Simulating a Carbon Trading Advantage from the Municipal Solid Waste Management: The Role of Waste-to Carbon in Malaysia

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Abstract. Management of municipal solid waste in Malaysia has proved to be efficiently, effectively, and adequate. This study has used existing literature and empirical evidences for analyzing the various issues related to carbon emission trading and solid waste management. A measurement of carbon potential value will be conduct after the municipal solid waste generation data was collected completely, and review the advantage of carbon emission trading from the municipal solid waste management in Malaysia, evaluate the benefit of carbon emission trading as an alternative investment tools and basic framework required to implement them. The article suggests that how an appropriate carbon emission trading system may give more benefit and economical value, and sustainable way of developing the future income generation in environmental sector in Malaysia. In other hand, the changing legislative environment is likely to make current practices highly non-optimal and increase pressures for a change of waste management strategy. The article will become more valuable to all those who have some interests in environmental economic and alternative investment sectors and would like to reduce the global warming and climate change effect and develop the potential value related to carbon emission trading in developing countries.

1. Introduction

In this recent years, the issues of municipal solid waste generation has taken a great attention, especially in an emerging countries where population is still rising substantially and there were limited landfills to accommodate daily waste from communities [1]. Solid waste presents unique and complex problems partly because it is both a source of pollution and secondary resources with waste management systems aiming to achieve a balance between environmental, technical, economic and regulatory factors [2]. In the other hand, there are many economic potential values from solid waste generation that can be taken as a community income generation.
Prior to the mid-1990s, waste management (WM) issues tended to revolve around public health and safety issues [18], and the optimization of landfill gas (LFG) capture and utilization [7]. The subject of its impact on greenhouse gases (GHG) has only been addressed recently, making it a relatively young study. This reflects an increasing acknowledgement of wastes contribution to GHG which is reflected in recent development in GHG mitigation policies internationally [19]. More importantly, there has been a movement to divert waste from landfills in order to reduce the negative environmental impact of landfills such as leachate contamination, GHG emissions and space limitation [16]. Composting has thus been widely acknowledged as an alternative to landfills.

In Malaysia, waste management and energy generation are undergoing significant changes, in reaction to new climate-driven statutory regulations. Climate change is also a serious issue, and Malaysia is embarking on a number of voluntary actions to reduce the emissions of greenhouse gases (GHGs) that can intensify climate change. Among the efforts to slow the potential for climate change are measures to reduce emissions of carbon dioxide (CO$_2$), methane (CH$_4$) and other non-carbon-dioxide GHGs, and promote long-term storage of carbon in forests and soil. Management options for MSW provide many opportunities to affect these processes, directly or indirectly.

Following a century of exponential growth in industrialisation together with population growth over time, the threat is reaching crisis point. The government at some point must confront the climate change problem by setting limits on CO$_2$ emissions. Reducing and converting CO$_2$ is a cost-competitive and safe way to achieve large-scale reductions in free-air emissions. Carbon emission trading is relatively new and booming issue in financial management area which aim is bringing down an air pollution by providing economic incentives to those who can achieve a significant reduction of carbon emission. The mechanism behind carbon emission trading is simple, yet ingenious. There is a central authority which prescribes a limit or a cap to the amount of air pollutant which can be emitted. Since the total of such caps is fixed, the total pollution or emission cannot exceed this level.

The flexibility of the hedge fund structure is the central reason these investment vehicles are so popular. The flexibility allows funds to specialize on certain investment sectors or strategies, and they can move quickly to the hot areas of the markets. One of the hot areas of the markets is the movement toward green investments and strategies. With this increased focus on energy and related areas, Carbon Hedge Funds have become a popular investment vehicle to focus on “carbon” as a new asset class. This article will overview the carbon hedge fund strategies.

