

LFG Collection & Utilization Project in Ipoh Baseline Information

1. Waste composition analysis

(1) Composition of incoming waste

Composition of incoming waste in the plant used in baseline emission estimation was determined based on the result of waste composition analysis conducted by Midac Co., Ltd. in 2009. The results and outline of the composition analysis are as described below;

Table 3-1: Basic condition on the analysis

| | |
|-----------------|---|
| Date | 23/11/2009 ~ 27/11/2009 |
| Place | Existing landfill in Ipoh City |
| Objective | 1. Understanding the waste composition installed to the landfill 2. Understanding the recyclables |
| Volume of waste | 50 tons/day |
| Origin of waste | The waste is originated from Household, Shop, and Market, the ratio of each item is 70%, 25%, and 5%. |

Table 3-2: Average composition of the incoming waste in the plant

| Waste Type | Tons/day | % |
|----------------|----------|------|
| Food | 18 | 36 |
| Garden | 4 | 8 |
| Wood and Straw | 3 | 6 |
| Paper | 7 | 14 |
| Textile | 1.5 | 3 |
| Others | 16 | 32 |
| Plastics | 8.1 | 16.2 |
| Glass | 0.9 | 1.8 |
| Steel | 0.95 | 1.9 |
| Aluminium | 0.05 | 0.1 |
| Nappies | 5.45 | 10.9 |
| Other inert | 0.7 | 1.4 |

(2) Composition of wastes before/after composting

Based on the survey results, composition of compost waste used in calculation of leakage emission is determined as shown in the table below. (Only includes organic wastes because recyclables have been taken out by sorting) as follows:

Table 3-3: Composition of wastes before/after composting

| | Before Composting | | After composting | |
|----------------|-------------------|-----|------------------|-----|
| | Ton/day | % | Ton/day | % |
| Food | 18 | 53% | 7.2 | 51% |
| Garden | 4 | 12% | 1.6 | 12% |
| Wood and Straw | 3 | 9% | 1.2 | 9% |
| Paper | 7 | 21% | 3.1 | 22% |
| Textile | 1.5 | 4% | 0.6 | 4% |
| Others | 0.2 | 1% | 0.2 | 2% |

2. Calculation of Emission Factor

The electricity consumed on-site is purchased from the TNB national grid of Peninsula Malaysia. The emission factor of the grid is calculated according to “Tool to calculate the emission factor for an electricity system (Version02)”. The latest available baseline electricity data was obtained from the Final Report for the Study on Grid Connected Electricity Baselines in Malaysia (Year 2006 - 2007) published by the Malaysia Energy Centre (PTM) in December 2008.

In accordance to the above mentioned tool, the following six steps were applied:

Step 1: Identify the relevant electric power system

There are 3 electricity grid system in Malaysia, namely, the Peninsula Malaysia national grid operated by the Tenaga Negara Berhad, the Sarawak State grid operated by Sarawak Energy Corporation and Sabah State grid operated by Sabah Electricity Supply Berhad (SESB). The electricity supply to the Ipoh City is imported from the national grid of Peninsular Malaysia.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option 1, “only grid power plants are included in the calculation” was chosen for this project.

Step 3: Select an operating margin (OM) method

Since the low-cost/must-run resources constitute less than 50% of total grid generation on average of the five most recent years, the calculation of the operating margin emission factor ($EF_{\text{grid,OM,y}}$) is based on “Simple OM” method.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system in Peninsula Malaysia, not including low-cost / must-run power plants/ units.

The Simple OM is calculated based on the net electricity generation and a CO₂ emission factor of each power unit (Option A), using the following formula.

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM,y}$: Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$: CO₂ emission factor of power unit m in year y (tCO₂/MWh)

m : All power units serving the grid in year y except low-cost /must-run power units

y : Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option)

The Simple OM is calculated using the data of all operation fossil fuel fired power plants generating electricity to the grid for the years 2005, 2006 and 2007.

Simple Operating Margin for Peninsular Malaysia for 2007

| Years | Generation (GWh) | CO ₂ Emission (tonnes) | Baselines (tCO ₂ /MWh) |
|---|------------------|-----------------------------------|-----------------------------------|
| 2007 | 89,241 | 56,409,586 | 0.632 |
| 2006 | 85,421 | 51,809,152 | 0.607 |
| 2005 | 82,605 | 49,150,332 | 0.595 |
| Average Operating Margin for 3 years | | | 0.611 |

Step 5: Identify the group of power units to be included in the build margin (BM)

The sample group of power units “m” used to calculate the build margin consists of the set of (a) five power units that have been built most recently. The source of data is from Energy Commission of Malaysia, as shown in the table below.

