

Overall Progress for Thailand's intelligent Carbon Credit Registry System

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Abstract— Thailand is a country with awareness in the importance of solution on the problem of global warming. Thailand is one of the countries in the group of Non-Annex 1. The country has no obligation in reducing the emission of greenhouse gas. Although Thailand has no obligation in reducing the emission of greenhouse gas, the guideline stipulated in Kyoto Protocol grants the chance for the developing countries such as Thailand to participate in reducing the amount of emission under the project of Clean Development Mechanism (CDM). This paper discusses about the big picture of activities arranged by Thailand in studying and developing the information and intelligent system called “Carbon Credit Registry System”. The system is used to keep CDM project information and result of project tracking. The system data framework is based on the standard of Data exchange standard for United Nation Framework Convention on Climate Change (DES) which can be easily extensible to international connection in the future.

Index Terms—Annex I, Non-Annex I, CDM, DES, CERs, Kyoto Protocol

I. INTRODUCTION

Thailand is a country with the awareness in the importance of solution on the problem of global warming with several countries. Therefore, the cooperation is set in solving the problem of world climatic change by ratifying in the United Nations Convention on climate change on 28th December, 1994, and ratifying in Kyoto Protocol on 28th August, 2002. Thailand is one of the countries in the group of Non-Annex 1 [1][6] which is the country has no obligation in reducing the emission of greenhouse gas.

Although Thailand has no obligation in reducing the emission of greenhouse gas, the guideline stipulated in Kyoto Protocol grants the chance for the developing countries such as Thailand to participate in reducing the amount of emission under the project of Clean Development Mechanism (CDM) [1][6]. This is the project launched for helping the developed countries in conforming to the obligation in reducing the emission of greenhouse gas. The investment is in the project to reduce the emission of greenhouse gas in the developing countries. The project proving the actual reduction of greenhouse gas will receive

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the credit called Certified Emission Reductions (CERs) [10] [17]. This CERs is a type of carbon credit sold and purchased in the carbon market. However, it is the product in the type of title deed of the reduced amount of greenhouse gas and will be calculated in the emission of greenhouse gas of Thailand.

Therefore, Thailand establishes “Thailand Greenhouse Gas Management Organization (Public Organization)” or “TGO” [17]. This is established under the supervision of Ministry of Natural Resources and Environment. The main objective is to analyze, synthesize, and give the opinion on the ratification of project to reduce the emission of greenhouse gas following the clean development mechanism as well as assessing the result of certified project, promoting the project development and market of certified emission of greenhouse gas, being the center about the operational situation of greenhouse gas, creating the database on the certified project and the sale of the certified emission of greenhouse gas, promoting and developing the efficiency along with giving some suggestion to public and private sectors on the management of greenhouse gas.

Thailand realizes the collection of data by implementing the information technology in developing the system to serve the connection with other countries in the future.

II. BACKGROUND

A.1 what's CDM Project

The Clean Development Mechanism (CDM) [1] project was created to help developing countries to comply with the obligation to reduce greenhouse gas emissions. The realization of investment projects reduces greenhouse gas emissions in developing countries. The project can prove that it actually reduces greenhouse gases. Credit will be called Certified Emission Reductions (CERs) [2][3]. CERs are carbon credits which are the type of trading in carbon markets. However, as referenced in the document, it is to reduce the amount of greenhouse gases and used to calculate the emissions of the country.

A.2 CDM Project in Thailand

Nowadays, there are 221 projects with Letter of Approval (LoA) [17] in Thailand (classified following the types of projects by UNFCCC into 2 types; 1. General project into 214 projects and 2. PoA into 7 projects). The amount of greenhouse gas expected to reduce following the project operation (Expected CERs) is 12,710,309 ton Carbon Dioxide compared per year.

There are 132 projects with LoA and are registered from CDM Executive Board (classified following the types of projects by UNFCCC into 2 types; 1. General project into 125 projects and 2. PoA into 7 projects. The amount of greenhouse gas expected to reduce following the project operation (Expected CERs) is 6,331,253 ton carbon dioxide compared per year.

From the projects registered with CDM EB, there are 27 projects with the certificate of reducing greenhouse gas (Issuance of CERs) calculated for the amount of reducing greenhouse gas as 2,880,274 ton carbon dioxide compared per year.

A.3 Concept of Carbon Market

The concept of the carbon market in the incentive is to reduce greenhouse gas emissions. Carbon trading market (carbon market)[4][5][10] used a market mechanism to drive a decrease in greenhouse gas emissions (GHG) where carbon credits are appointed as the goods in terms of the buyer and seller according to economic theory and market mechanisms such as the cost of reducing greenhouse gas emissions as low as possible.