2. Generation Rate of Municipal Solid Waste in Malaysia

Economic growth in Malaysia has brought prosperity; it has started to impose costs of industrial pollution and degradation of the urban environment [5]. The official estimated KL’s population in 2007 is 1.604 million according to statistic department 2007. In KL alone, the estimated solid waste generation was 4000 tons per day in the year 2000 [8]. Kuala Lumpur alone in 1991 spent roughly about RM 25.2 million cost of managing solid waste; the comparative figures of the damage costs of haphazard open damping landfill practice were RM 178.30 per ton [5]. With the increase in municipal waste generation from 5.6 million tons in 1997 up to 8.0 million tons in 2000, there is an urgent need for a better managed disposal option [3]. Table 1 shows solid waste composition of selected locations in peninsular Malaysia and Figure 1 shows the corresponding graphical representation.
Table 1. Solid waste composition of selected locations in Peninsular Malaysia (In Percentage) [21].

| Waste composition     | Kuala Lumpur | Shah Alam | Petaling Jaya |
|-----------------------|--------------|-----------|---------------|
| Garbage               | 45.7         | 47.8      | 36.5          |
| Plastic               | 9.0          | 14.0      | 16.4          |
| Bottles/glass         | 3.9          | 4.3       | 3.1           |
| Paper/cardboard       | 29.9         | 20.6      | 27.0          |
| Metals                | 5.1          | 6.9       | 3.9           |
| Fabric                | 2.1          | 2.4       | 3.1           |
| Miscellaneous         | 4.3          | 4.0       | 10.0          |

Figure 1. Solid waste composition of selected locations in Peninsular Malaysia.

Table 2 shows the recyclable components and their percentage share and recycling rate in tons per year. The graphical representation of percentage recyclables is shown in Fig. 2. Unfortunately, the attention paid by the authority towards this direction is not sufficient enough to tackle this issue. The Agenda 21 of the UNCED 1992, defined environmentally sound technologies protect the environment; moreover, recycling most of the wastes and handle residual wastes in more acceptable manner. Though recycling activity in Malaysia is rising up, the recycling industry still needs to be enhanced. Since 1993 a major effort of recycling was lunched by the Ministry of Housing and Local Government but unfortunately limited recycling activities taken place [1]. In Kuala Lumpur, by 2005 the recycling of the waste generated planned to reach 16% and 22% by 2020 [13].
Table 2. Recyclable components and their percentage share.

| Recyclable SW components | Mass (kg/Cap./year) | Percentage | Recycling rate (tons/year) |
|--------------------------|---------------------|------------|--------------------------|
| Food waste               | 387.63              | 56.80      | 155041.11                |
| Mix paper                | 35.59               | 16.50      | 14235.00                 |
| Mix plastic              | 61.87               | 15.30      | 24747.00                 |
| Textile                  | 07.12               | 01.30      | 2847.00                  |
| Rubber and leather       | 03.29               | 00.60      | 1314.00                  |
| Wood                     | 02.19               | 00.40      | 876.00                   |
| Other combustible        | 00.00               | 00.00      | 00.00                    |
| Yard                     | 25.73               | 04.70      | 10293.00                 |
| Fine                     | 03.83               | 00.70      | 1533.00                  |
| Glass                    | 06.57               | 01.20      | 2628.00                  |
| Ferrous                  | 13.14               | 02.40      | 5256.00                  |
| Aluminum                 | 00.55               | 00.10      | 219.00                   |

Fig. 2. MSW recyclables of Kuala Lumpur.
3. Waste in the emissions trading scheme
Emissions trading will help reduce emissions, encourage and support global action on climate change, and help put Malaysia on a path to sustainability. This factsheet explains how emissions trading will affect the waste sector.

4. Greenhouse gas emissions from waste
The greenhouse gases carbon dioxide, methane and nitrous oxide are emitted into the atmosphere from waste treatment and disposal. These emissions come from solid waste disposed in landfills, commercial and domestic wastewater treatment, and waste incineration. A distinction is drawn for sources of carbon dioxide in the waste sector; where the emissions come from disposing or treating organic matter, these emissions are considered part of the natural organic cycle and are not counted. Only carbon dioxide emissions from burning fossil fuel origin materials such as plastic are included in the emissions trading scheme.

The waste sector was responsible for Malaysia’s greenhouse gas emissions in a local, regional and global scope. It is the only sector that has reduced its greenhouse gas emissions below 1990 levels, in its case by 26 percent. This reduction has come from improved landfill management systems, the installation and operation of landfill gas recovery technologies, as well as by reducing organic waste disposed at landfills through recycling and composting.

