CHAPTER I

INTRODUCTION

1.1 Introduction

Nowadays, global warming is a big problem for our mankind. Every country in the world starts to discuss this problem widely and considers this problem being the main subject of intense concern because many scientists said that cause of global warming comes from human activity, and the effect from this one is clearer and more severe than in the past. It's time for every country and every nationality to cooperate and solve this problem together so as to keep the world living with us as long as possible. The Kyoto Protocol is one result of that cooperation which wants to help the world out of this crisis.

For developed countries, Annex 1 countries, the Kyoto Protocol adopted at the 3rd Conference of the Parties (COP3) in 1997 set the goal of reducing greenhouse gas (GHG) emissions, which is the main cause of global warming, by average 5% of each country's respective 1990 emission amount by 2008-2012. Clean development mechanism (CDM) is one of three types of the Kyoto protocol, which are Emission Trading (ET), Joint Implementation (JI) and Clean Development Mechanism (CDM), by two of them (ET and JI) allow only developed countries (Annex 1) to implement in emission reducing processes together- no matter purchasing carbon credits from other Annex-1 countries instead reducing greenhouse gas emissions domestically, or help each other to reduce greenhouse gases emission. In addition CDM is arrangement under the Kyoto Protocol allowing industrialized countries with GHG reduction commitment to invest in emission reducing projects in developing countries (either financial being valued as Certified Emission Reductions (CER) which can be purchased from companies of Annex 1 countries to offset the emission they produce, producing revenue to the host country, or technology support) as an alternative to what is generally considered more costly emission reductions in their own countries.

For Thailand known as one developing country, CDM has the potential to assist in achieving sustainable development. This research provides one project case study which nowadays is still lack of concentration from government and private

sectors, but it is in the range which can be counted as one of CDM project in order to show the potential value (revenue) and benefits getting from this execution.

1.2 Background of the research

In the Kyoto Protocol, there are six greenhouse gases addressed under the protocol:

1. Carbon dioxide (CO_2)
2. Methane (CH_4)
3. Nitrous Oxide (N_2O)
4. Hydro fluorocarbons (HFCs)
5. Perfluorocarbons (PFCs) and
6. Sulphur hexafluoride (SF_6)

These six GHGs are not equal in term of global warming potential (GWP), which measures the relative radiative effect of GHGs compared to CO_2. For example, one tone of methane has a GWP as potent as 21 tones of CO_2.

Greenhouse gas	Global warming potential
1. Carbon dioxide (CO_2)	1
2. Methane (CH_4)	21
3. Nitrous Oxide (N_2O)	310
4. Hydro fluorocarbons (HFCs)	140-11,700
5. Perfluorocarbons (PFCs)	6,500-9,200
6. Sulphur hexafluoride (SF_6)	23,900

From the category, Methane Emission Reductions projects, one of the highest profile CDM projects, are regarded as highly effective, since methane has twenty-one times more potential as a greenhouse gas compared with carbon dioxide and its collection technologies are comparatively inexpensive. Therefore, it is understood that the knowledge about the Methane Emission Reduction projects is very meaningful for possible CDM projects.

In the 1994 Greenhouse Gas Inventory, Thailand predicts a large increase in methane emissions due to the increase in solid wastes by its population growth and the switch from open dumping to sanitary landfills. By methane is produced from

organic waste by anaerobic fermentation. The use of methane as energy is considered to be an effective way to mitigate methane release.

Present, in Thailand, disposal methods create severe health and environment hazards. Efforts are being made to develop more satisfactory systems for waste management and disposal. Concern over the difficulty for management of landfill sites, particularly the establishment of new sites, as well the cost of waste disposal, has led to the development of technologies which convert waste into energy or useful by-products.

