones were picked out first. This was done with a simple “1 to 10” ranking method, with one being “not important” and ten “very important”. Based on the elicitation meetings, and the perceived ideas of what was important to the different stakeholders, a number was set for each requirement. The numbers were then summed up for each requirement and the ten with the highest score were chosen to be prioritized with the cost value approach. The results, which are red-marked, can be seen in Appendix IV and as shown, it turned out to be four functional requirements and six quality requirements.

Appendix I : Goal-based Approach

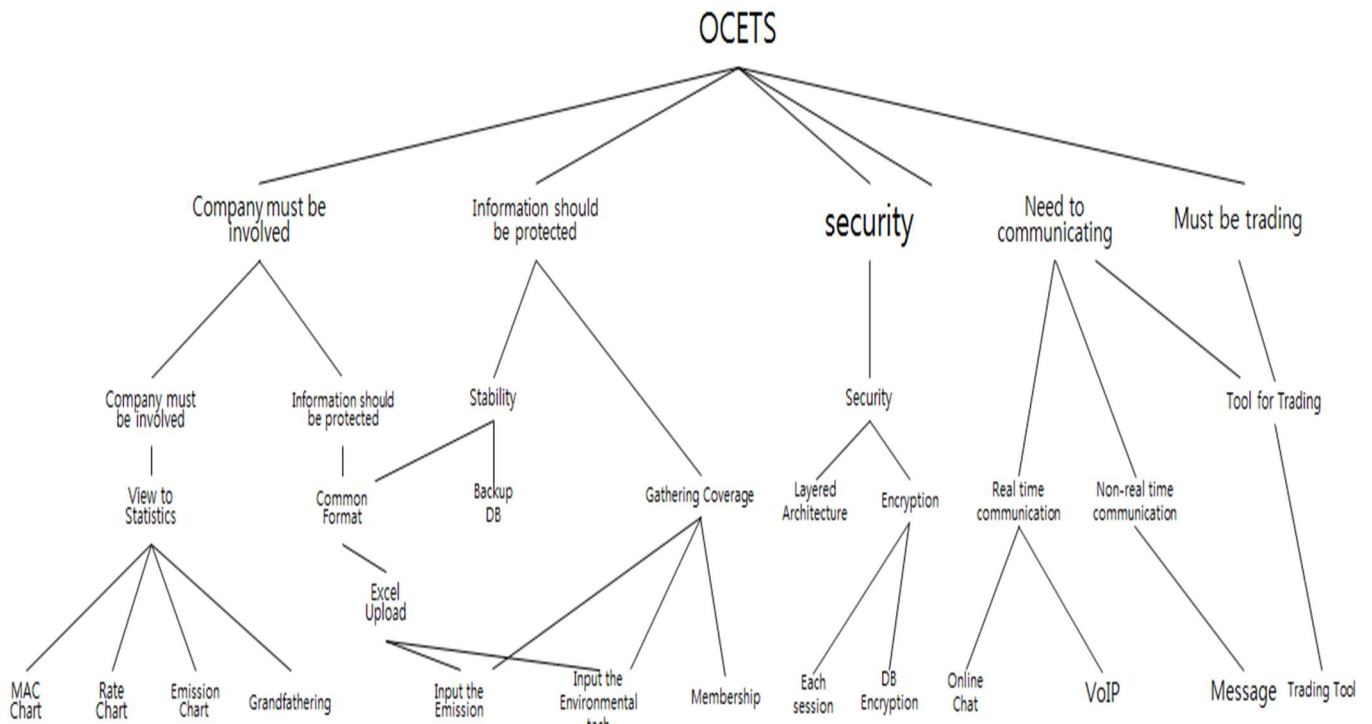


Figure 9. Goal Model

Appendix II: Scenario-based Approach

Intro: Background of the Scenario

The Government of the Republic of Korea recently distributed a certain amount of carbon credits in preparation for joining compulsory carbon emission reduction country. Every company whose carbon emission is exceeded its carbon emission credits will be charged penalty. If spare carbon emission credits are existed, it could be sold to other enterprises or countries. It is a scenario about OCETS what could trade carbon emission credits on-line.