5. Potential impacts of the emissions trading scheme on the waste sector
The cost of emission units is expected to be passed on to customers of landfills (the people and organizations depositing waste) through increased prices for waste disposal. There is no exact way of generalizing a cost increase to all users of landfills, as emissions from individual landfills are noticeably affected by landfill gas collection systems and the incentives and infrastructure for recycling and organic materials diversion. Users of landfills have markedly different items in their waste, which all have different potentials for landfill gas generation. Any price increases will also be affected by competition from other landfills and the management policies and priorities of the landfill owner – usually a local authority.

6. Methodology
6.1 Carbon Valuation Tool
The emissions trading scheme will include methane emissions from landfills that deposit solid waste. Such waste must be partially household waste. Methane emissions occur as a result of the biodegradation of organic matter contained in landfills. The emissions trading scheme will also include carbon dioxide, methane and nitrous oxide emissions from any future solid waste incineration plant that combusted household waste. If electricity is generated from waste incineration, then any emissions are counted in the industrial processes sector, which has a different entry date to the waste sector. The emissions associated with treating domestic, commercial and residential wastewater (including septic tanks) will not be covered by the emissions trading scheme. Emissions of these gases are extremely difficult to measure accurately at individual sites.

In estimating the level of provision to be made through the Waste Development Framework for Municipal Solid waste the following assumptions have been made that future waste arisings will be dependent upon the amount of waste produced per person, the average number of people living in each dwelling and the increase in number of dwellings.

From the recent market price at Europe Emission Exchange, standardized price that will be used for any metric ton carbon emission is about EUR10 - EUR15.
Table 3. Waste Per Ton Estimates of GHG Emissions for Alternative Management Scenarios.

| Material          | GHG Emissions per Ton of Material Source Reduced (MTCE) | GHG Emissions per Ton of Material Recycled (MTCE) | GHG Emissions per Ton of Material Landfilled (MTCE) | GHG Emissions per Ton of Material Combusted (MTCE) | GHG Emissions per Ton of Material Composted (MTCE) |
|-------------------|--------------------------------------------------------|--------------------------------------------------|---------------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| Aluminum Cans     | (2.24)                                                 | (3.70)                                           | 0.01                                              | 0.02                                             | -                                                 |
| Steel Cans        | (0.87)                                                 | (0.49)                                           | 0.01                                              | (0.42)                                           | -                                                 |
| Copper Wire       | (2.00)                                                 | (1.34)                                           | 0.01                                              | 0.01                                             | -                                                 |
| Glass             | (0.16)                                                 | (0.08)                                           | 0.01                                              | 0.01                                             | -                                                 |
| HDPE              | (0.49)                                                 | (0.38)                                           | 0.01                                              | 0.25                                             | -                                                 |
| LDPE              | (0.62)                                                 | (0.46)                                           | 0.01                                              | 0.25                                             | -                                                 |
| PET               | (0.57)                                                 | (0.42)                                           | 0.01                                              | 0.30                                             | -                                                 |
| Magazines         | (2.36)                                                 | (0.84)                                           | (0.08)                                            | (0.13)                                           | -                                                 |
| Newspaper         | (1.33)                                                 | (0.76)                                           | (0.24)                                            | (0.20)                                           | -                                                 |
| Office Paper      | (2.18)                                                 | (0.78)                                           | 0.53                                              | (0.17)                                           | -                                                 |
| Phonebooks        | (1.72)                                                 | (0.72)                                           | (0.24)                                            | (0.20)                                           | -                                                 |
| Textbooks         | (2.50)                                                 | (0.85)                                           | 0.53                                              | (0.17)                                           | -                                                 |
| Medium Density Fiberboard | (0.60) | (0.67) | (0.13) | (0.21) | - |
| Food Scraps       | -                                                      | -                                                | 0.20                                              | (0.05)                                           | (0.05)                                            |
| Yard Trimmings    | -                                                      | -                                                | (0.06)                                            | (0.06)                                           | (0.05)                                            |
| Grass             | -                                                      | -                                                | (0.00)                                            | (0.06)                                           | (0.05)                                            |
| Leaves            | -                                                      | -                                                | (0.05)                                            | (0.06)                                           | (0.05)                                            |
| Mixed Paper, Broad| -                                                      | (0.96)                                           | 0.09                                              | (0.18)                                           | -                                                 |
| Mixed Paper, Resid.| -                                                     | (0.96)                                           | 0.07                                              | (0.18)                                           | -                                                 |
| Mixed Paper, Office| -                                                      | (0.93)                                           | 0.13                                              | (0.16)                                           | -                                                 |
| Mixed Metals      | -                                                      | (1.43)                                           | 0.01                                              | (0.29)                                           | -                                                 |
| Mixed Plastics    | -                                                      | (0.41)                                           | 0.01                                              | 0.27                                             | -                                                 |
| Mixed Recyclables | -                                                      | (0.79)                                           | 0.04                                              | (0.17)                                           | -                                                 |
| Mixed Organics    | -                                                      | -                                                | 0.06                                              | (0.05)                                           | (0.05)                                            |
| Mixed MSW         | -                                                      | -                                                | 0.12                                              | (0.03)                                           | -                                                 |
| Carpet            | (1.09)                                                 | (1.96)                                           | 0.01                                              | 0.11                                             | -                                                 |
| Personal Computers| (15.13)                                                | (0.62)                                           | 0.01                                              | (0.05)                                           | -                                                 |
| Clay Bricks       | (0.08)                                                 | -                                                | 0.01                                              | -                                                | -                                                 |
| Concrete          | -                                                      | (0.00)                                           | 0.01                                              | -                                                | -                                                 |
| Fly Ash           | -                                                      | (0.24)                                           | 0.01                                              | -                                                | -                                                 |
| Tires             | (1.09)                                                 | (0.50)                                           | 0.01                                              | 0.05                                             | -                                                 |
6.2 Carbon Hedge Fund Mechanism