The total output generated by these 5 plants in 2007 is 33,206,840 MWh, resulting in 35% (i.e. more than 20% as stipulated by the “Tool to calculate the emission factor for an electricity system”) of the total system generation in Peninsular Malaysia (90,950,000 MWh).

| Name of Power Plants/ Fuel Types | Year of Operation | Type | Capacity (MW) | Total Generation (MWh) | CO2 Emission (tCO2) |
|----------------------------------|-------------------|------------------|---------------|------------------------|---------------------|
| 1. SKS Prai Power Station | 2002 | Gas & Distillate | 350 | 2,483,310 | 1,049,809 |
| 2. Panglima Power Station | 2003 | Gas & Distillate | 720 | 5,419,930 | 2,186,230 |
| 3. Janamanjung Power Station | 2003 | Coal | 2070 | 11,248,290 | 11,363,743 |
| 4. Tuanku Jaafar Power Station | 2005 | Gas & Distillate | 714 | 5,759,730 | 2,361,373 |
| 5. Tanjung Bin Power Station | 2006/2007 | Coal | 1400 | 8,295,580 | 8,184,319 |
| Total | | | | 33,206,840 | 25,145,474 |

In terms of vintage of data, Option 1 is chosen, in which, for the first credit period, the build margin emission factor ex-ante is calculated based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM,y}$: Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$FE_{EL,m,y}$: CO₂ emission factor of power unit m in year y (tCO₂/MWh)

m : Power units included in the build margin

y : Most recent historical year for which power generation data is available

The total CO₂ emission from the 5 power plants is calculated to be 25,145,474 tons CO₂. Therefore the Build Margin for Peninsular Malaysia is calculated as follows;

$$EF_{grid,OM,y} = 25,145,474 \text{ tonne CO}_2 / 33,206,840 \text{ MWh} = \underline{\underline{0.757 \text{ tonnes of CO}_2/\text{MWh}}}$$

Step 7: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{\text{grid,CM,y}} = EF_{\text{grid,OM,y}} \cdot w_{\text{OM}} + EF_{\text{grid,BM,y}} \cdot w_{\text{BM}}$$

Where:

$EF_{\text{grid,OM,y}}$:Build margin CO₂ emission factor in year y(tCO₂/MWh)

$EF_{\text{grid,BM,y}}$:Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

w_{OM} :Weighting of operating margin emissions factor (%)

w_{BM} :Weighting of build margin emissions factor (%)

The recommended values applied for w_{OM} and w_{BM} is both at 0.5 for the first crediting period.

Thus, the calculations are as below:

$$EF_{\text{grid,CM,y}} = 0.611 * 0.5 + 0.757 * 0.5 = \underline{\underline{0.684 \text{ tCO}_2/\text{MWh}}}$$

3. IRR Spread Sheet

IRR for basic scenario (7 years)

| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|----------------|----------------|---------|
| Total Project Cost | -13,000,000 | | | | | | | | |
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,726 | 2,773 | 2,820 | 2,868 | 2,916 | 2,966 | 3,016 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,726 | 798,913 | 815,492 | 832,476 | 849,878 | 867,708 | 885,979 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Total revenue from project activities (RM/year) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Depreciation | | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | |
| EBIT (Revenue - Expenses-Depreciation) | | -377,203 | -859,799 | -1,216,327 | -1,364,918 | -1,574,070 | -1,740,811 | -1,877,544 | |
| Loss carried forward | | -377,203 | -1,237,002 | -2,453,329 | -3,818,248 | -5,392,318 | -7,133,130 | -9,010,674 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -377,203 | -859,799 | -1,216,327 | -1,364,918 | -1,574,070 | -1,740,811 | -1,877,544 | |
| Free Cash Flow | | -13,000,000 | 1,479,940 | 997,343 | 640,816 | 492,225 | 283,072 | 116,331 | -20,401 |
| IRR (7 years) without CDM | | -34.55% | | | | | | | |