Intro: Background of the Scenario

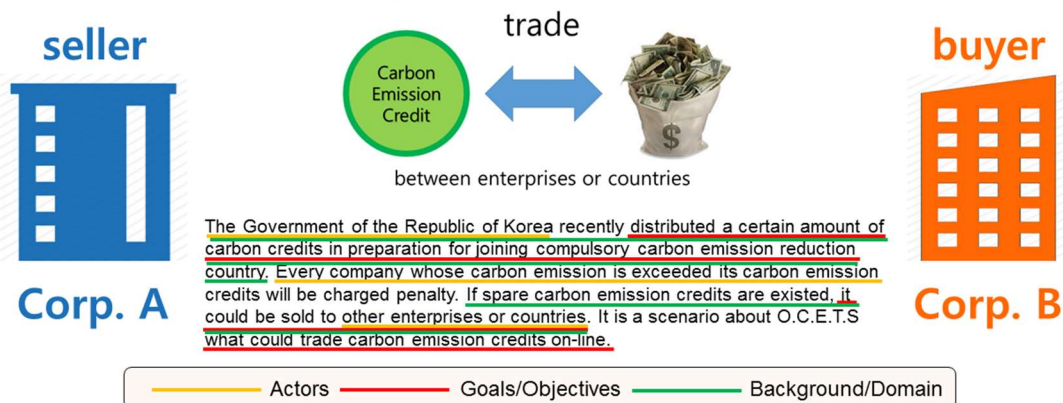


Figure 10. Background of the Scenario

CASE 0: Scenario of both A and B

A1, B1 who in charge of carbon emission trading of company A, B had to buy license of OCETS for using it. During trial period of 1 week using OCETS is free, but after that period, users who want to use it have to pay for license of OCETS (weekly, monthly, annually license available).

Main ID is issued by name of corporate A, B which subdivided into each employees. Since final approval should made by A3 and B3 who are in charge of it, A1 and B1 have to issue corporate ID to obtain approval of A2 and B2 which is also applied to A3 and B3. A1 and B1 who has admin account enrolled A3 and B3 as corporate member in modification menu of corporate information.

