# The Overview of Carbon Credit Market in Thailand

Kultida Bunjongsiri

School of Health Science, SukhothaiThammathirat Open University, THAILAND
Corresponding author: kultida73@gmail.com

***Abstract*** The concept of Carbon Credit Trading is generated from Kyoto Protocol and is basically used to control the greenhouse gas emissions (GHGs). This concept is used to earn carbon credit earnings and trading between various companies and governments. This concept is basically known for the reduction of carbon emissions in order to mitigate future climate changes; the target is mainly greenhouse gases especially carbon dioxide. Thailand is also facing challenges in energy-environment-economy development in the context of limited energy resources availability and global climate change. Recently, Thailand has proposed policies on GHGs mitigation such as Thailand's Nationally Appropriate Mitigation Action (NAMA), which aims at GHG mitigation in the energy sector. It is important to take stock of global scenario of the carbon credit business. Thailand signed and ratified the Kyoto Protocol in 2002. Since then, Thailand is exempted from the framework of the treaty; it is expected to gain from the protocol in terms of foreign investment. In this market, Thailand is an early entrant. Initially, the concept was only exploited and en-cashed by some big business players. But, now, some new and smaller companies are paying more attention and also utilizing the opportunities. This market is now the fastest growing financial market in Thailand. This article mainly focuses on the situation of carbon dioxide emissions both in global trend and in Thailand. It also explains the carbon credit trading market mechanism, accounting treatment of carbon trading situations of Thai projects. Results show that the international free emission trading policy can drive more GHGs reduction by decreasing energy supply and demand, and increasing costs of emissions.

***Keywords*****:** Carbon Credit Trading, Clean Development Mechanism (CDM), Green House Gases and Kyoto Protocol.

## 1. Introduction

Carbon credit is a tradable permit or certificate that provides the holder (or the mean of seller) of the credit the possibility to project the amount of carbon dioxide or an equivalent of another greenhouse gas. The main objective for the creation of carbon credits is the decrease of carbon dioxide emissions and other greenhouse gases from industrial obligations to reduce the effects of global warming. The concept of the carbon credit market or trading initially originated from the notion of using a market mechanism to manage a reduction in greenhouse gas emissions (GHGs) which carbon credits are engaged as the "products" in terms of the buyer and seller. According to the trading, such a market mechanism lowers investment costs for GHGs reductions. Motivation behind

purchasing carbon credits, especially in the case of businesses, is quite complex, e.g. demonstrating responsibility, market pressure, communication goals and legislation. Enterprises that have adopted an environment-friendly model can be said to be characterized by choosing methods of reducing their carbon footprint in a way that is most effective from the viewpoint of their business strategy. Offsetting emissions through buying carbon credits is available to any and all businesses, therefore it is a simple and quite obvious solution.

Governments, worldwide, have launched programs intended to reduce industrial pollution and promote a safely, sustainable future. Companies that generate large amounts of greenhouse emissions can purchase carbon credits to better manage their carbon footprint. A carbon credit is a certificate or permit that grants owners the legal right to emit one metric ton of carbon dioxide, nitrous oxide, methane or other GHGs. If one company produces few emissions, they may sell carbon credits to other businesses, such as those operating in the manufacturing, transportation or shipping industries.

In this circumstance, Thailand has pledged to reduce its greenhouse emission by 20-25 percent by the year 2030 at the 2015 United Nations Climate Change Conference (COP 21) in Paris, France. The country aims to push the Nationally Determined Contributions (NDC) to reach the 2030 reduction goal by including more industries in the emission reduction effort, particularly cement production, air conditioning, refrigerator, and compressor manufacturing by encouraging manufacturers to use coolants with the lowest Global Warming Potential (GWP) value.

The purpose of this paper is to examine the implementation of carbon credit market in Thailand through a Systematic Literature Review (SLR). Given this context, an investigation of carbon dioxide emissions preferences towards the world and Thailand are clearly needed. The article covers the aspects of voluntary carbon markets in Thailand through the Thailand Greenhouse Gas Management Organi-zation, TGO: what they are, how they work and, most critically, their business potential to help slow climate change for future environmental sustainability.