IRR for initial cost +10%

| Total Project Cost | -14,300,000 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|----------------|----------------|---------|
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,726 | 2,773 | 2,820 | 2,868 | 2,916 | 2,966 | 3,016 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,726 | 798,913 | 815,492 | 832,476 | 849,878 | 867,708 | 885,979 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Total revenue from project activities (RM/year) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Depreciation | | 2,042,857 | 2,042,857 | 2,042,857 | 2,042,857 | 2,042,857 | 2,042,857 | 2,042,857 | |
| EBIT (Revenue - Expenses-Depreciation) | | -562,917 | -1,045,514 | -1,402,041 | -1,550,633 | -1,759,785 | -1,926,526 | -2,063,259 | |
| Loss carried forward | | -562,917 | -1,608,431 | -3,010,472 | -4,561,105 | -6,320,889 | -8,247,415 | -10,310,674 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -562,917 | -1,045,514 | -1,402,041 | -1,550,633 | -1,759,785 | -1,926,526 | -2,063,259 | |
| Free Cash Flow | | -14,300,000 | 1,479,940 | 997,343 | 640,816 | 492,225 | 283,072 | 116,331 | -20,401 |
| IRR (7 years) without CDM | | -36.42% | | | | | | | |

IRR for initial cost -10%

| Total Project Cost | -11,700,000 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|----------------|----------------|---------|
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,726 | 2,773 | 2,820 | 2,868 | 2,916 | 2,966 | 3,016 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,726 | 798,913 | 815,492 | 832,476 | 849,878 | 867,708 | 885,979 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Total revenue from project activities (RM/year) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Depreciation | | 1,671,429 | 1,671,429 | 1,671,429 | 1,671,429 | 1,671,429 | 1,671,429 | 1,671,429 | |
| EBIT (Revenue - Expenses-Depreciation) | | -191,489 | -674,085 | -1,030,613 | -1,179,204 | -1,388,356 | -1,555,097 | -1,691,830 | |
| Loss carried forward | | -191,489 | -865,574 | -1,896,186 | -3,075,391 | -4,463,747 | -6,018,844 | -7,710,674 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -191,489 | -674,085 | -1,030,613 | -1,179,204 | -1,388,356 | -1,555,097 | -1,691,830 | |
| Free Cash Flow | | -11,700,000 | 1,479,940 | 997,343 | 640,816 | 492,225 | 283,072 | 116,331 | -20,401 |
| IRR (7 years) without CDM | | -32.38% | | | | | | | |

IRR for O&M cost +10%

| Total Project Cost | -13,000,000 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|----------------|----------------|---------|
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,999 | 3,050 | 3,102 | 3,154 | 3,208 | 3,262 | 3,318 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,999 | 799,190 | 815,774 | 832,763 | 850,169 | 868,004 | 886,281 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Total revenue from project activities (RM/year) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Depreciation | | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | |
| EBIT (Revenue - Expenses-Depreciation) | | -377,476 | -860,077 | -1,216,609 | -1,365,205 | -1,574,362 | -1,741,108 | -1,877,846 | |
| Loss carried forward | | -377,476 | -1,237,552 | -2,454,161 | -3,819,366 | -5,393,728 | -7,134,836 | -9,012,682 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -377,476 | -860,077 | -1,216,609 | -1,365,205 | -1,574,362 | -1,741,108 | -1,877,846 | |
| Free Cash Flow | | -13,000,000 | 1,479,667 | 997,066 | 640,534 | 491,938 | 282,781 | 116,035 | -20,703 |
| IRR (7 years) without CDM | | -34.58% | | | | | | | |

IRR for O&M cost -10%

| Total Project Cost | -13,000,000 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|----------------|----------------|---------|
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,454 | 2,495 | 2,538 | 2,581 | 2,625 | 2,669 | 2,715 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,454 | 798,635 | 815,210 | 832,190 | 849,586 | 867,411 | 885,678 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Total revenue from project activities (RM/year) | | 2,262,666 | 1,796,256 | 1,456,308 | 1,324,701 | 1,132,950 | 984,039 | 865,578 | |
| Depreciation | | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | |
| EBIT (Revenue - Expenses-Depreciation) | | -376,930 | -859,522 | -1,216,045 | -1,364,632 | -1,573,779 | -1,740,515 | -1,877,243 | |
| Loss carried forward | | -376,930 | -1,236,453 | -2,452,498 | -3,817,129 | -5,390,908 | -7,131,423 | -9,008,665 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -376,930 | -859,522 | -1,216,045 | -1,364,632 | -1,573,779 | -1,740,515 | -1,877,243 | |
| Free Cash Flow | | -13,000,000 | 1,480,212 | 997,621 | 641,098 | 492,511 | 283,364 | 116,628 | -20,100 |
| IRR (7 years) without CDM | | -34.53% | | | | | | | |