Organic waste, including food leavings, which were found mostly in waste compositions of Thai, is an important energy carrying product in renewable energy systems. One alternative choice for utilizing this energy is using it to produce electricity and supply to the grid so as to respond in the electrical demand of the country having continually growth in the recent year. When looking in the detail of waste-to-energy technology and geography, thermal treatment of solid waste is perhaps the most efficient way to recover energy from waste in Thailand due to high capacity in generating electricity comparing with other technologies; including, it can reduce the volume of waste (reduce methane emission), which has been increased and has been accumulated, efficiently. Furthermore, incineration techniques have become more effective and the resulting emissions of hazardous substances to the atmosphere are far better controlled than they were in the 1980s.

Year	Inceneration (MWe)	Gasification (MWe)	Anaerobic Digestion(MWe)	Refused Derived Fuel (MWe)	Integrated (MWe)	Landfill Gas to Energy (MWe)
2003	709.50	660.57	432.02	355.16	207.89	91.85
2005	738.17	627.44	449.48	369.51	216.29	95.56
2010	814.99	692.75	496.26	407.97	238.80	105.51
2011	831.29	706.60	506.18	416.13	243.58	107.62
2015	899.82	764.85	547.91	450.43	263.65	116.49
2020	993.47	844.45	604.93	497.31	291.10	128.61

TABLE 1-1: The evaluation of technologies- potential in elimination public wastes for energy (Source: Thailand's Potential and Technology of Waste Gasification for Power Generation- Somrat Kerdsuwan, 2006)

Incineration or mass burn is worthy solution in the waste disposal crisis when landfill space is limited. Incineration reduces the waste volume and generates heat and

power for commercial use. Although Wastes to Energy (WTE) facilities are not popular in the United States, they are widely used in Europe and Japan. Thailand also has one demonstration plant in Phuket municipality.

In survey, incineration system in Phuket, which has the burning capacity of 250 tons/ day, is used as the main process to treat Municipal Solid Waste (MSW) which also provides electricity (2.5 Mega-Watt, MW) as a supplementary function. Other MSW management practices located in the same area of the incineration plant are segregation of useful materials for utilization, and landfill for disposal of the remaining wastes which can not be incinerated. Nowadays, Phuket residents created more than 500 tonnes of rubbish a day, while the company's incinerator could burn only 250 tonnes per day. The rest was being dumped in a landfill, which could fill up very soon.

To solve this problem, the increasing capacity of burning might be the best solution for this problem, but the investment cost is quite high comprising with there are no commercial plants occurred in Thailand, and there are no concerns in the revenue getting from CDM activities. That makes incineration project is not quite attractive for investors, and making this project is difficult to occur in Thailand. So this research is created by having purposes to study a potential location where can be brought to be a case study for making a financial feasibility study of the incineration project in Thailand.

From collecting data, the waste dumping area at Nontaburi province seems to be highest possibility to continue in research due to the area which has limitation and high amount of waste brought to the site (around 1,000 tons per day- **forecasted data in 2007**) including the data which can be found from various reliable sources. That makes waste dumping area at Nontaburi province is chosen to be the case study for this research.

1.3 Statement of Problem

For Municipal Solid Wastes (MSW), incinerability will depend on two main factors, moisture and heating value. Both factors have seasonal variability, which must be considered while designing an incinerator. Air pollution is also a major

concern because contaminated or hazardous household wastes create the air emission and ash from the facility. Explosive materials shall be stored out to avoid harming the incinerator. Thus special attention is required for MSW burning operation, which added to the cost of the project.

Advantages of Incineration technology:

- The amount of waste for the landfill is the least
- Landfill contains less organic waste compared to baseline thus reduces the opportunity of the groundwater contamination
- Suitable for small space since the small amount of land is required

Disadvantages of Incineration technology:

- The project is barely feasible since investment and operation & maintenance costs are very high
- The power plant needs expert/ high quality technicians for the operation
- If the incinerator is not constructed well, environmental problems will occur

Although the incineration technology is the most suitable technology that should be applied and executed in Thailand, the cost of project still have not quite attractive for investment of investors, so CDM is applied to make the project getting more attractive than in the past.