A.4 Concept Carbon market in Thailand

According to the principles of project operation following the Clean Development Mechanism (CDM) [1][18] in Kyoto Protocol indicated that the operated project must help in the sustainable development of the host countries. Therefore, the project developer of CDM must process to apply for the Letter of Approval (LoA) from the Designated National Authority (DNA) of the host country located CDM. This is for confirming that the proposed project is the project voluntarily operated and can help in the sustainable development. LoA is one of the documents supplementary used for the registration of CDM by CDM Executive Board (CDM EB).

In Thailand, Thailand Greenhouse Gas Management Organization (Public Organization) (TGO) as the DNA of Thailand is responsible for considering the certification of the project[17]. CDM stipulates the sustainable development criteria (SD-Criteria) to be used as the criteria in considering the certification of the project following the Clean Development Mechanism. The project to be certified as the project following the Clean Development Mechanism must pass the sustainable development criteria stipulated by TGO.

Apart from the responsibility in considering the certification of CDM, TGO still has the mission in observing, monitoring, and assessing the project result. This is for making the project following the Clean Development Mechanism be the project operated for reducing the greenhouse gas and promote the sustainable development of Thailand. The data related to all operations in relevant with CDM no matter in the certification, observation, monitoring, and assessment is the very significant data. This data will be use in regulating the measures in the emission and the policy to support the operation in reducing the emission.

Therefore, Thailand sets the plan in the study of “Project of studying the guidelines in developing the registry system of carbon credit and the connectivity with the

international transaction log (ITL) suitable for Thailand” for serving such mission.

III. CARBON TRADING SYSTEM DESIGN FOR THAILAND

B.1 Problem Statement

- In the future, Thailand expects to establish the domestic carbon market which can trade carbon between the international carbon markets.
- Fact: Thailand is Non Annex I country so that the domestic carbon market system of Thailand cannot connect to the ITL (international carbon trading hub) which is international carbon market registry system. (so we cannot use internationally available software)
- Therefore, Thailand needs a sophisticated IT system that can be used to keep carbon registry in Thailand and flexible enough to be able to connect to ITL in the future.
- Our approach is to design and build our own registry system.
- We apply DES [6] (Carbon registry data exchange standard) to design the registry system for domestic use and can trade among of international carbon market at the same time.
- The registry system needs high security for information.

B.2 Requirement

- Stand alone and trade off internal country
- Thailand Registry can connect with global software and trade off with other country
- Develop its own registry for Thailand Registry and trade off with other country
- The way to build “Thailand Emissions Trading Scheme”
- Find the best solution for Thailand Registry System

B.3 System Related

In the entire picture, the related carbon credit registry for Thailand can be presented as follows:

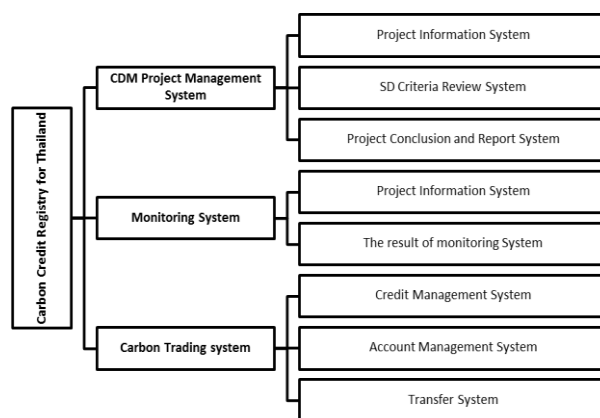


Fig.1 The connectivity system in Thailand

At present, Thailand has designed 2 relevant systems; CDM System which is the system to store the data of CDM project that is the general data of the project such as the project's name, location, types, and the calculation on indices is stored. The other relevant system is the monitoring system for observing and assessing the project after CDM has been approved from the DNA office in Thailand which is TGO for observing the operational result of projects whether it is in accordance with the conditions agreed at earlier stage or not.

C 3.1 CDM Project Management

CDM Project Management consists of several parts and main Modules as follows:

- Project Information System is the system to collect the data of projects and the project's details such as project's name, location, and type.
- SD Criteria Review System is the system to collect the data of environmental assessment by the bureau accredited with the standard to be the central unit in assessing the environmental and social index consisting of:

- Index of natural resources and environment for 13 environmental indices
 - Reduce the emission of greenhouse gas stipulated by Kyoto Protocol of the project
 - Reduce the emission of air pollution following the Notification on the Standard of Air Pollution, for example, NOx HC PM10 SO2 CO O3 VOC's Dioxin
 - Noise pollution (following the public standard)
 - Odor pollution (following the public standard)
 - Quantity of dirt in the wastewater following the public standard
 - Sewage treatment of the project
 - Soil pollution (following the public standard)
 - Contamination of underground water
 - Reduction of the quantity of harmful sewage
 - Demand on the use of water and efficiency of water usage of the project
 - Destruction of soil and coastal erosion/river bank erosion
 - Increase of green area in the project (see the statistics of green area of the province)
 - Other indices with the significant impacts
- Social Index
 - Promote the activities of development in the society, culture, and philosophy of sufficient economy
 - Participation of stakeholders
 - Health of workers and neighboring communities