The European Commission launched the European Climate Change Program (ECCP) in June 2000 with the objective to identify, develop and implement the essential elements of an EU strategy to implement the Kyoto Protocol. All 25 EU countries simultaneously ratified the Kyoto Protocol on 31 May 2002. The European Union Emission Trading Scheme (EU ETS) is a significant part of the ECCP and currently constitutes the largest emissions trading scheme in the world.

Actual trading in EU ETS emission allowances began January 1st, 2005. By the end of the same year, almost 400 million tonnes of carbon equivalent had been traded, representing a turnover in excess of EUR 7 billion. The impact of the release of sensitive information regarding the ETS net position in carbon emission allowances can be dramatic, as was illustrated in April 2006. First phase EU ETS carbon, in the form of the allowance expiring in December 2007, written Dec-07, had reached EUR 30 per tonne at their high in April 2006. Prices subsequently plummeted to below EUR 10 per tonne in a few days beginning May 2006 after EU figures on actual 2005 emission levels suggested emission caps to selected industries had been too generous to have a significant impact on emission practice. Emission caps for the second phase (2008-2012) are currently under review because of this apparent generosity of NAP levels in the first phase.

Risk management and hedging is a useful tool to reduce market place liability. Hedging is a strategy designed to minimize exposure to an unwanted business risk, while still allowing the business to profit from an investment activity. There could be hedgers on both sides of the market and that hedging is essentially a risk reduction technique more than anything, which allows informed traders and commodity dealers to profit from their intuitive knowledge of future changes in the difference between futures and spot prices. Many examples exist to demonstrate the mitigation of risk to an institution or financial portfolio. New products are constantly created and available on both over-the-counter and exchange traded markets. It would be wise to consult with a qualified Commodity Trading Advisor or broker to discuss the analysis for an on-going risk management solution or a onetime only hedge.

![Figure 3. Historical Carbon Trading, 2007 – 2008](image-url)
There is no doubt that developing nations are especially vulnerable, and even the currency tends to be tied to the price of those particular commodity items until it manages to be a fully developed nation. For example, one could see the nominally “fiat” money of Cuba as being tied to sugar prices, since the lack of hard currency paying for sugar means less foreign goods per peso in Cuba itself. In effect, Cuba needs a hedge against a drop in sugar prices, if it wishes to maintain a stable quality of life for its citizens. Whether you are a large producer or a whole set of consumers, you need to hedge your foreign currency exposures and the respective exchange futures commodities.

One has to understand that the primary goal of commodity price risk management is to protect the economic value of your business from the negative impact of commodity price fluctuations, at the lowest possible cost. Because commodity price volatility also provides opportunity for gains, a secondary goal is to strike a balance between risk and return. Risk management provides the ability to accurately budget on cash flow receipts.