## 2. Global carbon dioxide emissions

Global carbon dioxide emissions are expected to hit a highest record in 2018, despite urgent calls from climate scientists and international groups such as the United Nations to cut back. Worldwide, fossil fuel use is projected to add 2.7 percents more $CO_2$ into the atmosphere in 2018 compared with 2017. The data are presented in the Global Carbon Budget published online December 5 in Earth System Science Data [1]. In 2018, it is the second year in a row that the emissions, which fuel global warming, have risen substantially after a lull from 2014 to 2016. The United States is the largest per capita $CO_2$ emitter worldwide, releasing 4.4 metric tons of carbon per person in 2017, according to the Global Carbon Budget. Total U.S. fossil fuel $CO_2$ emissions are noted to have grown 2.5 percents in 2018, despite the United States using more renewable energy than ever before. China and India have seen particularly

large increases in carbon dioxide emissions from fossil fuel used in recent years, and 2018 continues that trend. However, the United States continues to rank on the top above other countries for the per capita amount of such carbon emitted each year as shown in Fig.1. In 2018, India seems to be the biggest rise in fossil fuel $CO_2$ emissions— approximately 6.3 percent over 2017. That's probably due to rapid economic growth and efforts to bring electricity to people living in rural communities. Nevertheless, India's emissions are still under the global average for the per capita record. Meanwhile, in China, the largest overall carbon emitter, that number reaches 4.7 percent in 2018. Both India and China are making attempts to shift away from coal as an energy source. In contrast, the European Union trends to cut its emissions by 0.7 percent in 2018 as a result from substantial investments in renewable energy. India and China are likely to emerge as the biggest sellers and Europe is going to be the biggest buyers of carbon credits. In 2015, global carbon credit trading was estimated at $5 billion,

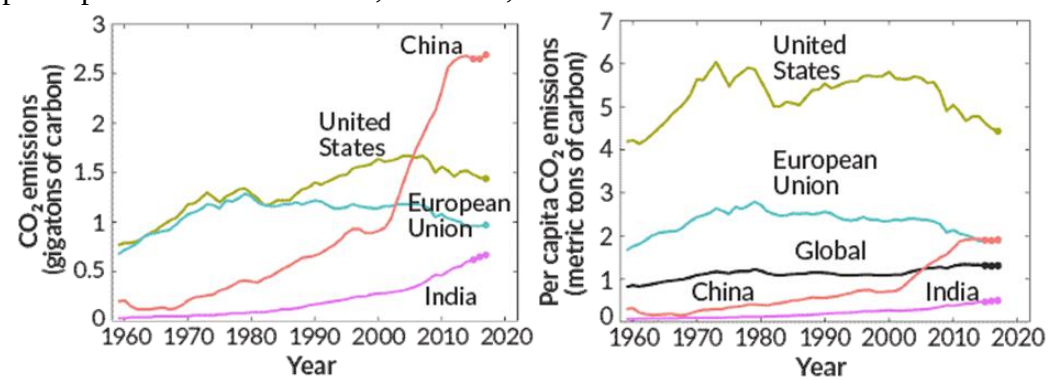


**Fig.1** Trends in carbon dioxide emissions by country and per capita [1].

with India's contribution at around $1 billion. India is one of the countries that have 'credits' for emitting less carbon. India and China have surplus credits to offer to countries that have a deficit [2].

By 2030, energy demand is expected to double as of 2015 in Asian countries. There is at least 134 million people, or 22 percents of the population, without access to electricity in the region. According to several projections [3, 4], the increase in regional demand will account almost 30 percents of the world in total [5]. Policy makers in this region, face challenges in developing and distributing the low-carbon energy resources, from their remote locations to those urban centers of production and livelihood, where they are needed most. Moreover, the economic, energy, and emission geography of Asian countries is highly uneven. While the Southeast Asia region is of equal size as European Union and has a greater population as a whole than North America, its coal, oil, gas, and other renewable energy resources such as hydro and biomass are unevenly distributed, as are the stages of their low-carbon technology development.

## 3. Carbon trade exchange

Carbon trade exchange is opening up carbon credit trading – once the preserve of large, well-off multinationals – to businesses large and small, speeding the flow of funds to clean technology projects across the world. The buying and selling of carbon credits can take place in two distinct areas: the compliance market and the voluntary market [6].

### 3.1 Compliance market (Mandatory market/Regulated market)

There are different approaches to reaching the standards set by the Kyoto Protocol. These include:

1. Joint Implementation (JI): this project is designed to assist industrialized Annex I countries in meeting their targets through investment and development of projects in Annex B countries. The Kyoto Protocol identifies 12 Annex B countries, also known as 'economies in transition': Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Russia, Slovakia, Slovenia and the Ukraine. As the Annex B host country also has a target under the Kyoto Protocol (unlike CDM host countries), a Joint Implementation project must reduce emissions against a 'business as usual' baselines in order to free up Emission Reduction Units (ERU) to sell. One ERU represents one ton of carbon dioxide equivalent.