IRR for revenue from electricity sales + 10%

| Total Project Cost | -13,000,000 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|------------------|----------------|--------|
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,726 | 2,773 | 2,820 | 2,868 | 2,916 | 2,966 | 3,016 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,726 | 798,913 | 815,492 | 832,476 | 849,878 | 867,708 | 885,979 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,488,933 | 1,975,882 | 1,601,939 | 1,457,171 | 1,246,245 | 1,082,443 | 952,136 | |
| Total revenue from project activities (RM/year) | | 2,488,933 | 1,975,882 | 1,601,939 | 1,457,171 | 1,246,245 | 1,082,443 | 952,136 | |
| Depreciation | | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | |
| EBIT (Revenue - Expenses-Depreciation) | | -150,936 | -680,174 | -1,070,696 | -1,232,448 | -1,460,775 | -1,642,408 | -1,790,987 | |
| Loss carried forward | | -150,936 | -831,110 | -1,901,806 | -3,134,255 | -4,595,030 | -6,237,438 | -8,028,424 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -150,936 | -680,174 | -1,070,696 | -1,232,448 | -1,460,775 | -1,642,408 | -1,790,987 | |
| Free Cash Flow | | -13,000,000 | 1,706,206 | 1,176,969 | 786,447 | 624,695 | 396,367 | 214,735 | 66,156 |
| IRR (7 years) without CDM | | -27.49% | | | | | | | |

IRR for revenue from electricity sales -10%

| Total Project Cost | -13,000,000 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|----------------|----------------|----------|
| Maintenance & Repair cost | | 580,000 | 589,860 | 599,888 | 610,086 | 620,457 | 631,005 | 641,732 | |
| Electricity cost | | 2,726 | 2,773 | 2,820 | 2,868 | 2,916 | 2,966 | 3,016 | |
| Labour cost | | 120,000 | 124,920 | 130,042 | 135,373 | 140,924 | 146,702 | 152,716 | |
| Others | | 80,000 | 81,360 | 82,743 | 84,150 | 85,580 | 87,035 | 88,515 | |
| Total Expenses (RM/year) | | 782,726 | 798,913 | 815,492 | 832,476 | 849,878 | 867,708 | 885,979 | |
| Revenue from CER | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Revenue from electricity sales (RM) | | 2,036,399 | 1,616,630 | 1,310,677 | 1,192,231 | 1,019,655 | 885,635 | 779,020 | |
| Total revenue from project activities (RM/year) | | 2,036,399 | 1,616,630 | 1,310,677 | 1,192,231 | 1,019,655 | 885,635 | 779,020 | |
| Depreciation | | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | 1,857,143 | |
| EBIT (Revenue - Expenses-Depreciation) | | -603,470 | -1,039,425 | -1,361,958 | -1,497,388 | -1,687,365 | -1,839,215 | -1,964,102 | |
| Loss carried forward | | -603,470 | -1,642,895 | -3,004,852 | -4,502,241 | -6,189,606 | -8,028,822 | -9,992,924 | |
| Income TAX | 25% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Nett Income (EBIT - income tax) | | -603,470 | -1,039,425 | -1,361,958 | -1,497,388 | -1,687,365 | -1,839,215 | -1,964,102 | |
| Free Cash Flow | | -13,000,000 | 1,253,673 | 817,718 | 495,185 | 359,754 | 169,777 | 17,927 | -106,959 |
| IRR (7 years) without CDM | | #NUM! | | | | | | | |

Organic Waste Composting Project Baseline Information

1. Waste composition analysis

(1) Composition of incoming waste

Composition of incoming waste in the plant used in baseline emission estimation was determined based on the result of waste composition analysis conducted by Midac Co., Ltd. in 2009. The results and outline of the composition analysis are as described below;