CASE 0: Scenario of both Corp.A and Corp.B

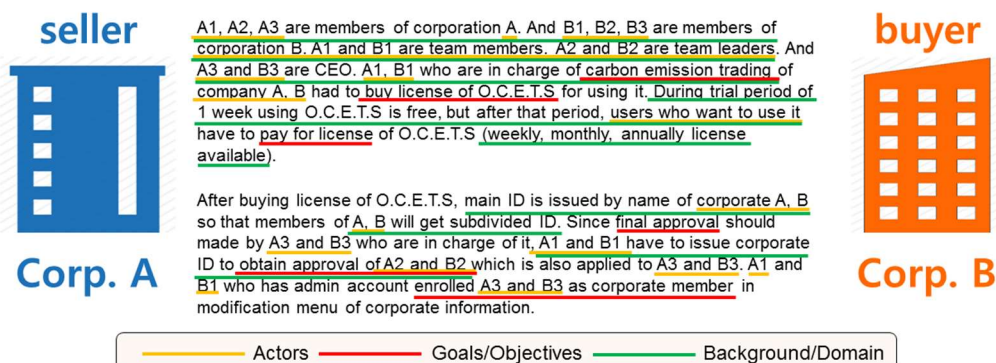


Figure 11. Scenario Case 0: Scenario of both Corp. A and Corp. B

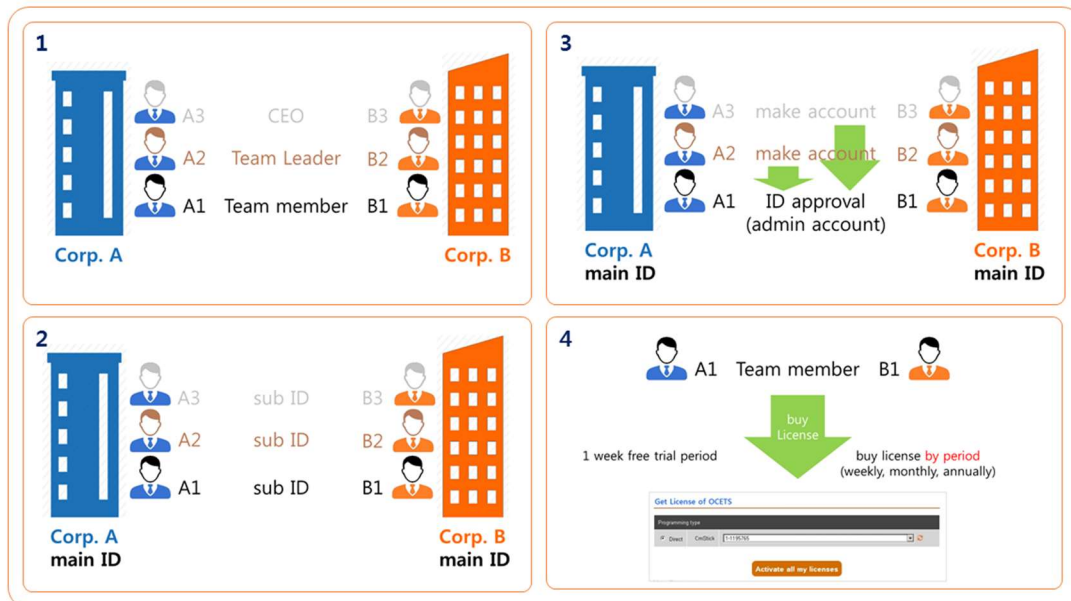


Figure 12. Story board of Scenario Case 1: Make ID and Buy License

CASE 1: Scenario of A, who sells carbon emission credits

A1, an employer of corporation A, connected to ocets.com through web browser by putting his ID and password into the login form. Considering MAC Chart simulation and recent situation, corporation A decided to sell carbon emission credits, because it seems to be more profitable than reducing carbon emission by developing environmental technique. In “statistics” menu, corporation A saw prices and credits registered by sellers. Also saw sorted by highest to lowest or by average. After seen in “statistics” A decided to sell as a same price as lowest price now. A enrolled in “selling” menu by pushing “selling credits” button.

Though corporate B received an inquiry about a price reduction, boss A2 and a chief executive A3 expressed intention of deny and sent a message about impossibility of discount. Nevertheless corporate B applied purchase application and therefore Corporate B purchased it though A1, A2 and A3 clicking final approval button which carried out by discussion process.

CASE 1: Scenario of Corp. A



A1, an employer of corporation A, connected to O.C.E.T.S dot com through web browser by putting his ID and password into the login form. In a “statistics” menu, considering MAC Chart simulation and recent situation, corporation A decided to sell carbon emission credits, because it seems to be more profitable than reducing carbon emission by developing environmental technique. Therefore A1 needs to be approved by A2 and A3. After approval, in “sell” menu, A1 saw prices and credits registered by sellers. Also saw sorted by highest to lowest or by average. After seen in “statistics”, A decided to sell as a same price as lowest price now. A1 enrolled in “sell” menu by pushing “selling credits” button.

Though corporate A received an inquiry about a price reduction from corporation B, team leader A2 and CEO A3 expressed intention of deny. Therefore A1 sent a message to B1, about impossibility of discount. Despite the denial of discount from corporation A, corporation B decided to purchase. So B1 pushed “buying credits” button in “buy” menu. Clicking “selling approval” button by A1, A2 and A3, trade of carbon emission credits are carried out successfully.

— Actors — Goals/Objectives — Background/Domain

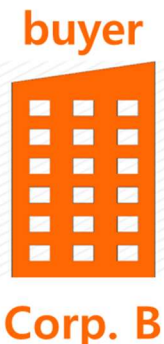
Figure 13. Scenario Case 1: Scenario of Corp. A

CASE 2: Scenario of A who buys carbon emission credits

B1, an employer of corporation B, connected to ocets.com through web browser by putting his ID and password into the login form. B1 set "auto alarm service" be ready for future purchase. This function will notice pop-up message when average price reached previously set price. In "statistics" menu, A1 saw quantity of credits trading sorted by country or corporation, market value, etc. from carbon trading control center in real-time. From MAC charts A1 checked tendency of the carbon trading market. B1 set manually set the amount of the carbon emission credits as corporation B needed in advance. After this step, B1 perform simulation in "simulation" menu whether buying credits will be profitable for A or not. Output is printed and sent to the boss B2. Since boss ordered employee to look for intention of price reduction of corporate B which has intention of selling carbon emission credit, they asked corporate B about it using OCETS messaging function. Though corporate A sent a message of deny, Corporate B made a decision to purchase it based on various information chart. Therefore, they clicked "purchase" button in purchase application. After pressed the button they checked a message which was written "After the transactions are completed within a certain period, you can cancel the deal again however carbon emission credit which was used before canceled cannot be canceled" and made a final applicant by re-clicking. Processing final approval starts with A1 to A3 in corporate A, both corporate accomplished carbon emission credit transaction.