2. Clean Development Mechanism (CDM): CDM has similarities with JI but the country that implements the project must not be in an Annex I or Annex B country; it must be in a developing country. Also, the amount of GHG reductions must be stated. The GHG which can be deducted from the project is called a Certified Emission Reduction (CER).

3. Emissions Trading (ET): This mechanism helps to generate the selling and buying of GHG emissions for Annex I countries. Since different countries who account as Annex I members all have commitments to decrease their GHG emissions at different levels, this allowance is referred to as AAU, Assigned Amount Units, which come into force in the year 2008 and end in the year 2012.

### 3.2 Voluntary market

The voluntary carbon credit market operates independent of the compliance market. Now that it is running, individuals, businesses and other organizations have the room to offset their greenhouse gas emissions by purchasing carbon credits from businesses that have reached actual goals in emission reduction. The voluntary carbon trading market is an efficient means of reducing high-GHG energy production through supporting projects concentrating on renewable resources.

As of today, this market is still smaller than the compliance market due to its nature and young age. Hence, experts compute a dramatic growth in this sector. By 2015, turnover is expected to reach 500 million tons of carbon dioxide expressed in carbon credit equivalent, which is a huge increase compared to the 42 to 45 million tons figure today [7].

In the voluntary market, project developers, wholesalers and brokers have a chance to trade carbon credits. Based on the standards set, many types of carbon credits exist in the voluntary market. They are called Voluntary Emission Reduction Units, VERs. The highest commercial benefit is quality, this is the same mechanism as in other segment of commerce and trade.

However, before making a real commercial value, carbon credits must be verified and certified by independent organizations entitled to issue certificates of total amount of carbon credits. Carbons

credits lacking such verification and certification by officially recognized organizations are reported as no value, and may not be marketed.

## 4. Carbon market in Thailand

In Thailand, there is no carbon market related to the selling and buying of carbon credits. However, there are Over-the-counter (OTC) trades taking place, in which developers of Clean Development Mechanism (CDM) projects and countries within the Annex I are exchanging credits through delegates, financial funds, and brokers. The '12th National Economic and Development Plan (2017-2021)' of Thailand calls for several mitigation measures, including the development of a domestic carbon market. The 'National Climate Change Master Plan (2015-2050)' also refers to carbon markets as a potential mechanism to reduce GHG emissions in the private sector. In addition, the importance of carbon markets has also been emphasized in Thailand's nationally determined contribution (NDC) [11]. In cooperation with the Partnership for Market Readiness (PMR) Thailand has developed a voluntary carbon market framework composed of the following complementary:

•Voluntary Emission Reduction Program (T-VER)

•Thailand Carbon Offsetting Program (T-COP)

•Energy Performance Certificate Scheme (EPC)

•Voluntary Emissions Trading Scheme (Thailand V-ETS) (under development)

•Low Carbon City Program (LCC)

From 2013-2016, TGO develop- ed a Measurement, Report and Verification (MRV) system for the 'Thailand Voluntary Emissions Trading Scheme' (Thailand V-ETS).

In 2013-2014, MRV general guidelines for the Thailand V-ETS were developed. Between October 2014 and September 2017, the Thailand V-ETS ran its first pilot phase, aimed at testing the MRV system, developing sector-specific MRV guidelines, and setting a cap and allocating allowances for covered factories.

The second pilot phase (2018-2020) tests the registry and trading platform. Under the 'National Reform Plan,' the Thai government must set up an economic instrument, such as a cap-and-trade program, to incentivize the private sector to reduce emissions. The specific instrument will be outlined in the 'Climate Change Act,' which is expected to enter into force by 2020. The TGO is working on an ETS implementation roadmap and legal framework, which will be proposed as a policy recommendation for the government to consider.

The framework provides a means for firms to voluntarily pursue cost-effective greenhouse gas emission reduction activities through engagement with a voluntary trading scheme with an offsetting mechanism. The T-VER is a domestic GHG crediting mechanism that can be used by companies and individuals to offset their carbon footprint voluntarily. The T-VER issues Voluntary Emissions Reduction credits to qualifying projects using CDM methodologies. The T-COP is a voluntary carbon offsetting program launched in March 2013, which provides a platform for participants to offset their own carbon footprint by contributing money to retire certified T-VER carbon credits [11, 12]. To build upon these voluntary platforms, Thai-land has received 3 million USD from PMR to support the development of its proposed V-ETS. V-ETS will help the private sector build MRV capacity and integrate carbon in their business models. The V-ETS will be a cap-and-trade system