Table 3-1: Basic condition on the analysis

| | |
|-----------------|---|
| Date | 23/11/2009 ~ 27/11/2009 |
| Place | Existing landfill in Ipoh City |
| Objective | 3. Understanding the waste composition installed to the landfill 4. Understanding the recyclables |
| Volume of waste | 50 tons/day |
| Origin of waste | The waste is originated from Household, Shop, and Market, the ratio of each item is 70%, 25%, and 5%. |

Table 3-2: Average composition of the incoming waste in the plant

| Waste Type | Tons/day | % |
|----------------|----------|------|
| Food | 18 | 36 |
| Garden | 4 | 8 |
| Wood and Straw | 3 | 6 |
| Paper | 7 | 14 |
| Textile | 1.5 | 3 |
| Others | 16 | 32 |
| Plastics | 8.1 | 16.2 |
| Glass | 0.9 | 1.8 |
| Steel | 0.95 | 1.9 |
| Aluminium | 0.05 | 0.1 |
| Nappies | 5.45 | 10.9 |
| Other inert | 0.7 | 1.4 |

(2) Composition of wastes before/after composting

Based on the survey results, composition of compost waste used in calculation of leakage emission is determined as shown in the table below. (Only includes organic wastes because recyclables have been taken out by sorting) as follows:

Table 3-3: Composition of wastes before/after composting

| | Before Composting | | After composting | |
|----------------|-------------------|-----|------------------|-----|
| | Ton/day | % | Ton/day | % |
| Food | 18 | 53% | 7.2 | 51% |
| Garden | 4 | 12% | 1.6 | 12% |
| Wood and Straw | 3 | 9% | 1.2 | 9% |
| Paper | 7 | 21% | 3.1 | 22% |

| | | | | |
|---------|-----|----|-----|----|
| Textile | 1.5 | 4% | 0.6 | 4% |
| Others | 0.2 | 1% | 0.2 | 2% |

2. Calculation of Emission Factor

The electricity consumed on-site is purchased from the TNB national grid of Peninsula Malaysia. The emission factor of the grid is calculated according to “Tool to calculate the emission factor for an electricity system (Version02)”. The latest available baseline electricity data was obtained from the Final Report for the Study on Grid Connected Electricity Baselines in Malaysia (Year 2006 - 2007) published by the Malaysia Energy Centre (PTM) in December 2008.

In accordance to the above mentioned tool, the following six steps were applied:

Step 1: Identify the relevant electric power system

There are 3 electricity grid system in Malaysia, namely, the Peninsula Malaysia national grid operated by the Tenaga Negara Berhad, the Sarawak State grid operated by Sarawak Energy Corporation and Sabah State grid operated by Sabah Electricity Supply Berhad (SESB). The electricity supply to the Ipoh City is imported from the national grid of Peninsular Malaysia.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option 1, “only grid power plants are included in the calculation” was chosen for this project.

Step 3: Select an operating margin (OM) method

Since the low-cost/must-run resources constitute less than 50% of total grid generation on average of the five most recent years, the calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on “Simple OM” method.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system in Peninsula Malaysia, not including low-cost / must-run power plants/ units.

The Simple OM is calculated based on the net electricity generation and a CO₂ emission factor of each power unit (Option A), using the following formula.

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM,y}$: Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$FE_{EL,m,y}$: CO₂ emission factor of power unit m in year y (tCO₂/MWh)

m : All power units serving the grid in year y except low-cost /must-run power units

y : Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option)

The Simple OM is calculated using the data of all operation fossil fuel fired power plants generating electricity to the grid for the years 2005, 2006 and 2007.

Simple Operating Margin for Peninsular Malaysia for 2007

| Years | Generation (GWh) | CO ₂ Emission (tonnes) | Baselines (tCO ₂ /MWh) |
|---|------------------|-----------------------------------|-----------------------------------|
| 2007 | 89,241 | 56,409,586 | 0.632 |
| 2006 | 85,421 | 51,809,152 | 0.607 |
| 2005 | 82,605 | 49,150,332 | 0.595 |
| Average Operating Margin for 3 years | | | 0.611 |

Step 5: Identify the group of power units to be included in the build margin (BM)

The sample group of power units “m” used to calculate the build margin consists of the set of (a) five power units that have been built most recently. The source of data is from Energy Commission of Malaysia, as shown in the table below.