- Index of development and/or transfer of technology

- Technological development
- Operational plan after finishing the project or finishing the Crediting Period selected by the project.
- Staff's training

- Economic index

- Increasing income of stakeholders
- Use of renewable energy
- Efficiency in energy usage
- Employment
- Use of domestic materials

- Project Conclusion and Report System is the report used for summarizing the result of project's assessment in the part of reducing the quantity of carbon dioxide following the criteria indicated by TGO or not. This system can be presented in several forms of report.

C3.2 Monitoring System

It is the system used in monitoring the project assessment accredited by TGO after the project has been approved. This is for observing that such project is still operated following the specified standard or not. This system consists of main module as follows:

- Project Information will collect the data of project details. The data of project's assessment will be transferred from the system of CDM Project Management
- The Result Monitoring System will collect the data of result of each time of project's assessment from the experts. The criteria of assessment will be considered following the frame of project operation whether it still maintains the standard of project operation or not. This part of result will be presented in the summary report in the form of graph.

IV. SYSTEM DESIGN

For the Carbon Credit Trading System, the design of Thailand consists of main module referred the design following the reference of design of data exchange standard (DES)[6]. UNFCCC stipulates the standard for all countries demanding to create the system collecting the carbon credit for trading to use the same standard in order to facilitate in the connection with international transaction log (ITL) in the future. The design in the part of carbon credit trading consists of main module as shown in the picture:

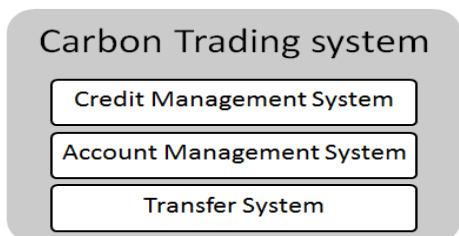


Fig2. Carbon Trading System Module

C.4.1 Credit Management System

For collecting the data, this module will collect the data in the part of numbers of carbon credit reduced by each organization in the country holding the activity to reduce CO2 by referring the project's name, account numbers, and total of carbon credit in such account. The feature of collection of carbon credit will be the serial block number to collect the numbers of carbon credit periodically specified by the serial block number. For Thailand, the value is stipulated as follows:

Original Register	Unit Type	Supplement -array Unit Type	Unit Serial Block Start	Unit Serial Block End	Original Commitment Period	Applicable Commitment Period	LULUCF Activity	Project Identifier	Track	Expiry Date
TH	Depend on Design Schem Type of Thailand	not use	Numeric length 15	Numeric length 15	1,2	1,2	not use	Depend on Design Project number of Thailand	not use	not use

Fig3. Standard of set up serial block number for Thailand

For the design in the part of transferring the carbon credit from serial block number, there are 2 types of transfer as follows:

1. Total amount method: user has to enter the data of numbers of carbon credit needed to be transferred.
2. Serial block method: User has to enter the data of serial number needed to be transferred. The serial block number start and serial block number end must be entered.

The process of transferring carbon credit can be as shown in the picture.

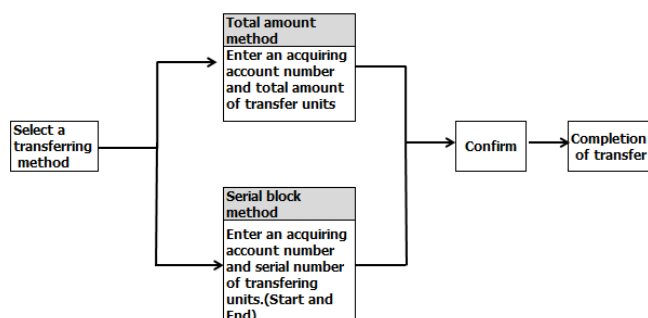


Fig 4. Transfer Credit Method

C.4.2 Account Management System

For collecting the data, this module will collect the data of opening the member account for collecting the numbers of carbon credit reduced by each project. The principle designed by Thailand is that after the project has passed the accreditation from the bureau of TGO, the accredited project

can request for opening the account number for collecting the data of numbers of reduced carbon credit. The principle of design must be as follows:

- Country number will refer to the standard of ISO3166. Thailand uses the Code: TH

Country Name	A2	A3	Country Number
THAILAND	TH	THA	764

Fig 5. Standard of country number

- Project number will refer to the project number from the project management system collecting the number of project, project's name, project's location, project's owner, and contacting address. The projects collecting the data in the project management system must pass the certification to reduce CO2 by TGO. The data is collected by file no. The feature in this part will be presented as Number which can be in 15 digits.