for energy related $CO_2$ emissions that targets no sectors specifically but is open for the voluntary participation of all firms. Emission allowances are allocated through a grandfathering approach, and partici-pants can achieve compliance through offsets from the T-VER program. Another notable part of this policy framework is the Low Carbon City Program (LCC), a crediting mechanism for local municipalities and commu-nities which will be integrated into the T-VER [11]. In order to support the implementation of the LCC program and its local mitigation activities, an LCC Fund will be established with the aim to deliver carbon finance and technical support to local municipalities and communities, and to become a one-stop-shop for buyers and sellers of LCC-TVERs. In addition, Thailand is developing a voluntary target-and-trade scheme for energy efficiency certifi-cates for the industrial and building sectors, known as the Energy Perfor-mance Certificate Scheme (EPC). The EPC is currently in a preparation phase and a pilot launch is planned for 2017-2019 [13].

**Table1.** Key features of Thailand Emission Trading Scheme (ETS)

| | |
|---|---|
| Total Population (April 2019) [14] | 69,281,173 |
| GDP (2017) [15] | USD 455.22 billion |
| GDP per capita (2017) [16] | USD 6,883.249 |
| Overall $C0_2$ emissions (2017) [17] | 279,296 $C0_2$ total Ktons |
| $C0_2$ Tons per capita (2017) [10] | 3.90 |
| Thailand ETS (Thailand Greenhouse Gas Management Organization, TGO) [6] | |
| Launch date | May 15 B.E. 2550 (2007) |
| GHG Reduction Project | CDM, T-VER, JCM, Crown Standard |
| Projects that received Letter of Approval (LoA) | 221 projects, expected Certified Emissions Reductions (CERs) is equivalent to 12,710,309 $tCO_2$ eq/year. |
| Number of registered CDM Projects | 148 projects, expected CERs is equivalent to 6,882,336 $tCO_2$ eq/year. |
| Number of registered JCM Model Projects | 7 projects, expected CERs is equivalent to 17,293 $tCO_2$ eq/year. |
| Sectors covered | Industries (power, water supply, manufacturing, etc.), buildings and transportation, Textile Factory, Solar PV System, Semiconductor Factory, Motorcycle Factory, Waste management activities, Wind power generation, Hydro power generation, Bio-coke technology |
| NAMAs (Nationally Appropriate Mitigation Actions) | - Renewable Energy: Biomass, Biogas, Hydro, Solar, Wind, Waste-to-Energy<br>- Energy Efficiency: EE improvement in Industries, Buildings and Transport<br>- Bio-fuels and alternative energy sources<br>- Environmentally sustainable transport system |
| Stakeholders (Thailand and foreign country) | 35 Organizations |

## 6. Fundamentals of carbon offsetting

Carbon offsetting can be considered as an act of social responsibility, as it provides organizations with the opportunity to take full account of GHG emissions from its operations and activities. The offsetting of GHG emissions also supports existing emissions reduction projects and the development of new emissions reduction projects. The demand for carbon credits stimulates the need for an adequate supply, which encourages the development of low carbon projects that are eligible to sell carbon credits to potential buyers. In this way, carbon offsetting is a viable approach that can significantly contribute towards reducing GHG emissions in Thailand. [18]

Under TCOP, the following calculation methodologies can be used to calculate GHG Emissions –[18]

1. For individuals – calculate GHG emissions from daily activities, the 'Carbon Footprint Calculation Tool' on TGO's website can be used.

2. For Organizations – the calculation of an organization's carbon footprint should include scope 1 emissions (direct emissions from company owned sources, such as combustion from boilers) and scope 2 emissions (indirect emissions from energy use, such as purchased electricity, heat or steam that is imported from an external or internal source). Scope 3 emissions (other emissions not specified in scope 1 or 2, such as outsourced activities, waste disposal etc.) can also be included.

3. For Products and Services – to calculate the carbon footprint of products, use TGO's 'Guideline for the Carbon Footprint of Products'. To calculate the carbon footprint of services, use TGO's Guideline for the Carbon Footprint of Products and Services.