The total output generated by these 5 plants in 2007 is 33,206,840 MWh, resulting in 35% (i.e. more than 20% as stipulated by the “Tool to calculate the emission factor for an electricity system”) of the total system generation in Peninsular Malaysia (90,950,000 MWh).

| Name of Power Plants/ Fuel Types | Year of Operation | Type | Capacity (MW) | Total Generation (MWh) | CO ₂ Emission (tCO ₂) |
|----------------------------------|-------------------|------------------|---------------|------------------------|--|
| 1. SKS Prai Power Station | 2002 | Gas & Distillate | 350 | 2,483,310 | 1,049,809 |
| 2. Panglima Power Station | 2003 | Gas & Distillate | 720 | 5,419,930 | 2,186,230 |
| 3. Janamanjung Power Station | 2003 | Coal | 2070 | 11,248,290 | 11,363,743 |
| 4. Tuanku Jaafar Power Station | 2005 | Gas & Distillate | 714 | 5,759,730 | 2,361,373 |
| 5. Tanjung Bin Power Station | 2006/2007 | Coal | 1400 | 8,295,580 | 8,184,319 |
| Total | | | | 33,206,840 | 25,145,474 |

In terms of vintage of data, Option 1 is chosen, in which, for the first credit period, the build margin emission factor ex-ante is calculated based on the most recent information available on

units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

- $EF_{grid,OM,y}$: Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- $FE_{EL,m,y}$: CO₂ emission factor of power unit m in year y (tCO₂/MWh)
- m : Power units included in the build margin
- y : Most recent historical year for which power generation data is available

The total CO₂ emission from the 5 power plants is calculated to be 25,145,474 tons CO₂. Therefore the Build Margin for Peninsular Malaysia is calculated as follows;

$$EF_{grid,OM,y} = 25,145,474 \text{ tonne CO}_2 / 33,206,840 \text{ MWh} = \underline{\underline{0.757 \text{ tonnes of CO}_2/\text{MWh}}}$$

Step 7: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$$

Where:

- $EF_{grid,OM,y}$: Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $EF_{grid,OM,y}$: Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)
- w_{OM} : Weighting of operating margin emissions factor (%)
- w_{BM} : Weighting of build margin emissions factor (%)

The recommended values applied for w_{OM} and w_{BM} is both at 0.5 for the first crediting period.

Thus, the calculations are as below:

$$EF_{grid,CM,y} = 0.611 * 0.5 + 0.757 * 0.5 = \underline{\underline{0.684 \text{ tCO}_2/\text{MWh}}}$$

3. Emission Reduction Calculation

(1) Baseline Emission Calculation

Parameters

| Parameters | Units | Values |
|---|-----------------------|--------|
| Landfill Operational parameters | | |
| Landfill Starting Year / Composting Starting Year | Year | 2013 |
| Landfill Closing Year / Composting Closing Year | Year | 2032 |
| Daily Waste Disposal Rate /Daily Waste Processed in Compost Plant | Tons/day | 50 |
| No. of Operating days in a year | days | 365 |
| Waste Composition | | |
| Pulp, paper, Cardboard (other than Sludge) | % of Wet MSW | 14.0% |
| Textiles | % of Wet MSW | 3.0% |
| Food and Food Waste, beverages and tobacco (other than sludge) | % of Wet MSW | 36.0% |
| Garden, Yard and Park Waste | % of Wet MSW | 8.0% |
| Wood & Wood Products | % of Wet MSW | 6.0% |
| Waste Degradability (DOC-j) | | |
| Pulp, paper, Cardboard (other than Sludge) | % of Wet MSW Fraction | 40% |
| Textiles | % of Wet MSW Fraction | 24% |
| Food and Food Waste, beverages and tobacco (other than sludge) | % of Wet MSW Fraction | 15% |
| Garden, Yard and Park Waste | % of Wet MSW Fraction | 20% |
| Wood & Wood Products | % of Wet MSW Fraction | 43% |
| Waste Decay Rates (K-j) | | |
| Pulp, paper, Cardboard (other than Sludge) | per year | 0.07 |
| Textiles | per year | 0.07 |
| Food and Food Waste, beverages and tobacco (other than sludge) | per year | 0.4 |
| Garden, Yard and Park Waste | per year | 0.17 |
| Wood & Wood Products | per year | 0.035 |
| Fraction of DOC that actually degrades (DOC-f) | | |
| Fraction of DOC that can decompose in a landfill | Fraction | 0.5 |
| Methane Correction Factor (MCF) | | |
| Managed landfill | Fraction | 1 |
| Unmanaged (> 5 M deep) | Fraction | 0.8 |
| Unmanaged (< 5 M deep) | Fraction | 0.4 |
| Semi-aerobic managed | Fraction | 0.5 |
| MCF used for calculation of CH4 emissions | | 1.0 |
| Landfill Gas Characteristics (F) | | |
| Fraction of methane in Landfill gas | Fraction | 0.5 |
| Density of Methane (1.013 bar and 15 °C (59 °F)) | kg/m3 | 0.7168 |
| Global warming potential of Methane | Number | 21 |
| Oxidation Factor (OX) | | |
| Oxidation Factor (OX) | Fraction | 0.1 |
| Model Accuracy | | |
| Model Correction Factor (Phi) | Fraction | 0.9 |
| LFG Capture in the baseline | | |
| Fraction of methane Captured at the SWDS and flared/combusted | Fraction | 0 |