It is also fair to explain that some form of risk taking is inherent to any business activity. Some risks are considered to be “natural” to specific businesses, such as the risk of oil prices increasing or decreasing is natural to oil drilling and refining firms. Other forms of risk are not wanted, but cannot be avoided without hedging. Not all hedges are financial instruments: a producer that exports to another country, for example, may hedge its currency risk when selling by linking its expenses to the desired currency. Banks and other financial institutions use hedging to control their asset-liability mismatches, such as the maturity matches between long, fixed-rate loans and short term (implicitly variable rate) deposits.

For example, rising fuel prices can cut into your profits and make budgeting difficult. That’s where we need to set up this mechanism, if your business purchases oil, you can certainly budget with greater certainty by effectively managing the risks associated with fluctuating fuel prices.

### 6.3 Basic Carbon Hedging Strategy

This explanation should be kept as simple as possible. First, it can be used an example of frozen concentrated soya juice (“SJ”), as a commodity example and need to know a few things about this commodity before start this simulation. Here's the specifications for orange juice futures contracts.

- **Contract Size**: 10,000 pounds (4536 kg) of soya juice
- **Point Value**: $1.50 per point
- **Minimum price move**: 5 points or 5/100 ths of a cent = $7.50 per contract

The assumption is taken about a soya juice producer first (SJ farmer). This person has to sell his soya juice in six months later. The problem is that any price drop in the soya juice market would have a negative effect on what the farmer can get for his crop once it's harvested.

The farmer can get around a large part of that risk by establishing a basic short commodity hedging strategy in the soya juice futures market. This may give the farmer some price protection, sort of like an insurance policy against large price fluctuations. Furthermore, the current price for soya juice in the cash market on February 1st is 90 cents per pound (fictional). The SJ farmer feels that's a fair price to cover his costs and make a profit. The farmer also knows that he will have about 10,000 pounds of SJ to bring to the market at harvest in six months. What the farmer does is sell his crop now using the futures market to protect that 90 cent sale price in the future. The farmer goes into the futures market and sells 1 contract (10,000 pounds of SJ) at the current market price of $1 per pound. Now let’s fast forward 1 month into the future and see how this protects his profit margins.

On August 1st the futures price of SJ has dropped to 70 cents per pound and the cash or current price for SJ drops to 65 cents per pound because there looks to be a bumper crop of SJ this year. This situation doesn't look good as the SJ producer needed to get 90 cents a pound to cover his costs and
make a profit. The farmer will be getting $3750 less for his SJ crop. The decimal point has been omitted and the calculation looks like this: 9000 - 6500 = 2500 X 1.50 = $3750 loss per contract.

Does the money loss from the crop? What about the SJ contract from the farmer sold in the futures market a few month ago? The farmer sold 1 contract at $1 per pound. If the farmer plan to buy that contract back right now he would only have to pay 70 cents a pound. The farmer has a profit of $4500 for the futures contract. The decimal point has been omitted and the calculation looks like this: 10000 - 7000 = 3000 X 1.50 = $4500 profit per contract.

Furthermore, what the hedge has done to partially protect the SJ farmer's price risk is being analyzed. The $3750 cash loss is offset by the $4500 profit in the futures market, leaving the farmer with a theoretical profit on the hedging strategy of $750. This is not a bad deal.

**Commodity Futures Fact:** A commodity hedging strategy does not remove all price risks. In fact, there are costs associated with trading in commodity futures markets that must be factored into any hedging strategy. Those costs include the commissions paid on the futures trades and the costs associated with placing money in the futures account to cover initial margin requirements (good faith deposits) and maintenance margin calls (additional deposits to cover adverse price variations).

The market is continuing to another month into the future. On July 1st another report shows that the first report overestimated the SJ supply and the price has risen to $1.20 a pound and the cash price of SJ has gone up to $1.05 because of the simple economics of supply and demand. What will happen to the farmer’s cash? The farmer can now get $2250 more for his SJ. The calculation looks like this: 10500 - 9000 = 1500 X $1.50 = $2250 more profit.

The profit must be analyzed first. The farmer shouldn't run out and buy a new BMW yet. It will cost him $1.20 per pound to buy back the futures contract he sold at $1. That gives him a loss of $3000 for his futures hedge. The calculation looks like this: 10000 - 12000 = 2000 X $1.50 = $3000 loss.