## 7. Trading processes

The trading of rights to emit greenhouse gases (Emission Trading Scheme: ETS) is a powerful tool with the widest used in the against climate change agenda. It is known and widely used in developed countries such as Canada, the EU, the US, New Zealand. One tool is the use of "Financial incentives" to encourage the reduction of GHG emissions. [19]

The trading of rights to emit greenhouse gases from the holder (mostly mean to the government) imposed a ceiling on greenhouse gas emissions compared to the base year (known as cap setting). For an industry with high volume of GHG emissions, the government will allocate the right to emit GHG (known as allowance allocation). Each factory / enterprise cannot exceed the emission levels which was already set out in the annual Cap. The results of measurements of emissions arrived from GHG plant/ enterprise through the verification (known as verification) to the state every year.

The greenhouse has been allocated by the government based on the amount of greenhouse gases emitted (As reported at the end of the year), which plant / corporate greenhouse gas emissions had the right to receive the allocation. The buyer need to buy the right to emit greenhouse gases from factories / other organizations under the same system. Or there is another option, may purchase carbon credits. The project reduces greenhouse gas Standard ETS system in which it recognized the right to adopt the emissions system. If the plant / enterprise produce less greenhouse gas emissions than the right to emit GHG to be allocated. It can be collected the right to emit greenhouse gases for next year or sell to another industrial / organizational. GHG price tends to vary according to supply and demand in the market. The trading processes can be seen in Fig.2.

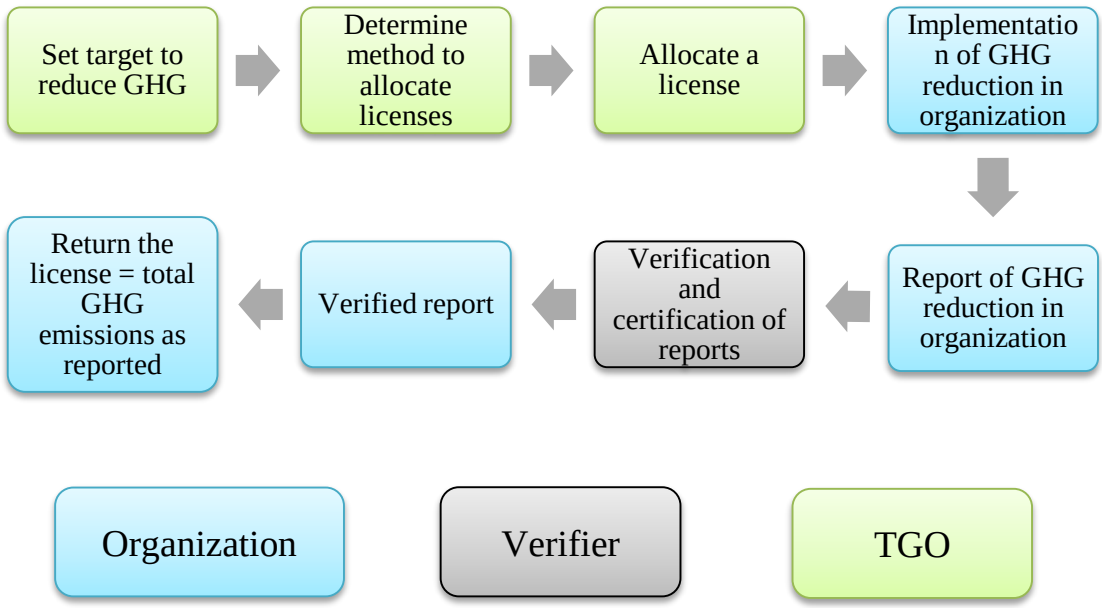


**Fig.2** Trading Processes of GHG in Thailand [19].

## 8.Conclusions

Energy security and the threat of climate change are the main focus in energy planning in Southeast Asian countries, as in other parts of the world. Thailand is the second largest energy consumer in the region. Lack of sufficient infrastructure and investment leads to the country toward fossil fuel electricity generation. The potential of renewables is abundant in the country, for avoiding the climate change threat while supplying electricity at affordable rates. The outmost purpose of carbon credits trading is, consequently, to reduce the emission of GHG into the atmosphere. Otherwise, carbon credits are exchanged in a carbon market, commonly referred to as the cap-and-trade market, where businesses can distribute each other's rights to pollute. Currently implemented policies are projected to influence greenhouse gas emissions, but do not prevent emissions from increasing up to 2030. Thailand would require additional measures to achieve their 2025/2030 targets. It should be noted that the country likely to meet its targets not necessarily undertaking more stringent action on mitigation, as this depends on the ambition level of the nationally determined target.

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**Authors' biography :**

Dr.Kultida has active research interest in Environmental Engineering. She has over 22 years' experience as a lecturer in the University. She has been awarded fellowship recognition of the Higher Education Academy under the UK Professional Standards Framework (UKPSF),