Even though CDM is adopted to use as one alternative choice for increasing the feasibility of emission reduction project, no one can answer what is the optimum solution for this implementation- whether investor should do CDM activities by themselves and sell their carbon credit to the developed countries in high price, or whether they should push this load to agencies and public sector buyers e.g. the World Bank and several bilateral government buyers, which was set for the purpose of giving consulting, proceeding in CDM's acquisition to non-Annex1 countries, in order to buy the carbon credits in lower price comparing with the global market, or even the owner does not do anything but giving investors from Annex-1 country support their technology and let them take the carbon credit which can be reduced to fulfill their legally binding quantitative obligations laid down in the Kyoto Protocol. From these problems, the solving process is required to clarify what the best solution of these problems is.

In the clarification, it is explanation of currency situation of the power plant following by varies of assumption, so it is necessary to use some measuring tools to assess the feasibility of the project. Financial and Economic Value Added (EVA) analysis are the chosen tools for this assessment by believing in completing a thorough investment analysis may seem complicated and difficult. But the reward of a soundly based decision will be worth the effort invested. In including EVA as one assessment tool besides using only financial analysis due to "People will manage the things against which they are judged, which makes performance measurement an underpinning of all financial practices, Economic profit is a financial measure that links performance to shareholder wealth creation. It provides a solid foundation for linking financial management practices to company performance"- [**Economic Value Added** by Craig Savarese/ P.4]

Comprising, recent management trends have emphasized the importance of shareholder wealth creation as the goal of any business enterprise. The ability of a business to create shareholder wealth besides focusing only on profit from operation is increasingly seen as the key indicator of management and business performance.

1.4 Objective of Research

To use this study as a guideline to help in making a decision for investors who realize in the problem of climate change in nowadays so as to concentrate on the MSW Power Plant being one alternative choice for their investment.

1.5 Expected Benefit

As a result, the thesis is expected to yield a benefit in several heading as categorized below:

- To provide guideline for any investor or any section in Thailand to push them making waste to energy project occurs in Thailand
- To gain more understanding the criteria of calculation method of methane emission and financial situation from public waste to be benefit for persons who will study later.
- Be able to know what is the best solution for CDM in power plant so as to help investors in making a right decision on what direction they should proceed.

1.6 Scope of the research

The scope of this study is confined to research and analysis the optimum solution for CDM execution of MSW incineration power plant at Nontaburi which has been designed to clarify the finance situation (in both of financial and economic outcomes) in 4 stipulations as shown:

1. The project does not be included CDM criteria in its execution
2. The project is included CDM criteria in scope of work. All activities (documents, metering and all technologies) dealing with CDM, the company will be responsible by themselves (not limited to employ consultant service to help in this implementation), and sell the carbon credit in high price.
3. The project is included CDM criteria in scope of work by the project participants will make an agreement with CER buyer or broker who will pay initial transaction cost for this implementation. By price of the carbon credit, it depends on the agreement which two of them have made. This credit price will relate on project risk and procedures.
4. The last one, the project is included CDM criteria in the process but, in this assumption, the company will negotiate with an Annex-1 country to give them support technology so as to reduce investment cost of the project owner. The amount of methane emission reduced will give to Annex-1 investors to fulfill their legally binding quantitative obligations laid down in the Kyoto Protocol.

Which one can give the maximum outcome; it will be chosen to be the optimum solution.

1.7 Research procedure

The sequence of the study would be carried out as illustrating below:

1. Study the related literatures include,
   - Academic journal
   - Relevant thesis and dissertation
2. Collect the relevant information from related documents and experts include,
   - Academic journal
   - Research report and information provided from Electricity Generating Authority of Thailand (EGAT)
   - CDM methodology from UNFCCC website
   - Academic seminar
   - Expert interview
3. Define the support methodology for the analysis include,
   - Financial analysis
   - Economic Value Added (EVA) analysis
   - Emission Reduction calculation processes
4. Analyze the information in 4 stipulations
5. Identify problems: The possibility of the 4 assumptions will be identified
6. Conclusion and Recommendation
7. Thesis written up