The result about how the commodity futures hedge has limited his potential profit margin. The $2250 gain on the cash price of the SJ crop is offset by the $3000 loss he currently has on his commodity futures hedge. The net result of liquidating the hedge right now would be a loss of $750.

This two examples show the importance of maintaining the hedge (regardless of price fluctuations) until the crop is ready for delivery. The cash price and the futures price will converge and become almost equal at the expiration month of the futures contract except for costs such as carrying charges (also known as "the basis"). By liquidating the futures contract and breaking the protection of the hedge before expiration, the farmer then becomes at risk to price fluctuations. The farmer also loses money on the costs associated with the futures portion of the hedge itself.

**Commodity Futures Fact:** In a liquid market, the number of speculators (people looking to profit from price fluctuations) far outnumbers the number of hedgers (those protecting themselves against price risks), but the hedgers generally carry much larger open positions.

### 6.4 Implementation of Waste-to-Carbon Simulation

This followed examples of hedging or mitigation of risk by using exchange traded derivatives. Contract size 1,000 Certified Emission Reductions (1 Lot). The Price Quotation is in points with two decimal places, equivalent to a value of EUR 0.01 per CER. The Minimum Price Change is EUR 0.01 per CER, equivalent to a value of EUR 10 per contract.

A waste manager which was collaborated with a hedge fund manager has an energy-related investment portfolio closely resembling the EUREX (European Energy Exchange). The Investment (hedge fund) Manager believes the global and regional economy is worsening with deteriorating expected returns.
The next two to three weeks are reports of quarterly US crude oil inventories. Until the report exposes, he is concerned of the results from a short term crude oil market correction. Without the privilege of foresight, he is unsure of the magnitude the earnings figures will produce. He now has an exposure to market risk.

The investment manager thinks of his options. The greatest risk is to do nothing, if the market falls as expected, he risks giving up all recent gains. If he sells his portfolio early, he also risks being wrong and missing further rally's. Then he realizes a hedge is the best option to mitigate his short term risk. He begins by calling his CTA (Commodity Trading Advisor) and after consultation places an order to sell short the CO2 Derivative Index on the EUREX. Now his result is when the market falls as expected, he will offset any losses in the portfolio with gains from the index hedge and his portfolio continues upward, he will continue making profits. A month later the investment manager again calls his CTA and closes the hedge by buying back the equivalent number of contracts on the EUREX. Regardless of the resulting market events, the investment manager was protected during the period of short term volatility. There was no risk to their investment portfolio.

**Simulation on Data - 2007:**

| Description                                                                 | Value          |
|----------------------------------------------------------------------------|----------------|
| Total sum of Kuala Lumpur population                                       | (+/-) 1,600,000|
| Organic waste generation volume predicted per person per day                | +/- 0.5 kilogram|
| Total organic waste generation volume of Kuala Lumpur per month             | 30 days x 0.5 kilogram |
| x 1,600,000                                                                 | 24,000,000 kilogram |
| 16,800 tonnes of organic waste x (21)                                      | 352,800 CER     |

- Kuala Lumpur may generate organic waste for **24,000 tonnes / month**

**Density**

- Asumption of organic waste composition = 70 percent
- 1 tonne of organic waste x (21-CH4) = 1 CER
- 16,800 tonne of organic waste x (21) = 352,800 CER

Simple Equation for Carbon Emission Trading (CET) from Recycled-Reduced Organic Waste:

**July 1st**

1 CER = EUR 20 (as assumption)  
CET = 352,800 CER x EUR 20 = EUR 7,056,000  
Converted to Malaysian Ringgit ➔ EUR (1 EUR = MYR 5.05)  
= EUR 7,056,000 x MYR 5.05  
= **RM 35,632,800** / month of July

**Aug 1st**

1 CER = EUR 10 (as assumption)  
CET = 352,800 CER x EUR 10 = EUR 3,528,000  
Converted to Malaysian Ringgit ➔ EUR (1 EUR = MYR 5.05)  
= EUR 3,528,000 x MYR 5.05 = **RM 17,816,400** / month of August

On August 1st the cash or current price for Carbon drops from EUR 20 to EUR 10 per 1 CER and the futures price of Carbon has dropped from EUR 23 to EUR 11 per 1 CER. Because of the carbon price is falling in August, this situation doesn't look good as it needs to get EUR 10 per 1 CER in cash to cover his costs and make a profit. The monthly return is decreased almost a half from the one month. The decimal point has been omitted and the calculation looks like: EUR 20,000 – EUR 10,000 = EUR 10,000 loss per contract.
The appropriate strategy should be implemented is short (or sell) in the carbon futures price at the EUREX market. The waste manager goes into the futures market and sells 1 contract (1,000 CER) at the current market price of EUR 23 per pound. Now lets fast forward 1 month into the future and see how this protects his profit margins. The calculation will be EUR 23,000 – EUR 11,000 = EUR 12,000 profit per contract.