CASE 2: Scenario of Corp. B

B1, an employer of corporation B, connected to O.C.E.T.S dot com through web browser by putting his ID and password into the login form. B1 set "auto alarm service" be ready for future purchase. This function will notice pop-up message when average price reached previously set price. In "statistics" menu, A1 saw quantity of credits trading sorted by country or corporation, market value, etc from carbon trading control center in real-time. From MAC charts A1 checked tendency of the carbon trading market. B1 set manually set the amount of the carbon emission credits as corporation B needed in advance. After this step, B1 perform simulation in "simulation" menu whether buying credits will be profitable for A or not. Output is printed and sent to the boss B2. Since boss ordered employee to look for intention of price reduction of corporate B which has intention of selling carbon emission credit, they asked corporate B about it using OCETS messaging function. Though corporate A sent a message of deny, Corporate B made a decision to purchase it based on various information chart. Therefore, they clicked "purchase" button in purchase application. After pressed the button they checked a message which was written "After the transactions are completed within a certain period, you can cancel the deal again however carbon emission credit which was used before canceled cannot be canceled" and made a final applicant by re-clicking. Processing final approval starts with A1 to A3 in corporate A, both corporate accomplished carbon emission credit transaction.



— Actors — Goals/Objectives — Background/Domain

Figure 14. Scenario Case 2: Scenario of Corp. B

Appendix III: Use-case diagram for whole system

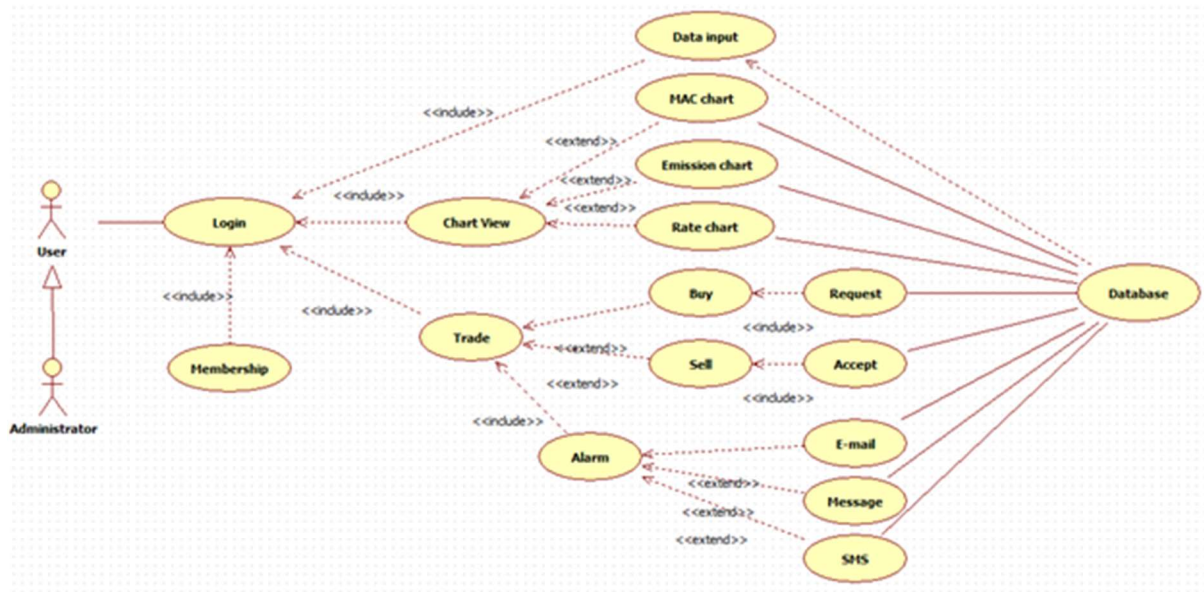


Figure 15. Use-case diagram for whole system

Appendix IV: Prioritization Result of 10 selected Requirements Using Cost-Value Approach