Methane Generation Profile

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Total | |
|------|------|------|------|------|------|------|------|------|------|------|-------|-------|
| | | | | | | | | | | | tCH4 | tCO2 |
| 2013 | 125 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 | 2635 |
| 2014 | 93 | 125 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 219 | 4589 |
| 2015 | 71 | 93 | 125 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 289 | 6071 |
| 2016 | 55 | 71 | 93 | 125 | 0 | 0 | 0 | 0 | 0 | 0 | 344 | 7222 |
| 2017 | 44 | 55 | 71 | 93 | 125 | 0 | 0 | 0 | 0 | 0 | 388 | 8139 |
| 2018 | 36 | 44 | 55 | 71 | 93 | 125 | 0 | 0 | 0 | 0 | 423 | 8888 |
| 2019 | 30 | 36 | 44 | 55 | 71 | 93 | 125 | 0 | 0 | 0 | 453 | 9513 |
| 2020 | 25 | 30 | 36 | 44 | 55 | 71 | 93 | 125 | 0 | 0 | 478 | 10047 |
| 2021 | 22 | 25 | 30 | 36 | 44 | 55 | 71 | 93 | 125 | 0 | 500 | 10510 |
| 2022 | 19 | 22 | 25 | 30 | 36 | 44 | 55 | 71 | 93 | 125 | 520 | 10919 |

(2) Leakage Emission (Leakage from compost products disposed of in the landfill)

Parameters

| Waste Composition | | |
|--|--------------|-------|
| Pulp, paper, Cardboard (other than Sludge) | % of Wet MSW | 22.0% |
| Textiles | % of Wet MSW | 4.0% |
| Food and Food Waste, beverages and tobacco (other than sludge) | % of Wet MSW | 51.0% |
| Garden, Yard and Park Waste | % of Wet MSW | 12.0% |
| Wood & Wood Products | % of Wet MSW | 9.0% |

*Other parameters are same as that used in baseline emission calculation.

Methane Generation Profile

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Total | |
|------|------|------|------|------|------|------|------|------|------|------|-------|------|
| | | | | | | | | | | | tCH4 | tCO2 |
| 2013 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 1069 |
| 2014 | 38 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 1866 |
| 2015 | 29 | 38 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 | 2474 |
| 2016 | 23 | 29 | 38 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 140 | 2949 |
| 2017 | 18 | 23 | 29 | 38 | 51 | 0 | 0 | 0 | 0 | 0 | 159 | 3330 |
| 2018 | 15 | 18 | 23 | 29 | 38 | 51 | 0 | 0 | 0 | 0 | 173 | 3642 |
| 2019 | 12 | 15 | 18 | 23 | 29 | 38 | 51 | 0 | 0 | 0 | 186 | 3905 |
| 2020 | 11 | 12 | 15 | 18 | 23 | 29 | 38 | 51 | 0 | 0 | 197 | 4129 |
| 2021 | 9 | 11 | 12 | 15 | 18 | 23 | 29 | 38 | 51 | 0 | 206 | 4325 |
| 2022 | 8 | 9 | 11 | 12 | 15 | 18 | 23 | 29 | 38 | 51 | 214 | 4499 |