At last, what the hedge has done to partially protect the waste manager’s price risk. The EUR 10,000 cash loss is offset by the EUR 12,000 profit in the futures market, leaving the waste manager with a theoretical profit on the hedging strategy of EUR 2,000. This is not a bad deal.

**Further Simulation**

**Scenario 1: Price falls in the cash and futures market**
At this point, a waste manager receive a nett-return, which is the profit return from the futures market is offset with the loss from the cash market.

| Cash Market       | Futures Market       | Base Profit/Loss |
|-------------------|----------------------|------------------|
| 10 July: EUR 10/ CER | Sell at EUR 13/ CER   |                  |
| 10 Aug: EUR 8/ CER    | Buy at EUR 11/ CER    |                  |
| (-) EUR 2/ CER       | (+) EUR 2/ CER        | nett             |

**Scenario 2: Price up in the cash and futures market**
When this situation happened, a waste manager will still receive a nett-return, which is the profit return from the futures market is offset with the loss from the cash market.

| Cash Market       | Futures Market       | Base Profit/Loss |
|-------------------|----------------------|------------------|
| 10 July: EUR 10/ CER | Sell at EUR 11/ CER   |                  |
| 10 Aug: EUR 13/ CER    | Buy at EUR 14/ CER    |                  |
| (+) EUR 3/ CER       | (-) EUR 3/ CER        | nett             |

**Scenario 3: Price up in the cash and Price falls in the futures market**
At the other market situation, a waste manager will receive double profit-return, which is the profit return from the futures market is accumulated with the profit from the cash market.

| Cash Market       | Futures Market       | Base Profit/Loss |
|-------------------|----------------------|------------------|
| 10 July: EUR 10/ CER | Sell at EUR 11/ CER   |                  |
| 10 Aug: EUR 13/ CER    | Buy at EUR 8/ CER     |                  |
| (+) EUR 3/ CER       | (+) EUR 3/ CER        | (+) EUR 6/CER    |

**Scenario 4: Price falls in the cash and Price up in the futures market**
At this last point, a waste manager will receive double loss, which is the loss from the futures market is accumulated with the loss from the cash market.

| Cash Market       | Futures Market       | Base Profit/Loss |
|-------------------|----------------------|------------------|
| 10 July: EUR 10/ CER | Sell at EUR 11/ CER   |                  |
| 10 Aug: EUR 8/ CER    | Buy at EUR 14/ CER    |                  |
| (-) EUR 3/ CER       | (-) EUR 3/ CER        | (-) EUR 6/CER    |
5. Conclusion
From the scenarios above, first and second scenarios may give a waste manager fully price protection from hedging activity. The third scenario can be used as a profit generator by waste manager. The last fourth scenario cannot support waste manager to gain some profit return from the CER. The investment manager may also limit the risk potential by applying the first, second and third scenario of carbon emission trading in the futures market.

Since the setting is incomplete by nature there exists an interval for arbitrage-free prices and we have chosen one price based on a local risk minimizing criteria. One can come up with explicit formulas for pricing and hedging under the assumption that the market's net position is common knowledge among the market participants. Under the more realistic setting where the market does not observe the net position directly the initial design of the regulatory structure for the financial instruments associated with the global carbon market will play a significant role in determining how the instruments will trade and the type of information that is available to regulators, market participants, and the general public.

Existing regulatory models for financial markets, including the GHG cap-and-trade systems currently in operation, provide useful lessons for the design of a market-based approach to limit GHG emissions. Building upon these lessons, policymakers can implement an appropriate regulatory structure for allowance-based financial instruments at the outset, ensuring an efficient and effective approach to reducing the nation’s GHG emissions.