ID	Hyo	Kyeong	Joon	Soon	Dong	hoon	Yoon	Total
FR1	9	7	5	6	6	8	6	47
FR2	3	6	4	3	4	5	3	28
FR3	4	6	8	6	7	7	6	44
FR4	6	5	3	6	7	6	6	39
FR5	6	9	3	5	7	6	5	41
FR6	8	10	10	9	9	10	10	66
FR7	10	8	10	10	8	10	8	64
FR8	10	10	10	8	8	10	8	64
FR9	6	8	5	8	9	7	8	51
FR10	3	6	7	5	6	8	4	39
FR11	3	4	3	6	5	5	5	31
FR12	4	3	7	6	6	7	7	40
FR13	4	6	9	7	7	7	7	47
FR14	4	4	3	6	6	6	5	34
FR15	4	7	7	5	6	6	6	41
FR16	4	7	5	5	6	6	6	39
FR17	4	3	4	2	5	7	3	28
FR18	6	6	3	7	4	4	6	36
FR19	5	4	5	5	4	7	5	35
FR20	5	7	6	5	6	6	5	40
FR21	5	4	4	6	5	4	6	34
QR1	8	7	7	7	7	6	7	49
QR2	6	6	6	7	5	7	7	44

QR3	6	8	5	6	5	7	6	43
QR4	6	8	5	6	7	7	6	45
QR5	6	6	4	5	4	5	5	35
QR6	8	9	5	7	9	10	8	56
QR7	9	8	7	9	7	8	9	57
QR8	6	7	6	8	7	8	7	49
QR9	6	9	9	9	7	7	10	57
QR10	4	4	3	3	4	6	3	27
QR11	4	6	2	3	4	6	3	28
QR12	9	9	7	8	6	8	8	55
QR13	7	5	6	7	4	5	6	40
QR14	8	5	8	9	5	5	7	47
QR15	7	7	7	6	6	7	6	46
QR16	8	9	8	8	6	7	7	53
QR17	6	6	5	5	5	6	5	38
QR18	6	6	5	8	5	6	6	42
QR19	6	8	7	7	7	7	7	49
QR20	7	8	6	6	7	5	6	45
QR21	8	6	4	7	7	7	6	45
QR22	8	9	9	8	8	4	8	54
QR23	7	9	8	7	7	4	7	49
QR24	7	9	6	6	7	5	8	49
QR25	8	9	8	7	7	4	7	49

Table 1. Select of ten most important requirements

ID	Title	Requirement Type
FR6	Mac a deduction and display graph	Function
FR7	Compute area for each section	Function
FR8	Trade request function(sell and buy)	Function
FR9	Membership join	Function
QR6	Short waiting time when connecting, trading ...	Quality
QR7	Save information safely	Quality
QR9	Safely conserve data	Quality
QR12	Periodically and automatically backup	Quality
QR16	Probability of failure per system down time shall be low	Quality
QR22	Easily see the prediction of the future data	Quality

Table 2. 10 most important requirements

Value	FR6	FR7	FR8	FR9	QR6	QR7	QR9	QR12	QR16	QR22
FR6	1	5	7	7	1/3	1/5	1/3	1/3	5	7
FR7	1/5	1	3	5	6	1/5	1/3	1/3	1/3	5
FR8	1/7	1/3	1	4	5	1/6	1/4	1/4	1/5	3
FR9	1/7	1/5	1/4	1	1/3	1/5	1/5	1/3	5	4
QR6	3	1/6	1/5	3	1	1/9	1/5	1/5	1/7	2
QR7	5	5	6	5	9	1	3	3	2	8
QR9	3	3	4	5	5	1/3	1	3	1/3	7
QR12	3	3	4	3	5	1/3	1/3	1	1/3	5
QR16	1/5	3	5	1/5	7	1/2	3	3	1	9
QR22	1/7	1/5	1/3	1/4	1/2	1/8	1/7	1/5	1/9	1

Table 3. Value

Cost	FR6	FR7	FR8	FR9	QR6	QR7	QR9	QR12	QR16	QR22
FR6	1	1/5	1/2	3	5	1/7	1/3	1/5	1/3	7
FR7	5	1	1/5	7	3	1/5	1/3	1/5	3	5
FR8	2	5	1	3	5	1/9	1/5	1/6	1/5	7
FR9	1/3	1/7	1/3	1	3	1/3	2	1/5	3	7
QR6	1/5	1/3	1/5	1/3	1	1/7	1/6	1/7	1/6	2
QR7	7	5	9	3	7	1	3	2	3	9
QR9	3	3	5	1/2	6	1/3	1	2	3	7
QR12	5	5	6	5	7	1/2	1/2	1	3	5
QR16	3	1/3	5	1/5	1/3	6	1/3	1/3	1	5
QR22	1/7	1/5	7	7	1/2	1/9	1/7	1/5	1/5	1