- Account number will collect the account no. used in collecting the numbers of carbon credit. The account number designed to be connected to the project's name uses the principle of design as follows:

Registry Identifier	Account Type	Account Identifier	Applicable Commitment Period
TH	Depend on country design for example : 110:Holding Account	Unique numeric value Length:15	1,2

Fig 6. Standard of account number

C.4.3 Transfer System

Transfer system will be the system to collect the data of transfer of carbon credit from the open account to the destination account. The process of transfer is as follows:

- The account owner login to the system.
- Select the destination account for transferring carbon credit
- Select the method of transfer of serial block number
- Confirm the transfer of carbon credit and the system will perform the transfer automatically.

V. CONCLUSION

Thailand realizes the importance of reduction of CO2 and stimulates all industrial sectors to participate. Therefore, the system is designed and developed for helping in the project's data collection and details of assessment for the approval of project which can reduce the quantity of Carbon with the use of information technology. This is for collecting the registration of carbon credit and stimulating the trade of carbon credit in the country and, in turn, to encourage all industrial sectors in reducing CO2. The designed and developed system is in accordance with the international standard stipulated by UNFCCC called DES. In the future,

Thailand sees the importance of trading of carbon credit in international level. The developed system can be connected with other trading systems in the world in the near future.

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REFERENCES

- [1] Cui Changbin, A Research on Mechanism of Chinese Emission Permits Trade of Carbon under Low-carbon Economy Mode [D]. Hebei normal university, 2008, (8).
- [2] Thailand Greenhouse Gas Management Organization(TGO); http://www.tgo.or.th/english/images/stories/cdm/situation2_big.jpg
- [3] Zhang Dongsheng, International carbon market situation and trend [J]. World Forestry Research, 2005, (10): 9-13.
- [4] Yu Tianfei, The system concept of carbon trading [J]. Forestry Economics, 2007, (5): 49-51.
- [5] Zhou Yichen and Xue Huifeng, Carbon trading legal system based on Chinese national conditions [J]. Environment economy, 2010, (10): 49-52.
- [6] United Nation Framework Convention on Climate Change; http://unfccc.int/files/kyoto_mechanisms/registry_systems/application/pdf/des_full_ver_1.1.8.pdf
- [7] H.Akekaluck and U.Bunyarit,Comparative Survey of appropriate Carbon Credit Registry Systems for Thailand, The 7th International Conference on Computing and Information Technology (I C 2 I T 2011),Bangkok,May11-12 (May2011)
- [8] H.Akekaluck and U.Bunyarit ,Conceptual Design of Carbon Credit Registry System for Thailand, The 7th International Conference on Computer Sciences and Convergence Information Technology (ICCIT2012),Seoul Korea,Dec3-5 2012 (Dec2012)
- [9] IPCC. Climate Change 2007—Mitigation of Climate Change: Working Group III Contribution to the Fourth Assessment Report of the IPCC, Cambridge University Press, Cambridge, UK, 2008.
- [10] N. Stern, The Economics of Climate Change: The Stern Review, Cambridge University Press, Cambridge, UK, 2007.
- [11] D.W. Jorgenson, P.J. Wilcoxon, Reducing US Carbon Emissions:an Econometric General Equilibrium Assessment, Res. Energy. Econ. 15 (1993) 7–25.
- [12] J. Whalley, R. Wigle, The international incidence of carbon taxes, in:R. Dornbusch, J.M. Poterba (Eds.), Global
- [13] Warming:Economic Policy Responses, MIT Press, Cambridge, MA, 1991, pp. 233–263.
- [14] C. Perroni, T.F. Rutherford, International trade in carbon emission rights and basic materials:general Equilibrium Calculations for 2000, Scand. J. Econ. 95 (1993) 257–278.
- [15] J. Whalley, R. Wigle, Cutting CO2 Emissions:the Effects of Alternative Policy Approaches, Energy J. 12 (1991) 1109–1124.
- [16] J.A.E. Edmonds, M.J. Scott, J.M. Roop, C. McCracken, International emissions trading and global climate change: impacts on the costs of greenhouse gas mitigation, Pew Center on Global Climate Change, 1999.
- [17] Thailand Greenhouse Gas Management Organization(TGO); http://www.tgo.or.th/english/images/stories/cdm/situation2_big.jpg
- [18] United Nation Framework Convention on Climate Change; http://unfccc.int/files/kyoto_mechanisms/registry_systems/application/pdf/des_full_ver_1.1.8.pdf