References
[1] Agamuthu, P., 2001. Solid Waste: Principles and Management. Institute of Biological Sciences, University of Malaya.
[2] Emery, A., Davies, A., Griffiths, A., Williams, K., 2007. Environmental and economic modelling: a case study of municipal solid waste management strategy in Wales. Resource, Conservation and Recycling 49, 244–263.
[3] Fauziah, S.H., Agamuthu, P., 2003. A Comparative Study on Selected Landfills in Selango, Kuala Lumpur Municipal Solid Waste Management. Institute of Biological Sciences, Faculty of Science, University Malaya.
[4] Hadi, A.S., Johari, M.Y., 1996. The Malaysian Urban System. Paper Presented at Comparative Urban Studies Meeting, Asian–Pacific Center, Fukuoka, Japan, and Mimeo.
[5] Hassan, M.N., Zakaria Z., Rahaman, R.A., 1999. Managing Costs of Urban Pollution in Malaysia: The Case of Solid Waste. Paper presented in MPPJ Seminar Petaling Jaya, Malaysia.
[6] Hassan M.N., Chong T.L., Rahman, M.M., Salleh, M.N., Zakariah, Z., Awang, M., Yunus, M.N., 2000. Solid Waste Management – What’s the Malaysian Position, Seminar on Waste to Energy 2000, Universiti Putra Malaysia.
[7] Komilis Dimitris P., Robert K. Ham. 1999a. The effect of lignin and sugars to the aerobic decomposition of solid wastes. Department of Environmental Studies, University of the Aegean. Athens, Greece.
[8] Murad, M.W., Siwar, C., 2006. Waste management and recycling practices of the urban poor: a case study in Kuala Lumpur city, Malaysia. Online Journal of Waste Management Research, ISWA, UK.
[9] Nasir, A.A., 2007. Institutionalizing Solid Waste Management in Malaysia: Department of National Solid Waste Management. Ministry of Housing and Local Government Malaysia, Power Point Presentation, December 6.
[10] Nasir, M.H., 2004. Lecture Notes. Faculty of Environmental Studies, UPM.
[11] Norbu, T., Visanathan, C., Basnayake, B., 2005. Pretreatment of municipal solid waste prior to landfilling. Waste Management 25, 997–1003
[12] Omar, M.N., 1999. Characterization and Management of Solid Waste in Klang Valley, Master Thesis, Faculty of Engineering, University of Malaya, Kuala Lumpur Management; Paper Presented in Seminar on Managing Solid Waste Held in Peatling Jaya, Selangor on March 27.

[13] Pillay, M.S., 1999. Municipal Solid Waste Management System: A Situational Appraisal and Possible Solution: Paper Presented in Seminar on “Local Communication and the Environment” Organized by EPSM, 24–25th October, 1998 Shah’s Village Hotel.

[14] Rigamonti, L., Grosso, M., Giugliano, M., 2009. Life cycle assessment for optimizing the level of separated collection in integrated MSW management systems. Waste Management 29 (2), 934–944.

[15] Siraj, M., 2006. Waste Reduction: No Longer an Option but a Necessity: in Bernam. Kuala Lumpur.

[16] Slater, R., Gilbert, J., Frederickson, J. (2001) Review of Composting Practices in the UK. In proceedings: Profit from Waste. Institute of Mechanical Engineers, London.

[17] Tchobanoglous, G., Theisen, H., Vigil, S., 1993. Integrated Solid Waste Management-Engineering Principles and Management Issues. McGraw-Hill, New York.

[18] Tchobanoglous and PR O’Leary, Landfilling, in Handbook of Solid Waste Management, F. Kreith (ed.). McGraw-Hill. Inc., New York. 1994.

[19] Themelis, Nickolas J. and Ulloa, Priscilla A, (2007). Methane generation in landiflls, Renewable Energy, 32:1243-1257.

[20] Troschinetz, A.M., Mihelcic, J.R., in press. Sustainable recycling of municipal solid waste in developing countries. Waste Management. <http://dx.doi.org/10.1016/j.wasman.2008.06.004>.

[21] Wahid, A.G., Hassan, M.N., Muda, A., 1996. Domestic and Commercial waste: Present and Future Trends. CAP-SAM National Conference on the State of the Malaysian Environment, Penang: RECDAM.