Table 4. Cost

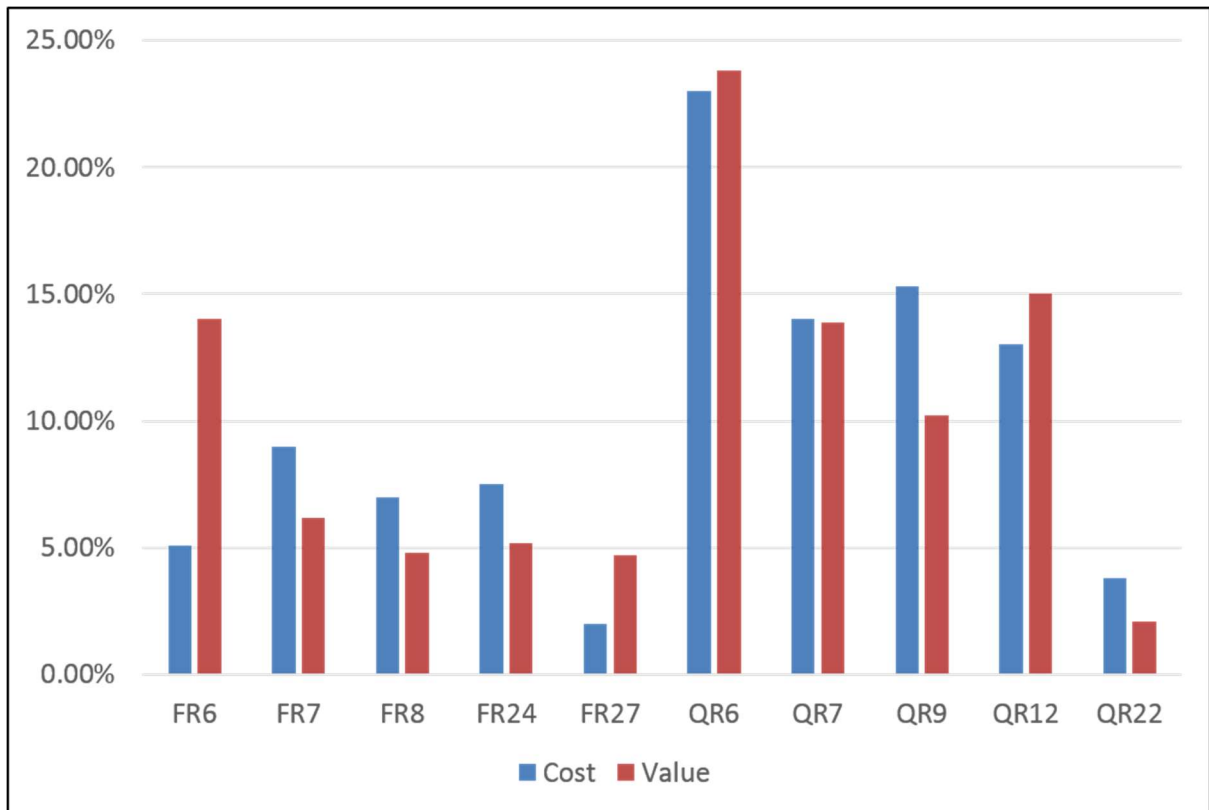


Figure 16. Requirements Cost-Value graph

Appendix V: Result and workflow

1. Expected result

- Demonstrating the efficiency using the MAC/Emission/Rate charts will be used for making profits of the companies.
- Market price for carbon emissions will be stabilized and settled like stock trading market.
- Easy (easy to see, easy to learn and easy to use) OCTES will be dedicated to companies who need to buy or sell carbon emission credits.
- It could help Korean economic activation, by selling or buying rights to emit carbon. Moreover there will be more opportunities to work for.
- Finally OCTES will devote to make reduced GHGs clean Korea.

2. Task Description

Name	Tasks
HyoSeung Park	Project management , use case writing
KyeongSeok Yang	Scenario based Requirements extraction
Joonkap Park	Research and Survey papers, drawing up a document
DaeSoon KIM	Goal-based Requirements extraction

3. Timetable

	1 W	2 W	3 W	4 W	5 W	6 W	7 W	8 W	9 W	10 W	11 W	12 W	13 W	14 W	15 W
Identify the project idea															
Understanding the characteristics of the domain															
Paper survey															
Proposal															
RE															
Elicitation, understanding and Structuring															
Modeling and analysis															
Communications and Negotiations															
V&V															
Scenario															
Prototype															
Final report															